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PROCEEDINGS

May 3-5, 1961

RESERVES FOR REOPENED CLAIMS ON WORKMEN'S COMPENSATION

BY

RAFAL J. BALCAREK

INTRODUCTION

Reopening of closed claims occurs in most lines of insurance, but in the case of Workmen's Compensation these reopenings have acquired a major importance because of their frequency and the success with which these reopened claims are pressed.

Most companies make the reserve for reopened claims a part of the reserve for Incurred But Not Reported Claims, calculated at the end of each year for the purpose of the Annual Statement. However, it appears that the methods used for the calculation of the reserves on regular I.B.N.R. claims do not lend themselves readily for estimating the liability arising out of reopened claims. The excellent paper by Thomas Tarbell (see *Proceedings* of the Casualty Actuarial Society Vol. XX) relates the I.B.N.R. reserves to the experience of the immediate past (usually eleven months experience of the current year) modified by current factors such as comparative volume of exposure (the volume of business in force), accident frequency and average claim cost. In the case of reopened Workmen's Compensation claims this method seems largely inapplicable because:

1. Reopenings take place over a long span of time. It will take several years before we know what is the actual number of reopened claims for which we should establish a reserve at the end of the present year. Eleven months experience would just not be sufficient.
2. The present volume of business in force and the present accident frequency do not directly influence the number of reopenings. A claim before it is reopened must be first reported and then closed. Each of these events may be separated by intervals of time of considerable length.

3. The present average claim cost on regular claims is widely different from the average costs on reopened claims, because the latter are very special kind of claims, which have their own averages.

To summarize, the I.B.N.R. claim reserve is established to bridge the natural lag between the occurrence and reporting of an accident, and the I.B.N.R. claims are just a normal run of claims which have not been reported because of the lag. On the other hand the reopened claims are anything but normal, consequently a different approach to the problem is needed. The approach which I would propose can be divided into two parts:

1. Estimating the number of closed claims at the end of a particular year which would be reopened at a later date. We are not concerned with claims closed and reopened during the same calendar year.
2. Estimating the average incurred costs after reopening.

NUMBER OF REOPENED CLAIMS

Consideration was given to relate the number of reopened claims to:

1. The number of open claims at the end of a particular year.
2. The number of claims reported during the latest calendar year.
3. The number of claims closed during a calendar year.

In regard to the numbers of open claims and reported claims, they did not seem to be directly connected with reopened cases and the relations obtained seemed rather unstable. Logically, the best connection should be with claims closed because (a) a claim has to be closed before it can be reopened (b) other things being equal, one would expect that a greater number of closed claims would give rise to more numerous reopenings. The actual results appeared to favor this approach. The mode of relating reopened cases to closed cases was through a development of probability that a claim closed in a particular calendar year will be reopened during the next t calendar years.

Table 1 summarizes the experience of the Standard Accident Insurance Company over the years 1936-1958. The number of closed claims during that period of time exceeded 1,000,000 and the number of reopened claims amounted to over 4,500. The reopened claims are expressed as percentages of claims closed. The reopenings are traced year by year until the end of the eighth year after the year of closing. Admittedly, there can be some claims reopened more than eight years after closing but they are extremely rare. Moreover, cases reopened that late do not appear very successful from the claimants' point of view. During the whole period under consideration Standard Accident paid only two cases reopened more than eight years after closing, the grand total of these payments amounting to $667. Of course, it should be taken into account that most states have time limitations on reopenings and in New York a special fund would take over a case when more than 7 years have elapsed since the date of accident and more than 3 years from the date of last payment; both of these conditions must be met. Consequently under the New York law a case reopened more than 7 years after closing would not affect our reserves.

TABLE 1

RATIO OF REOPENED WORKMEN'S COMPENSATION CLAIMS TO TOTAL NUMBER OF CLAIMS CLOSED

Years of Closing	*Percentage of reopenings occurring after the year of closing in the indicated years*							
	1st	*2nd*	*3rd*	*4th*	*5th*	*6th*	*7th*	*8th*
1936	.482	.062	.034	.017	.007	.002	.002	.002
1937	.470	.061	.024	.009	.007	.005	.005	.000
1938	.434	.046	.023	.012	.003	.003	.000	.000
1939	.416	.099	.020	.015	.009	.003	.006	.000
1940	.388	.041	.024	.006	.009	.009	.000	.009
1941	.340	.058	.025	.009	.016	.007	.000	.000
1942	.356	.045	.014	.010	.008	.006	.000	.002
1943	.328	.035	.030	.017	.006	.004	.000	.000
1944	.341	.054	.031	.018	.005	.008	.000	.005
1945	.342	.064	.043	.014	.023	.003	.006	.000
1946	.396	.102	.015	.002	.000	.009	.000	.002
1947	.359	.061	.022	.010	.004	.004	.004	.002
1948	.253	.032	.027	.012	.006	.005	.005	.000
1949	.207	.041	.019	.009	.015	.002	.004	.002
1950	.242	.052	.024	.018	.011	.002	.002	.000
1951	.281	.064	.026	.004	.006	.002	.002	.000
1952	.323	.065	.042	.011	.004	.004	.004	
1953	.332	.071	.030	.018	.014	.002		
1954	.336	.080	.026	.008	.010			
1955	.331	.060	.027	.005				
1956	.288	.063	.030					
1957	.321	.056						
1958	.386							
Average	.346	.060	.026	.011	.009	.004	.002	.002

Table 2 below summarizes the probabilities developed from figures in Table 1.

TABLE 2

REOPENED COMPENSATION CASES

Year t After Year of Closing	*Probability of Reopening in Year t*		*Cumulative Probability for Reopenings in Year t and Later*	
	Observed	*Theoretical*	*Observed*	*Theoretical*
	1	*2*	*3*	*4*
1st	.00346	.00346	.00460	.00460
2nd	.00060	.00063	.00114	.00114
3rd	.00026	.00023	.00054	.00051
4th	.00011	.00012	.00028	.00028
5th	.00009	.00007	.00017	.00016
6th	.00004	.00004	.00008	.00009
7th	.00002	.00003	.00004	.00005
8th	.00002	.00002	.00002	.00002

In view of the possibility of random fluctuations (due to the very small probabilities involved) distorting the observed figures, it was judged advisable to fit a curve to our data. The fitted curve is $P = .03346t^{-2.45}$ and its values for each year are given in column 2.

Columns 3 and 4 show cumulative probabilities, both observed and theoretical, for the years starting from t up to the 8th year. It is actually these data which are to be used for estimating the number of claims which are closed at the end of the present year and which will be reopened during the next eight years. The procedure is simple:

.00460 $\times$ No. of claims closed during the present year
.00114 $\times$ No. of claims closed during the 1st preceding year
.00051 $\times$ No. of claims closed during the 2nd preceding year
.00028 $\times$ No. of claims closed during the 3rd preceding year
etc.

The sum of these multiplications will give us the desired figure.

Questions could arise whether the obtained figure should not be adjusted for changes in the economic cycle. Frequent statements have been made that there is a close connection between these reopenings and unemployment rates. Table 3 below puts together the 1st year reopening rates and average annual rates of unemployment among the civilian labor force.

TABLE 3

REOPENED COMPENSATION CASES AND UNEMPLOYMENT

Calendar Year	*1st Year Reopenings. % of Cases Closed*	*Annual Rate of Unemployment % of Civilian Labor Force**	*Calendar Year*	*1st Year Reopenings. % of Cases Closed*	*Annual Rate of Unemployment % of Civilian Labor Force**
1937	.482	14.3	1949	.253	5.9
1938	.470	19.0	1950	.207	5.3
1939	.434	17.2	1951	.242	3.3
1940	.416	14.6	1952	.281	3.1
1941	.388	9.9	1953	.323	2.9
1942	.340	4.7	1954	.332	5.6
1943	.356	1.9	1955	.336	4.4
1944	.328	1.2	1956	.331	4.2
1945	.341	1.9	1957	.288	4.3
1946	.342	3.9	1958	.321	6.8
1947	.396	3.9	1959	.386	5.5
1948	.359	3.8			

* These are official figures compiled by the U.S. Dept. of Commerce, Bureau of the Census and U. S. Dept. of Labor, Bureau of Labor Statistics.

The correlation coefficient between these two series of data amounts to +0.69. However, a closer inspection of the figures shows that this is due to pre-World War II figures when the very high unemployment rates were accompanied by relatively high reopenings. If we exclude the figures prior to 1942 we obtain a radically changed correlation coefficient of —0.17; this small negative coefficient is without statistical significance. Two conclusions could be drawn from this: (a) that unemployment ceased to be a factor in reopenings or (b) that only very high unemployment rates would be accompanied by higher reopenings. The writer favors the first view on account of the improved unemployment benefits which seem to compete effectively with the Workmen's Compensation benefits. In addition, he believes that prewar unemployment rates are a thing of the past, consequently he is against adjustments based on anticipated changes in the economic cycle, even if such changes could be accurately forecast.

INCURRED COSTS

The first step is to compute the average incurred costs on claims reopened in the past. Immediately, two major problems will arise:

1. The reserves on reopened cases have an unusually high margin of safety. It seems that the claim examiner's attitude to reopened cases is quite different from his attitude to the usual run of cases. Consequently, when computing costs on reopened claims in the past, it is ab-

solutely necessary to adjust the amounts outstanding by expected development.

2. Because of the relatively small number of cases, a large single case could substantially distort the average. This was eliminated to a considerable degree by the use of a 5-year moving average.

Having obtained these averages, the problem is to relate them to some other values so that the future costs could be estimated. An ideal situation would be if these costs could be related to something simple like the average reserves on open claims or the average incurred cost per reported case. But a considerable lack of stability was encountered. An additional complication was that both those values are subject to development. Again the best results were obtained by looking at the cases closed. The figures are shown in Table 4.

TABLE 4

PAID COSTS ON CLOSED CLAIMS AND INCURRED COSTS ON REOPENED CLAIMS

Five Years Ending	*Paid Per Case Closed*	*Adjusted Incurred Cost Per Reopened Case, Allotted to the Year of Closing*	*Ratio*
1945	$ 61.09	$240.44	3.936
1946	64.72	249.35	3.853
1947	68.53	285.95	4.173
1948	71.12	331.46	4.661
1949	75.22	380.45	5.058
1950	79.71	418.85	5.255
1951	86.14	428.12	4.970
1952	94.79	448.66	4.733
1953	104.12	494.86	4.753
1954	111.93	496.48	4.436
1955	117.89	524.60	4.450
1956	123.33	565.50	4.585
1957	128.04	620.09	4.843
1958	137.19	580.29	4.230
10 Year Average	119.45	535.20	4.481
1941—1958 Average	94.88	417.63	4.402

The reserve on reopened claims can be now easily obtained by applying the average paid costs of the year of closing to the estimated number of claims to be reopened in the future, the claims arranged by year of original closing. The total multiplied by a factor of approximately 4.5 should give us an adequate reserve.

SOME PRACTICAL CONSIDERATIONS

In regard to the number of reopened claims and their allocation to the year of closing, they are relatively easy to obtain and within a few years they would provide us with significant statistics as to the pattern the reopenings follow. However, with regard to average costs the situation is different because the development of reserves has to be taken into account and as mentioned before the reserves on reopened cases have an unusually high margin of safety. An added complication is that generally Workmen's Compensation claims take a very long time to develop. Consequently, there is a need for establishing a mechanical procedure for handling these reopened claims in order to arrive at a good estimate.

Generally, it is not possible to utilize directly the regular loss punch cards for this purpose as (a) they do not have enough space to indicate reopening, date of reopening and the date of closing, (b) we are not interested in the total incurred cost for these claims but only in the costs incurred subsequently to reopening. Therefore, it would be necessary to set up a special set of punch cards for the reopened claims. Each of these cards would initially show the line of business, state, claim number, date (month and year) of accident, date of closing, date of reopening and total paid prior to reopening. There would be also columns for cumulative paid from the date of accident and amounts outstanding. At the end of each year, these reopened claim cards would be matched with regular loss cards in order to obtain the cumulative paid and the latest outstandings. Subtracting from these figures the paid prior to reopening would give us the incurred cost after reopening.

In order to test the reserves on reopened cases one should group the reopened claims by year of reopening and provide for the run-off of the reserves outstanding at the end of that year. Because of the slow development we should observe the changes in incurred cost over a long period of time, at least ten years.

After the system is set up, one is sooner or later confronted with a problem what to do with a claim which is being reopened for the second time. If the second closing and reopening occurred during the same calendar year, then they can be ignored, as there is no penalty to the calendar year's operations. However, if the second reopening occurs after the year of second closing, we will have to establish a second card, because we have there actually two closings and two reopenings with two different incurred costs after reopening, to be allocated as penalties to two different year ends.

CONCLUSIONS

The main conclusion is that reasonably accurate reserves for reopened claims on Workmen's Compensation can be established by basing the estimate on past closed claims and their average payments. This is important because both of these figures can be promptly and easily obtained and in addition they are not subject to future development. In other words they provide us with a firm ground on which to base our estimate. The fact that it has been shown that unemployment (at least in a moderate range) does not

affect noticeably the rate of reopenings, is also of considerable importance. In the past, one of the major difficulties was that the rate of reopenings was assumed to be a function of the rate of unemployment, consequently the actuary forecasting the future course of reopenings found himself usually forecasting the future course of the country's economy. And frankly, this type of forecasting is an unenviable job. Now it could be that before the Second World War the rate of reopenings was connected with the level of unemployment. Fortunately, this connection seems to have disappeared.

A STUDY OF THE SIZE OF AN ASSIGNED RISK PLAN

BY

FRANK HARWAYNE

Assigned Risk Plans are thought to expand or contract in volume according to whether or not a prospect of profitable insurance operation is lacking. In order to develop a quantitative first estimate of an Assigned Risk Plan volume, it will be assumed that underwriters relate this prospect of profitable insurance operation to expected claims occurrence, and such expectation is sufficient to reject the request for voluntary coverage. It is also assumed that property damage liability claims will not be separately considered because many of such occurrences are already reflected in bodily injury liability claims[1] and others reflect environmental factors rather than the individual's susceptibility to accidents.

The foregoing approach leaves only the bodily injury liability claims records of individuals for the purposes of underwriters' acceptance or rejection of a particular risk. At the risk of oversimplifying, it is assumed that the reported bodily injury liability claims reflect the situation before fault has been completely determined. If underwriters will prospectively accept or reject individual risks with claims records according to some doctrine of fault, it is fair to remove from consideration half of the individuals with claims records as not being at fault. Therefore, 50% of the observed claim frequency would involve fault. Assuming that underwriters consider the accident records over three years (the length of time used in the Assigned Risk Plan) the voluntarily insurable population which would be free of liability for a three-year period could be estimated. For example, the accident year 1958 bodily injury liability claim frequency on Class 2A in the three boroughs of Manhattan, Bronx and Brooklyn was .193. Discounting this by 50% gives a net annual frequency for liability of .10. Over a three-year span, there would be approximately 74% of the total free of liability[2]. Such a figure could be used as an approximate measure of the theoretical voluntary insurance market under observed average claim frequency conditions.

Actually, during 1959 the voluntary Class 2A business in the three boroughs was 66% of the total available Class 2A business. The ratio of 66% to 73% can be used to estimate whether or not the Assigned Risk Plan on this account is unduly saturated with Class 2A business in the three boroughs. Such a ratio would not be very sensitive, certainly not beyond one

[1] For example, the reported claim frequencies for accident year 1958 are:

	Bodily Injury	*Property Damage*
Man., Bronx and Brooklyn	12.4%	12.4%
Other N. Y. territories	5.1	9.9

[2] For purposes of a first approximation, it is assumed that the three year frequency is three times the net annual frequency and is distributed approximately according to the Poisson distribution. If a negative binomial or compound Poisson distribution had been used with a variance equal to 1.2 times the mean, the comparable figure would have been slightly higher, namely 76%.

decimal accuracy. A ratio below 1.0 indicates assigned risks are more than expected, while a ratio higher than 1.0 indicates assigned risks are less than expected. Sheets 1 and 2 of the attached Table A give such ratios based on the accident year 1958 private passenger bodily injury liability experience of the National Bureau and the Mutual Bureau members and subscribers, compared with their reported risks written voluntarily during the first half of 1959. It is interesting to note that the ratios for the three boroughs and the balance of New York State separately, produce indices of 1.0 signifying that the size of the Assigned Risk Plan is not overly large in relation to the claim frequency in New York State. On the other hand, in the three boroughs of New York City, there appears to be an over-concentration of assigned risks in Classes 1A and 2A with a ratio, of .9; Class 2C with a ratio of .6; and there appears to be a lack of concentration in Class 3 with a ratio of 1.1. These same ratios hold in the balance of the State for Classes 2A and 3; for Class 2C the ratio drops to .5 and, in addition, there appears to be a concentration in the Assigned Risk Plan of Class 2CF (farmers) with a ratio of .7.

From this first estimate it appears that the newly adopted Assigned Risk Plan which would afford credit against Assigned Risk Plan quotas for voluntary acceptance of Class 2 business, should in large measure correct the present relative saturation of the Assigned Risk Plan with young driver business. On the other hand, it may not be necessary to provide incentive credits for the placing of assigned risk business in the voluntary market. Rather, it would seem more profitable to work toward a general reduction of claim frequency in the State. This would benefit the general population through lower rates and would also provide a more permanent solution to a reduction of the volume of business in the Assigned Risk Plan by enhancing the prospect of profitable insurance operation.

It is realized that the technique outlined for review of the size of the Assigned Risk Plan in New York State is only a rough first estimate and subject to criticism on various scores; nevertheless, it is believed to be the first attempt to deal with the problem of how large an Assigned Risk Plan may be considered to be "normal". Constructive criticism could result in welcome refinement. The technique might be adapted to similar reviews elsewhere; undoubtedly the results of such studies should prove interesting and useful.

TABLE A (SHEET 1)

Manhattan, Bronx and Brooklyn

Comparison of Private Passenger Voluntary Business

With Estimated Business Free of Liability for Three Years

Experience of National and Mutual Bureaus Members and Subscribers				*By Rate Classification*	
(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
Classification	*B.I. Claim Frequency*	*50% of Prev. Col.*	*Est. % Free of Liab. for 3 Years*[a]	*Vol. Bus. as % of Total*	*Ratio (5) ÷ (4)*
1A	.116	.06	84%	79%	.9
1B	.120	.06	84	87	1.0
1C	.131	.07	81	81	1.0
2A	.193	.10	74	66	.9
2C	.269	.14	66	38	.6
3	.124	.06	84	94	1.1
1AF	.....	.....	.....	.....	.....
2AF	.....	.....	.....	.....	.....
2CF	.....	.....	.....	.....	.....
Total	.124	.06	84%	80%	1.0

Note: Based on Voluntary Business Written January through June 1959 and Accident Year 1958 Private Passenger Bodily Injury Claim Frequencies.

[a] Based on the Poisson distribution with three year mean equal to three times column (3).

TABLE A (SHEET 2)

Balance of State

Comparison of Private Passenger Voluntary Business

With Estimated Business Free of Liability for Three Years

Experience of National and Mutual Bureaus Members and Subscribers				*By Rate Classification*	
(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
Classification	*B.I. Claim Frequency*	*50% of Prev. Col.*	*Est. % Free of Liab. for 3 Years*[a]	*Vol. Bus. as % of Total*	*Ratio (5) ÷ (4)*
1A	.048	.02	94%	93%	1.0
1B	.046	.02	94	94	1.0
1C	.062	.03	91	91	1.0
2A	.084	.04	89	82	.9
2C	.135	.07	81	44	.5
3	.065	.03	91	97	1.1
1AF	.019	.01	97	97	1.0
2AF	.046	.02	94	93	1.0
2CF	.082	.04	89	61	.7
Total	.051	.03	91%	92%	1.0

Note: Based on Voluntary Business Written January through June 1959 and Accident Year 1958 Private Passenger Bodily Injury Claim Frequencies.

[a] Based on the Poisson distribution with three year mean equal to three times column (3).

COSTS OF HOSPITAL BENEFITS FOR RETIRED EMPLOYEES

BY

MURRAY W. LATIMER

The officers of a client company asked, in mid-1960, for an estimate of the cost of providing hospital benefits for employees who retire under the company pension plan. The pension plan is funded, on an actuarial basis which the company has found to be satisfactory, through a trust fund. The company officials began with the idea that it ought to be possible to provide advance funding for the health benefits of employees who retire with a company pension in the same way regular pensions are provided for in advance. The active employees of the company are covered under Blue Cross and Blue Shield plans; the terms of the Blue Cross plan will be summarized later. The initial request for an estimate was limited to hospital benefits. If a decision were to be made to begin the advance funding of all health care benefits, cost estimates for other areas would be required. This paper deals only with the first estimate.

The company is engaged in manufacturing. As of July 1, 1960, the total number of its employees was a little over 50,000. The major plants were located in the East, Middle West, the South and in California; there were small plants in three other eastern states, warehouses in six more widely located, and sales offices in thirty-two states. There were about 4500 pensioners. Over 96 per cent of active employees and over 99 per cent of the pensioners are men. The pension plan is non-contributory while company and employees share the Blue Cross-Blue Shield premiums for active employees. It would be possible for retired employees to be continued in the group along with the active employees and, initially at least, this is what the company had in mind. The contract between the company and the Blue Cross organization provides that the premiums are to be based on experience.

It was pointed out that the problem of funding health care benefits is beset with even more difficulties than is true for pensions. First of all, the company would want to be sure that any contributions paid into a fund for future health care benefits for retired employees would be fully deductible for income tax purposes. So far as this writer is aware, there have been no arrangements presented to the income tax authorities, either federal or state, which would establish whether and under what conditions tax deductibility could be secured.[1]

Second, the pension under the company plan is the higher of (1) a percentage of average salary during the final 10 years of employment for each year of continuous company service, diminished by approximately two-thirds of the average social security primary insurance amount for employees retiring currently, or (2) a fixed amount for each year of such service up to 35. In 1960,

[1] In an informal conference, the writer was told by an official of the Internal Revenue Service that a pension plan in which the monthly pension would be the variable premium for a prepaid health care plan would probably be approved if the payment were in cash directly to the pensioner who could, of course, choose to spend the pension in any way he saw fit.

new pensions were averaging about 45 per cent more than in 1955; but all pensions being paid were higher than in 1955 by only about 20 per cent because the pensions, once granted, are, under the terms of the plan, fixed for the remainder of the lives of the pensioners.[2] Under an arrangement for the payment of Blue Cross-Blue Shield premiums or the equivalent, all pensions would increase each time the premiums rose. The effect would be to make the costs of the pension equal to health care premiums far more uncertain than the cost of the present pension plan.[3]

Third, while the pension plan is non-contributory, employees pay for approximately half of the cost of Blue Cross-Blue Shield protection. Since the employees are currently exposed to the risk of requiring hospital care or medical services of the kind provided by Blue Shield, their contributions are earned in full by the time their coverage ends following termination of their service. This would not be true for an employee who leaves company service before he is entitled to a company pension. Under such circumstances his contribution would have been paid with respect to a risk to which he had never been exposed and therefore should be returned. Thus the use of employee contributions in paying for retired employee health benefits (i) introduces administrative and actuarial complexities which, as will appear, are in any event not lacking, and (ii) more important, adds to necessary costs the cost of a benefit (payable upon death or withdrawal before retirement or death after retirement, but before exposure to actual risk is fairly commensurate with the accumulated contributions of the employee) not related to the objectives of the plan.

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[2]The plan has been amended twice to increase pensions in effect, but the costs of such increases were calculated at the time they were made.

[3]It is relevant at this point to mention that three methods of financing Blue Cross benefits for pensioners are available to this company: They may be continued in the group along with active employees; they may be continued as a group but with the present plan benefits; or they may, at the time of retirement, convert to individual direct-pay contracts. There is a single uniform plan applicable to all active employees, no matter where they are located or what the provisions of the local Blue Cross plan may be. The various Blue Cross organizations have organized a syndicate, managed by the Blue Cross organization covering employees at operating headquarters, to which a uniform monthly premium per employee is paid for the uniform benefits provided to such employees and their eligible dependents. The premiums are based on an experience rating formula; they are, in effect, 109 per cent of claims plus 8 cents per employee per month.

If the pensioners are kept in the group with the active employees, premiums will be immediately affected and the proportion of pensioners as compared with active employees will be a major factor in premiums. If a special group for pensioners is formed, the costs of claims for pensioners alone will determine the premium. If retiring employees convert to a direct-pay individual contract, they pay the community-rated premium and receive the benefits of the regular plans offered generally by the Blue Cross plan which operates at the last place of employment of the retiring employee. These benefits are frequently less than those of the uniform plan covering the active employees, and the pensioners and the union which represents active employees wish the uniform plan coverage continued. About one-quarter of the pensioners have direct-pay contracts with local Blue Cross plans. With the spread of special plans for covering retired-worker families, the right of conversion is likely to be limited to joining these plans rather than to joining a general conversion pool, implying an increase in required contributions.

Finally, provision of some medical care for aged persons has been the object of intense discussion by federal and state legislators and officials and by the public generally. The demand for health care benefits for retired-worker families which this discussion has encouraged can be expected to find reflection in the utilization of such services when they are made available and perhaps in the prices charged for such services.

PLAN PROVISIONS

Pensions

Since the hospital benefits are to be provided to pensioners, the conditions under which pensions may be granted under the company pension plan are relevant. There are, in general, two classes of pensions—age and disability.[4] A pension is payable to an employee upon his retirement after completing 15 or more years of continuous service if (a) he has attained the age of 65, or (b) has become "permanently incapacitated" while in the active service of the company. An employee is, generally speaking, to be deemed "permanently incapacitated" if he has, for 6 consecutive months, been totally disabled by bodily injury or disease so as to be prevented thereby from engaging in any occupation or employment for remuneration or profit and, in the opinion of a qualified physician, such disability will be permanent and continuous during the remainder of the employee's life. There is no compulsory or automatic retirement age.

Blue Cross[5]

In-patients (pensioners or their spouses) confined to a hospital which is a member of a Blue Cross plan or which participates in a local hospital service plan having reciprocal relations with Blue Cross are entitled, for a period not exceeding 120 days for each hospitalization,[6] to: bed and board in semi-private accommodations; general nursing care; use of the operating room and delivery room; anesthesia when provided as a regular hospital service, dressings, plaster casts and splints; laboratory examinations; basal metabolism tests; x-ray examinations; electrocardiograms; electroencephalograms; physiotherapy and hydrotherapy; oxygen and its administration; administration of blood or blood plasma; radiation therapy; and drugs and medicines as listed at the time of hospitalization in the U. S. Pharmacopoeia, National Formulary or New and Non-Official Remedies.

Readmission to a hospital within 90 days after a previous hospitalization is considered part of the first hospitalization. Each visit for treatment at the out-

[4] Any employee who leaves the service of the company without qualifying for an immediate age or disability pension, but who has completed 15 or more years of continuous service, has the right, under the plan, to a pension beginning when he attains age 65. The company intends only those entitled to a pension immediately following termination of employment to be eligible for health care benefits.

[5] While the plan applied in 1960 only to active employees, it is here described as applicable to pensioners.

[6] An exception relates to mental or nervous disorders and pulmonary tuberculosis, for which benefits are payable up to a maximum of 30 days during any 12-month period.

patient department of a hospital counts as one day of hospitalization. The occupant of a private room would be required to pay the hospital the regular charge for the private room in excess of $12. Subscribers confined in an accredited general hospital which is neither a member of nor covered by reciprocal arrangements with Blue Cross will be entitled to an indemnity of up to $25 for the first day of hospitalization and up to $10 per day for each additional day of hospitalization not in excess of 119 days for a single stay. Maternity benefits are not to be provided under the plan for the spouses of pensioners.

Limited benefits are available for (a) surgical and radiation treatment in the out-patient department of a hospital which is a member of Blue Cross; (b) emergency out-patient treatment in an accredited general hospital, as the result of, and beginning within 48 hours after, a non-occupational accident; and (c) in-patient admissions for diagnostic study and diagnostic services performed in the out-patient department of a hospital which is a Blue Cross member and which provides such services when directed toward a definite condition of disease or injury. The exclusions are, except for the services described in the preceding sentence, those usually to be found in comprehensive Blue Cross service plans.

The hospitalization coverage would begin with the start of the pension. Under the pension plan, all pensions begin with the first day of the first full month of retirement. Coverage for both pensioner and spouse would end on the earlier of the date of death or the last day of the last month for which the pension is paid. A spouse surviving a pensioner, or a pensioner whose pension is terminated, would have the right to convert to a direct-pay contract under the local Blue Cross plan. This conversion option is assumed, for the purposes of the estimate in this paper, to produce no charge against the company.

Blue Cross Premiums.

As mentioned previously, the Blue Cross coverage for pensioners can be obtained in three ways: by continuation in the company group along with active employees, by formation of a separate group with present benefits (except such as may be excluded), or by conversion at the time of retirement to a direct-pay contract under a local Blue Cross plan. The premiums for converted contracts are higher than the current net premiums after experience rating refunds. But, for pensioners, it is reasonably certain that the premiums are less than the cost; on all converted contracts the 1959 losses were almost 110 per cent of earned premiums. A substantial increase in group conversions by pensioners would almost certainly increase the underwriting loss if the relation between the overall community premiums and premiums for conversions remains constant. It is general Blue Cross policy to subsidize premiums on group conversions, but no definite percentage seems to have been fixed for the subsidy. The drive to cover retired persons by Blue Cross through direct-pay contracts can be expected to result in periodic increases in the community premiums for such coverage.

If pensioners are continued in the company group along with active employees or form a separate group, the experience rating formula is such that

any additional cost for pensioners' hospitalization benefits would be immediately reflected in premiums. To the extent by which (a) the ratio of pensioners to the total covered under the company group is less than the corresponding ratio for the whole "community" covered by the entire Blue Cross plan, and (b) the experience with pensioners under the company group is more favorable than for the whole community, net premiums for continuation of pensioners in the company group will offset the subsidy in the community rate and the lower benefits of local Blue Cross plans. The company's favorable experience rate for active employees is attributable to many factors of which (1) a pension plan effectively operating for many years, and (2) youthful hiring ages would be neutral or would tend to raise pensioner costs. The company has a very effective plan under which ill employees and dependents are visited and assisted by company nurses. This plan does not now apply to pensioners, but consideration is being given to such an expansion. If arrangements are made for pensioner coverage, the pensioner experience might be somewhat more favorable than it would otherwise be.

The company was considering making the health care benefits provided for active employees available to former employees who were then pensioners, and wanted an estimate of the cost of such a move. In calculating such a cost it was assumed that the premiums would reflect the full cost on the basis of actual experience with such pensioners.

Pensioners, active employees and spouses[7] were distributed by age on July 1, 1960, as follows:

		Pensioners			
Age of Pensioner	*Age*	*Disability*	*Age of Pensioner*	*Age*	*Disability*
35-39	—	1	69	509	19
40-44	—	4	70	502	12
45-49	—	5	71	426	1
50-54	—	16	72	275	—
55-59	—	37	73	151	—
60-64	—	165	74	131	—
65	221	64	75	90	—
66	492	63	76-79	81	—
67	567	52	80 & over	20	—
68	601	32	Total	4066	471

[7] There has been no count of spouses. Estimates of numbers of spouses in the several age groups have been based on data as to the marital status and ages of spouses of railroad workers on the basis of whose deaths (in 1954-56) application for survivor benefits were made to the Railroad Retirement Board, as reported by the Board in the report on the Seventh Actuarial Valuation. Average ages of spouses (all females) from Railroad Retirement data were rounded up to the next higher integral year.

Age of Pensioner	Spouses of Age Pensioners	Spouses of Disability Pensioners	All Pensioners	Average Age
Under 50	—	8	8	43
50-54	—	13	13	50
55-59	—	30	30	55
60-64	—	134	134	59
65-69	1843	177	2020	63
70-74	1050	9	1059	67
75-79	106	—	106	71
80 & over	10	—	10	75
Total	3009	371	3380	

Active Employees and Spouses

Age	Employees	Spouses	Average Age of Spouses
Under 20	205	51	18
20-24	1,309	785	21
25-29	3,980	3,065	26
30-34	5,768	4,649	31
35-39	7,616	6,306	36
40-44	9,308	7,791	41
45-49	8,576	6,921	46
50-54	6,184	5,120	50
55-59	4,245	3,451	55
60-64	2,664	2,166	59
65-69	924	712	63
70-74	135	95	67
75 & over	9	6	71
Total	50,923	41,118	

The average Blue Cross premium for active employees in the second quarter of 1960 was $8.837 per participant. No separate premiums for employees with and without dependents were quoted; as of January 1, 1960, 82.86 per cent of the employees had dependents. The Blue Cross organization has quoted a premium for the year beginning July 1, 1960, of $8.82 per month for single pensioners and $16.33 for a couple, without subsidy.

A composite rate for pensioners as of July 1, 1960, was estimated to be $14.415, about 63 per cent higher than the active employee cost for the second quarter of 1960. Hospital costs for active employees include maternity services and benefits for children; pensioner family costs contain no maternity benefits and costs for children can, without perceptible error, be disregarded.

It was estimated that maternity and child costs were 31.9 per cent of all hospital costs for the active employee plan. If maternity and children's benefits had been excluded from that plan, the second quarter cost per employee would have been $6.018. Thus the composite quoted premium for pensioners and spouses was about 2.40 times the rate of active employees and spouses, exclusive of benefits for children and maternity cases.

Hospital Utilization by Retired Employees and Their Spouses

In the calculation of long range costs, the initial premium, while important, is by no means the only factor. Utilization increases with age; as pensioners grow older their utilization will rise. And as a pension plan itself ages, the average age of pensioners tends to rise. As will be pointed out, there is a long-term trend towards increasing hospitalization utilization; this trend must be examined. Finally, the costs of hospital care measured in some appropriate units of utilization have been increasing rapidly for a number of years. These price increases have had a marked effect on premiums for hospital benefits.

The best single unit for measuring the volume of hospital services is a day of hospital confinement. It is not a perfect unit; the use of hospital out-patient services is not well measured by this unit, nor has any very satisfactory method of measurement been found. For lack of any better unit, the day of hospital care is used in this paper as the measure of hospital utilization.

What would be desirable, if it were available, is actual experience as to hospital utilization by persons who have retired from their jobs after relatively long periods of steady employment. Most such persons and their spouses are over 65 years of age. Unfortunately, so far as this writer could discover, no such experience has been accumulated. The best that can be done is to examine the experience as to hospital utilization of persons who are under 65. Some comments as to the possible differences between retired persons and elderly persons who have not retired will be made after the experience has been examined.

Eight studies of hospital utilization by elderly persons were analyzed for this paper. These were:

(a) "Voluntary Health Insurance and the Senior Citizen," compiled and published by the New York State Insurance Department (1957);

(b) American Life Convention (ALC), Health Insurance Association of America (HIAA), and the Life Insurance Association of America (LIAA) (1959), study summarized by E. J. Faulkner in testimony before the Congressional Committee on Ways and Means, July 1959;

(c) 1954 hospital utilization by participants in the Philadelphia Blue Cross plan, published by Spiegelman in "Ensuring Medical Care for the Aged";

(d) Direct-pay contract experience under Rhode Island Blue Cross in 1959, compiled and published by that Blue Cross organization;

(e) A study of hospitalization experience of the population of Cuyahoga County, Ohio (utilization experience undated, study published in 1959 by the Citizens Hospital Study Committee, Northeast Ohio);

(f) Health Insurance Plan of Greater New York (HIP), (1955) study by Shapiro and Einhorn in "Public Health Reports," August 1958;

(g) Indiana Blue Cross (1956), study by Hineman published by Blue Cross organization, 1959;

(h) New Jersey Blue Cross (1958), study compiled and published by Research Office of Blue Cross organization in 1959.

The data utilized here and just referred to are based on experience under insurance, Blue Cross or indemnity. Data based on surveys have been omitted as not as useful for present purposes as the experience with insurance operations. The Canadian experience under the Saskatchewan type legislation has been omitted also as not bearing directly on probable experience in the United States.

The data from the studies suggest that the average days of hospitalization per pensioner, if equal to that of the average male over 65, would be at least 3 per annum if the maximum duration per stay is 120 days. The "at least" and the "if" clauses are used advisedly for several reasons. First, most of the experiences are at least 3 or 4 years old and, as will be seen later, there is some trend toward increased utilization. Second, none of the experiences appear to be based on retired lives exclusively. The experience of one large hospital service plan[8] suggests that for persons 65 and over hospital utilization of those who have retired is at least one-third higher than for those employed.

Two of the eight experiences indicate average days of pensioner hospitalization substantially less than the other six: the Health Insurance Plan of Greater New York (HIP) and Cuyahoga County, Ohio. The data based on these two experiences are not given much weight here. The HIP data are related to a particular method of medical practice and payment therefor which is not now in wide use. The likelihood of plans such as HIP being generally available in the foreseeable future is too small to warrant giving weight to the experience for present purposes. The Cuyahoga County figures are based on too diverse groups and cover too brief a period to be significant.

For the purpose of calculating the cost of advance funding of hospital benefits it is concluded that a factor should be added to the averages based on the available experience to allow for the fact that the male group here will be composed entirely of retired persons. The hospitalization experience for the pensioner group here will, other things being equal, be rather less favorable than that of persons retired under private pensions generally. The company has no compulsory or automatic retirement age; health considerations play a large part in decisions (some made by employees, some by the company, as a result of physical examinations) to retire. That is, the physical condition of the pensioners may be somewhat inferior to that of pensioners under the average company pension plan where automatic retirement is frequently to be found.

It is concluded that, for cost calculation purposes, it should be assumed that hospital utilization up to 120 days per stay for the present age pensioners

[8] Cited in Secretary of Health, Education and Welfare "Report Submitted to the Committee on Ways and Means, Hospitalization Insurance for OASDI Beneficiaries" (Committee Print, Government Printing Office, 1959), p. 89, n. 6.

will, at present, be 3.5 days per pensioner per annum. This is based roughly on an increase of 5 per cent over the averages based on the New York State study and the ALC-HIAA-LIAA data and an allowance of just under one-sixth of the base for changing from a part-active part-retired employee base to a base in which all male participants are retired. This allowance implies the guess that the current experience with hospital coverage of persons over 65 is based on active and retired lives in about equal proportions.

It is assumed that the hospitalization experience of the spouses (wives in this case) of employees retired because of age will not differ significantly from that of the wives of active employees of like ages. The averages based on the New York State 1957 data and on the ALC-HIAA-LIAA 1959 study, after adjustment of the latter to a 120-day maximum stay, are in exact agreement. For the present cost calculations it is therefore assumed that the average days of hospitalization per present age pensioner spouse, up to 120 days per stay, will be currently 2.5 per annum.

No study has been available for disability pensioners. To receive a disability pension an employee must have at least 15 years of service, so that the minimum age of a disability pensioner will be about 32. As will later be explained in detail, the after-life of age pensioners is here assumed to be represented by the GA-'51 (male) mortality table with ages set back one year, while current mortality of disability pensioners approximates that of the 1944 Disabled Railway Employees mortality table for persons of equal age who have been disabled for 2 years. The disabled annuity value at 32 approximates that under the GA-'51 table at age (as adjusted) 62. Therefore, the average days of hospitalization for disabled pensioners at age 32 is taken to be the average for persons aged 62, with the differential constant at 28 years instead of 30 from age 37 on. Again, it is assumed that the hospital experience for spouses (wives) of disability pensioners will be the same as for other women of the same age up to age 65. It seems reasonable to suppose that the wives of disabled men are themselves in poorer-than-average health. No exact measurement of this extra hazard is known to this writer. An allowance of 8 per cent is added to the days of hospitalization of wives of disability pensioners over 65 to compensate for this risk.

The average days of hospitalization for current pensioners and the spouses can be expected to rise as more and more pensioners survive to older ages. The ALC-HIAA-LIAA experience, because it is the most recent available for individual ages, is taken as the basis for the slope in increase by age. The ALC-HIAA-LIAA average days for aged persons at each age and sex applied to the actual ages of age pensioners and spouses of pensioners over 65 indicated overall averages of 2.654 days per pensioner and 2.295 days per spouse of a pensioner over 65. To bring these averages up to 3.5 and 2.5 days, respectively, the ALC-HIAA-LIAA averages for males and females were raised by 31.88 per cent and 8.932 per cent, respectively. The average days of hospitalization so adjusted were used in the cost calculations and are given in Table 1.

The proportion of pensioners who are married and the ages of spouses have been based on the Railroad Retirement experience already referred to. For cost purposes, these data, which are published for quinquennial age groups,

are assumed to apply to the middle age of each group and proportions and ages are interpolated on a straight line basis. Ages of spouses are taken to the next higher whole year. The data relating to the proportion of pensioners who are married are also shown in Table 1. On the basis of this table, the average compensable days of hospitalization per annum for present pensioners, age and disability together, is 3.936, and for their spouses 2.481.

UNIT HOSPITALIZATION COSTS

The average total expense per patient day in short-term general and other special hospitals, as compiled and published by the American Hospital Association, was $28.17 in 1958 and $30.19 in 1959. The increase of $2.02, 7.2 per cent, was relatively less than in ten other years since 1946. Or, to state the reverse, in only two years since 1946 has the year-to-year increase in the cost of a day of hospital care increased less than from 1958 to 1959. The nationwide level of cost of a day of hospitalization at the middle of 1960 may well be above $32.

TABLE 1

Proportion of Pensioners at Each Age who are Married and Average Days of Compensable Hospitalization of Pensioners and Their Spouses at Each Age of Pensioners

Age of Pensioner	*Proportion of Pensioners who are Married*	*Average Days of Compensable Hospitalization of Pensioners in Year of Age*		*Average Days of Compensable Hospitalization of Pensioner's Spouses in Pensioner's Year of Age*	
		Disability[a]	*Age*	*Disability*[a]	*Age*
(i)	*(ii)*	*(iii)*	*(iv)*	*(v)*	*(vi)*
32	.8060	2.64		0.86	
33	.8104	2.65		0.89	
34	.8148	2.66		0.92	
35	.8192	2.77		0.96	
36	.8236	2.90		1.01	
37	.8280	3.03		1.05	
38	.8298	3.17		1.09	
39	.8316	3.17		1.12	
40	.8334	3.30		1.17	
41	.8352	3.43		1.20	
42	.8370	3.56		1.23	
43	.8310	3.69		1.26	
44	.8250	3.82		1.27	

[a] Persons retired for disability are permanently classified as disability pensioners, irrespective of their attained ages.

45	.8190	3.96		1.31	
46	.8130	4.22		1.33	
47	.8070	4.35		1.38	
48	.8090	4.48		1.40	
49	.8110	4.75		1.46	
50	.8130	5.01		1.51	
51	.8150	5.41		1.59	
52	.8170	5.67		1.59	
53	.8192	6.07		1.64	
54	.8214	6.33		1.71	
55	.8236	6.73		1.76	
56	.8258	6.99		1.84	
57	.8280	7.25		1.89	
58	.8250	7.65		1.97	
59	.8220	7.91		2.03	
60	.8190	7.91		2.12	
61	.8160	7.91		2.20	
62	.8130	7.91		2.20	
63	.8046	7.91		2.28	
64	.7962	7.91		2.28	
65	.7878	7.91	3.03	2.47	2.29
66	.7794	7.91	3.17	2.47	2.29
67	.7710	7.91	3.17	2.58	2.39
68	.7582	7.91	3.30	2.70	2.50
69	.7454	7.91	3.43	2.71	2.51
70	.7326	7.91	3.56	2.71	2.51
71	.7198	7.91	3.69	2.82	2.61
72	.7070	7.91	3.82	2.83	2.62
73	.6900	7.91	3.96	2.95	2.73
74	.6730	7.91	4.22	3.05	2.83
75	.6560	7.91	4.35	3.05	2.83
76	.6390	7.91	4.48	3.17	2.94
77	.6220	7.91	4.75	3.29	3.05
78	.6008	7.91	5.01	3.40	3.15
79	.5796	7.91	5.41	3.41	3.16
80	.5584	7.91	5.67	3.52	3.27
81	.5372	7.91	6.07	3.76	3.49
82	.5160	7.91	6.33	3.88	3.59
83	.4898	7.91	6.73	3.89	3.60
84	.4636	7.91	6.99	3.99	3.70
85	.4374	7.91	7.25	4.23	3.92
86	.4112	7.91	7.65	4.47	4.14
87	.3850	7.91	7.91	4.47	4.14
88	.3654	7.91	7.91	4.48	4.15

Age of Pensioner	Proportion of Pensioners who are Married	Average Days of Compensable Hospitalization of Pensioners in Year of Age		Average Days of Compensable Hospitalization of Pensioner's Spouses in Pensioner's Year of Age	
		Disability[a]	Age	Disability[a]	Age
(i)	(ii)	(iii)	(iv)	(v)	(vi)
89	.3458	7.91	7.91	4.49	4.16
90	.3262	7.91	7.91	4.81	4.46
91	.3066	7.91	7.91	4.82	4.47
92	.2870	7.91	7.91	4.84	4.48
93	.2720	7.91	7.91	4.86	4.50
94	.2570	7.91	7.91	5.05	4.68
95	.2430	7.91	7.91	5.06	4.69
96	.2290		7.91		5.01
97	.2160		7.91		5.23
98	.2030		7.91		5.56
99	.1910		7.91		5.77
100	.1790		7.91		6.00
101	.1680		7.91		6.32
102	.1570		7.91		6.53
103	.1470		7.91		6.53
104	.1370		7.91		6.53
105	.1280		7.91		6.53
106	.1190		7.91		6.53
107	.1110		7.91		6.53
108	.1030		7.91		6.53
109	.1000		7.91		6.53
110	.1000		7.91		6.53
111	.1000		7.91		6.53

[a] Persons retired for disability are permanently classified as disability pensioners, irrespective of their attained ages.

This is an average for the whole country. While the company involved here has employees in a number of widely scattered states, the nationwide average overstates the actual average slightly. The benefits provided in 1959 had a current value of $29.34 per day in the hospital. Further, the usual Blue Cross plan reimburses hospitals through some formula which, directly or indirectly, results in a discount from the price charged those who pay hospital bills directly. That is true in the present case; the average payment per hospital day in 1959 was $27.64, indicating a discount of about 5.8 per cent. In any event, the cost of a day of hospitalization in 1959 for the company's active employees and their dependents was almost 8.5 per cent less than the national average. The average payments in 1957 and 1958 were, respectively, $22.87 and $25.82 per day of hospitalization. The increase of 1958 over 1957 was 12.9 per cent, while from 1958 to 1959 the rise was 7.0

per cent. The increase of 1959 over 1957 was 20.9 per cent as compared with a 16.2 per cent increase in the national average. That is, a day of hospitalization for employees of the company with whose pensioners this paper is concerned now costs less than the national average but is rising at a more rapid rate. This has apparently been true of the company's hospital costs for some time. Exact comparisons over a longer period are prevented by a substantial change in the plan late in 1956.

We are here concerned with pensioners. Is the cost of a day of hospitalization for a pensioner and his spouse more or less than the average? First, in the company involved here, the cost of a day of hospitalization in maternity cases was higher than the cost of a day of other in-patient care by 12.9 per cent in 1957, 7.6 per cent in 1958 and 16 per cent in 1959. Maternity benefit costs in these three years averaged 14 per cent of total benefits. If the cost of a day of maternity care had been the same as for other in-patient care, the average total cost of a day of hospitalization in the three years would have been reduced by 1.7 per cent. Thus the fact that pensioner families will have, for all practical purposes, no obstetrical cases should tend to reduce costs slightly.

The fact that costs for children will be eliminated from pensioner families will operate in the opposite direction. However, the effect apparently will be slight. Under the company plan the cost of a day of in-patient care for dependents, including children, was about 1 per cent higher than the cost of a day of in-patient hospitalization of an employee in 1958 and 1959 and about 1 per cent lower in 1957. The company hospitalization costs have not been divided for the several age groups of employees and dependents. Such a classification was made in Indiana in 1956. The hospital bill per day for patients over 65 was $21.87 as compared with $22.91 for patients of all ages. In the Hineman study of Indiana Blue Cross 1956 experience, obstetrical cases were omitted. Daily hospitalization costs for participants over 65 in other types of cases were less than the average for all participants other than children.

Using the Indiana figures, all that are available, it is concluded that the omission of children will increase the average daily cost of hospitalization by 1 per cent. The cost per day for persons over 65 will be 4.54 per cent less than the average for all adults. The average for males in the over-65 group will be 3.22 per cent above and that for women over 65, 3.58 per cent below the average for both sexes in the over-65 age group.

Applying these percentages to the $27.64 average for 1959 we get:

$.983 \times \$27.64 = \$27.17$, average cost per day of non-maternity care;

$1.01 \times \$27.17 = \$27.44$, average cost per day of adult care;

$.9546 \times \$27.44 = \$26.194$, average cost per day of hospitalization for patients over 65;

$1.0322 \times \$26.194 = \$27.04$, average cost per day of hospitalization for a male patient over 65;

$.9642 \times \$26.194 = \$25.26$, average cost per day of hospitalization for a female patient over 65.

These were 1959 costs. When this study was being prepared in the third quarter of 1960, it was estimated that the daily Blue Cross costs under the company plan in 1960 would be more than 10 per cent in excess of 1959.[9] Data differentiating between utilization and price of services were not available when the estimate was prepared. For present purposes, it is estimated that the cost of a day of hospital care for a pensioner over 65 in 1960 was $29.75 and for a spouse of such a pensioner $27.80. For want of data indicating different figures for the particular group, these averages will be applied to disability pensioners under 65 and their spouses.

The Blue Cross premiums for pensioners, $8.82 for pensioners without dependents and $16.33 for pensioner and spouse, assumed that expenses and contingency reserves would be 9 per cent of claims. On the basis of the utilization and cost per day of hospitalization developed here (see page 22), with loadings as in the quotation, the monthly premiums would be:

For pensioner without dependents:

$$\frac{(3.936)(\$29.75)(1.09)}{12} = \$10.636$$

For pensioner and spouse:

$$\frac{[(3.936)(29.75) + (2.481)(27.80)](1.09)}{12} = \$16.901$$

Weighted average:

$$\frac{(3380)(\$16.901) + (1157)(\$10.636)}{4537} = \$15.303$$

Hospital Utilization Costs and Trends

For the purposes of a long range cost estimate, trends in the utilization and in costs of hospital services must be taken into account. The first question to be asked is whether hospital utilization among retired persons and their spouses is increasing. Unfortunately, all the over-65 utilization data are from separate studies which have not been repeated. It is impossible to determine from a comparison of the data from the several sources what sort of a trend, if any, exists.

That there has been a general trend toward greater utilization of hospital facilities admits of no doubt. Part of this trend has been connected with the spread of insurance and part is due to change in the public attitude towards and in the functions of hospitals. Between 1949 and 1959 the hospital utilization under all Blue Cross plans in the United States (number of days of hospitalization per 1000 Blue Cross participants) rose from 846 to 1041, or by almost 2.1 per cent per annum, compounded. Over a longer period the increase in Blue Cross utilization has been slower than in the recent past.

[9]The 1960 overall costs per hospital day in fact turned out to be 8.8 per cent higher than in 1959. The daily payment after discount rose 8.5 per cent while average days in hospital per employee (but including days of dependents) increased by 5 per cent. The increase in hospital days per employee (excluding dependents' hospital days) was 2.8 per cent. Partly because of a sharp decline in employees at work in 1960 and 1959, the proportion of employees having dependents rose significantly.

Thus Blue Cross utilization in 1943 was 802 per 1000 participants, indicating an overall increase in utilization in the period 1943-59 of a little over 1.6 per cent per annum compounded.[10] The average increase in days per 1000 participants over the 10-year period was 19.5 as compared with 14.9 in 16 years. Thus utilization seems to be increasing faster in the 1950's than in the 40's.

The use of compound interest in calculating increases in hospital utilization is perhaps not warranted. The implication of compounding is that, in the long run, there is no limit on utilization. The slowing down of the rate of increase, despite liberalized access to hospital services, indicates that there may be some top limit. That limit is probably far from being attained; but for the purpose of projecting costs in the future, arithmetic rather than geometric progression is to be preferred.

Blue Cross utilization in recent years has been increasing more rapidly than formerly, whereas the reverse is true for the general population. Since the latter includes Blue Cross subscribers, the utilization for those who are not covered by Blue Cross must be increasing quite slowly, if at all. This is an illustration of the generally known fact that possession of insurance against health care costs tends to stimulate use of the agencies providing health care. Since we are here dealing with Blue Cross, it would be reasonable to expect utilization to increase in the next several years at the rate, in days per 1000 participants, of, say, the past five if benefits were to be increased as they were during that period. We are here dealing with a fixed plan. Recent increases have not been, overall, substantial. It is concluded that an annual increase in utilization of about 2 per cent of the 1959 average is a reasonable expectation for Blue Cross generally. Will the increase for pensioners be more or less than the average?

The great public interest in health care for the aged is likely to result in an increase in utilization, even if no further legislation is enacted. And the forces that will produce the increase will also make it more rapid than for the average elderly person who is insured against health care costs.

But there is some evidence that for an important group of workers the illness of aged employees has been rising faster than have illnesses among employees in the same industry at all ages. In the year ending June 30, 1949, there were 499.5 days of illness among each 100 male railroad employees eligible for sickness benefits under the Railroad Unemployment Insurance Act. In the year ended June 30, 1958 (the latest for which the necessary data had been published when this paper was prepared), the days of sickness per 100 male eligibles had risen to 780. But there had also been a substantial rise in the proportion of older employees. Weighting the days of sickness at the various ages by the numbers of persons at those ages in the 1949 fiscal year produces an average of 661.6 days of sickness per 100 male eligibles. The proper comparison, therefore, is between 499.5 and 661.6. Sickness

[10] United Steelworkers of America, "Special Study on the Medical Care Program for Steelworkers and Their Families" (Pittsburgh, September 1960), p. 108; Louis S. Reed, "Blue Cross and Medical Service Plans" (Federal Security Agency, 1947), p. 113.

among male railroad employees in the 9-year period rose by 32.45 per cent.[11] During the 9-year period there had been no change either in the definition of sickness, in the length of time for which benefits were paid or in the waiting periods in each benefit year. The relationship between sickness benefits and pensions did not change significantly. There were slight changes in the earnings requirement for eligibility, but it is clear that these could not have had any significant influence on the trend of sickness rates.

The average days of sickness of male employees 65 and over were larger, by about 62.43 per cent, than 9 years earlier. That is, illness among employees over 65 increased at a rate almost double that for all employees.[12] This does not prove that the hospitalization of over-65 employees would have increased in the same ratio; it is to be doubted that such would have been the case. Nor is it certain that railroad experience would have been duplicated in the company involved here, or that the experience of active employees indicates a similar relative change for retired persons. But the railroad sickness insurance system is the largest operating in the United States and its trend experience (after correction for the aging) is hardly atypical. For present purposes it would seem appropriate to assume that the volume of hospitalization among retired employees will tend to rise a little more rapidly than among actives.

Reference has already been made to the rapid rise in the cost of a day in the hospital in recent years. The (national) average cost of hospitalization per patient day since 1946, as compiled and published by the American Hospital Association, is as follows:

Year	*Average Cost per Patient Day*	*Yearly Per Cent Increase*
1946	$9.39	—
1947	11.09	18.1
1948	13.09	18.0
1949	14.33	9.5
1950	15.62	9.0
1951	16.77	7.4
1952	18.35	9.4
1953	19.95	8.7
1954	21.76	9.1
1955	23.12	6.2
1956	24.15	4.5
1957	25.99	7.6
1958	28.17	8.4
1959	30.19	7.2

[11] If the 1958 age distribution were used for 1949, the average days of illness in the earlier year would have been such as to indicate an increase of 33.57 per cent. After the text was written the Railroad Retirement Board published the sickness experience for the year ended June 30, 1960, without any sex breakdown. On the basis of an age distribution the same as in fiscal year 1949, sickness rates in fiscal year 1960 produced an increase in days of sickness of 45.0 per cent above what they were. If the age distribution had been constant at the 1960 figure, the indicated increase would have been 44.1 per cent.

[12] The recently published railroad figures indicate that between the fiscal years 1949 and

This nationwide trend can be duplicated in particular sections. For example, in New York State the average cost per patient day in Blue Cross affiliated hospitals was found by the Columbia study[13] to have been $13.55 in 1947, $20.36 in 1952 and $26.71 in 1957. The rate of increase in the overall state average was influenced largely by the relatively slow increase in New York City hospitals. Over the 10-year period the hospital costs per day in all the up-state cities were more than doubled. The cost of a day of hospitalization under the company plan was given above as $22.87, $25.82 and $27.64 in 1957, 1958 and 1959, respectively. The average in 1953 was $12.98. The increase in company costs due to a change in the plan is indeterminate, but probably between one-fifth and one-third.

Increases in daily hospital costs over periods of time compare as follows:

Coverage of Data	*Period*	*Average Annual Increase in Hospital Costs per Patient Day During Period*	*Percentage of Average Annual Increase to Average Cost in* *First Year of Period*	*Last Year of Period*
Nationwide[a]	1946-59	$1.60	17.04	5.30
Nationwide[a]	1950-59	1.62	10.37	5.37
Nationwide[a]	1955-59	1.77	7.66	5.86
Nationwide[a]	1957-59	2.10	8.08	6.96
New York State[b]	1947-57	1.32	9.74	4.94
New York State[b]	1952-57	1.27	6.24	4.75
New York City[b]	1947-57	1.40	9.03	4.74
New York City[b]	1952-57	1.38	6.10	4.68
Buffalo[b]	1947-57	1.25	12.51	5.56
Buffalo[b]	1952-57	1.46	9.61	6.49
Company[c]	1953-59	2.01	12.90	7.27
Company[d]	1953-59	1.72	9.94	6.22
Company	1957-59	2.38	10.41	8.61

[a] Based on data published by the American Hospital Association as given in the preceding tabulation.
[b] As published in the Columbia study.
[c] Assuming plan improvements would have increased 1953 costs by one-fifth.
[d] Assuming plan improvements would have increased 1953 costs by one-third.

In considering future trends of hospital utilization and unit costs, account must be taken of the current efforts to reduce the volume of hospital inpatient care by greater resort to out-patient services. The Columbia study points out that if the average hospital stay could be reduced by 2 or 3 days, the average cost of a hospital stay would remain about constant if per diem costs increased by 50 per cent.

1960 illnesses among employees over 65 increased 59.4 per cent as compared with 45 per cent for all employees.

[13] "Prepayment for Hospital Care in New York State," report by Ray E. Trussell and Frank Van Dyke of the Columbia School of Public Health and Administrative Medicine to the Commissioner, Department of Health, and Superintendent of Insurance, New York State.

During the 10 years 1949-59, Blue Cross utilization of out-patient services increased much more rapidly than did in-patient care. Despite this trend toward more extensive use of less costly hospital services, the upward surge of both unit and aggregate hospital costs continued.

There has been substantial discussion of the possibility of the substitution of home care with adequate nursing for in-patient hospital services. For older persons, care in skilled nursing homes, if available, may have advantages, including economy, over hospital care. As mentioned earlier, the Company maintains an extensive visiting nurse service. Company hospital costs are perhaps lower than if there had been no such service; but there is nothing to show that the company costs have been rising any less rapidly than hospital costs generally. Nor are there indications that accommodations in nursing homes capable of giving adequate care are likely to be available in sufficient quantity to make any more significant contribution toward the health care of the rapidly increasing numbers of retired persons in the foreseeable future than is the case at present.

It is reasonable to suppose, however, that the efforts to contain the upward trend of hospital utilization and costs will have sufficient power to prevent increases from taking a geometric pattern. For both utilization and unit costs, the calculations in this paper will be based on an upward arithmetic trend, with certain modifications introduced by way of illustration. For the basic calculation (though other amounts will be used to indicate magnitudes) it will be assumed that the average cost of a day of hospitalization will increase at $2.00 per annum for the average retired worker and at an amount for the spouses, $1.87, which is the same percentage of the current daily cost for them as $2.00 is of the current daily cost for retired workers.

Methods of Calculating Cost

It is proposed to use what, in pension terminology, is called the "entry-age normal" method of computing costs. In essence, the process involves calculation of:

(a) The present value of (i) the hospitalization benefits to be provided in the future for present active employees and pensioners and their spouses, and (ii) a contribution of $1.00 per annum payable in equal monthly installments during the remaining service of each present employee;

(b) The annual amount (normal annual cost) required to be paid in equal monthly installments during the entire active service of new employees to provide, for such of them as qualify, hospitalization benefits after retirement for themselves and their spouses;

(c) The present value of the normal annual cost payable during the remaining service of each active employee;

(d) Aggregate past service cost [(a) minus (c)];

(e) The past service cost amortization installment per active employee [(d) divided by the number of employees and multiplied by the appropriate amortization factor]; and

(f) Total cost per active employee [the sum of (b) and (e)].

The calculation of pension costs under the entry-age normal method requires, in addition to the factors already discussed, assumptions as to (i) the rate of termination of employment without the right to any pension or hospitalization benefit, (ii) the rate of retirement among those eligible for an age pension and hence for hospitalization benefits, (iii) the rate of permanent and total disability, (iv) the rate of mortality in active service, (v) the rate of mortality after age and disability retirement, (vi) the distribution by age of new employees, and (vii) the rate of interest to be earned on funds accumulated in excess of benefits in the early years of the plan's operation. The first four of these rates are combined to form a service table. The rate of mortality in active service is based on the A-1949 male table without projection;[14] mortality after age retirement is assumed to follow the GA-1951 table with ages set back one year; and the mortality applied to lives of disability pensioners is the 1944 Disabled Railway Employees table (ultimate rates). The other probabilities needed for construction of the service tables and the service tables themselves used for this paper have been published elsewhere.[15] The distribution of employees by age has been given. For cost calculation purposes a distribution of employees having less than 15 years of service on the valuation date, by age at the time of original hire and by length of service, and a distribution, by attained age, of those having more than 15 years of service are also required. These distributions are given in Table 2. The valuation date is July 1, 1960. The distribution, by age at the time employed, of employees hired in the 5 years preceding the valuation date is taken as the distribution of those who will be hired in the future. The rate of interest assumed to be earned on any excesses of contributions over benefits in the initial years of operation is 3 per cent per annum, compounded annually. Net costs will be increased by 9 per cent for expenses and contingency reserves. Costs will be shown on a minimum basis (normal plus interest on past service cost), maximum (normal plus one-tenth of past service cost) and with past service costs amortized over 30 years from the valuation date.

In order to be able to observe the cost effects of different assumptions as to the future cost of a day's hospitalization and the amount of annual increases in such costs and in utilization, the results of the cost calculations will be presented in several stages and separately for pensioners and their spouses. The final average costs per employee will be given for the following:

I. No increase in either cost per day of hospitalization or in utilization:
   Cost per hospital day
   a. $29.75 for pensioners
      27.80 for spouses
   b. $26.00 for pensioners
      24.30 for spouses
   c. $25.00 for pensioners and spouses

[14] The mortality rate in the A-1949 table was, of course, first converted to a probability of death in active service for use in constructing the service table. The employment termination, disability and retirement "rates" are taken as probabilities.

[15] Murray W. Latimer and Joseph Musher, "The Actuarial Impact of Long-Term Wage Trends on Salary Scales for Industrial Type Pension Plans," Proceedings of the Conference of Actuaries in Public Practice, Vol. VI, pp. 174-204.

II. Cost per day of hospitalization and utilization both increasing;
Both increases will be calculated in terms of percentages of 1960 levels and therefore will be the equivalent of fixed annual amounts. Costs are given for the following increases:

	Annual Increase in Cost per Day of Hospitalization	*Equivalent Annual Increase in Cost per Day of Hospitalization Resulting from Higher Utilization*	*Equivalent Total Annual Amount of Increase Based on Cost of a Day of Hospitalization of $29.75 for Pensioners and $27.80 for Spouses*	
	Per Cent of First-Year Cost[a]	*Per Cent of First-Year Cost*[a]		
	(Uniformly Applicable to Pensioners and Spouses of All Ages)		*Pensioners*	*Spouses*
a.	6%	1%	$2.08250	$1.946
b.	6	1½	2.23125	2.085
c.	6	2	2.38000	2.224
d.	7	1	2.38000	2.224
e.	7	1½	2.52875	2.363
f.	7	2	2.67750	2.502

[a] No compounding. The increase resulting from higher utilization could properly be, but is not, based on the cost after the allowance for the increase. The rate of increase in utilization may properly be thought of as slightly less than the 1, 1½ or 2 per cent per annum shown.

III. Costs per day of hospitalization, after allowance for increased utilization, will be larger than in the first year by the amounts under II. In each year thereafter the increase will be diminished (and after a period of years the decrease will be larger) by:

(a) ¾ per cent of total first-year increase;

(b) 1 per cent of total first-year increase;

(c) 2 per cent of total first-year increase;

(d) 3 per cent of total first-year increase.

In the notation used in this paper, m (the annual amount of reduction in the increase) under (a) coupled with (a) under II for pensioners is ¾ per cent of $2.0825, or .01561875; m under (d) coupled with (c) under II would be 3 per cent of 2.38 for pensioners or 3 per cent of 2.224 for spouses.

Over the years the assumptions in II result in very high costs of a day of hospital care. Thus in 1990 a 6 per cent increase in the cost of a day's hospital care, without compounding, means that such costs would be 180 per cent higher than in 1960; i.e. a $29.75 cost per day in 1960 would be $83.30 in 1990. In addition, if utilization were to increase by 1 per cent of the present level each year, the cost effect is assumed to be the same as if daily hospital costs had increased by 30 per cent over 1960, or by $8.925 per day. The total cost effect, therefore, is the same as if utilization remained constant and daily hospital cost rose to $92.225.

TABLE 2

Number of Employees on July 1, 1960
Distributed by Age and Length of Service

Age when Employed[1]	*Length of Service (Years)*						
	Under 1	*1 & Less than 2*	*2 & Less than 3*	*3 & Less than 4*	*4 & Less than 5*	*5 & Less than 10*	*10 & Less than 15*
Under 20	70	13	130	130	103	527	551
20-24	45	103	722	695	689	2470	1447
25-29	38	46	346	530	660	2605	1429
30-34	14	68	255	298	482	1991	1064
35-39	13	33	172	165	347	1402	812
40-44	10	20	62	101	136	890	589
45-49	5	5	50	19	65	409	361
50-54	5	1	13	8	39	169	203
55-59	3	4	6	3	12	68	32
Total	203	293	1756	1949	2533	10,531	6488

	Total Under 5 Years	*Total Under 15 Year*	*15 Years and Over*	
			Attained Age[2]	
Under 20	446	1524	32-36	1033
20-24	2254	6171	37-41	4214
25-29	1620	5654	42-46	6886
30-34	1117	4172	47-51	5882
35-39	730	2944	52-56	4045
40-44	329	1808	57-61	3083
45-49	144	914	62-66	1733
50-54	66	438	67-71	271
55-59	38	128	72-76	23
Total	6734	23,753	Total	27,170

[1] To nearest birthday.
[2] At last birthday.

Even in the light of the recent rapid increases in unit hospital costs, the amounts to which costs would rise in the next 30 and 50 years under the assumptions specified can only be characterized as colossal. They seem consistent only with a continuous inflation. It is doubtful if any fund accumulation ought to be entered upon now with any such continuous trend in mind. Three methods of reducing the apparent cost can be followed. One is to make the assumed percentages of increase smaller than those listed under II; another is to introduce a decreasing rate of increase and ultimately an absolute decrease. The third method involves formulae which apply differential factors to segments of the commutation functions. The first method can be accom-

plished very simply under II by multiplying the costs of increase, as they will be given separately from (and under the unmodified assumptions to be added to) the costs under I where neither unit costs nor utilization are assumed to increase. The second method is embodied in division III. The third method has not been explored for this paper.

The total cost of a day of hospitalization under II (a) increases by 6 per cent per year and the effect of the assumed rise in utilization is to make the overall increase 7 per cent per year or, for the pensioners' 1960 cost of $29.75, $2.0825 per year. Thus for 1961 the effective overall equivalent cost would be $31.8325, in 1962 $33.9150, and so on. Under III the cost in 1960 and 1961 would be unchanged; the 1962 overall equivalent cost per day of hospitalization, instead of being $2.0825 higher than in 1961, would be higher by only 99.25 per cent of $2.0825 under III (a), [99 per cent under III (b), 98 per cent under III (c), 97 per cent under III (d)]. The effect of introducing each of these various reductions in the factors of increase is illustrated for pensioners under two of the six increase assumptions under II (a) [annual overall increase of $2.0825] and (f) [annual overall increase of $2.6775] in the following tabulation.

			Cost of a Day of Hospitalization of a Pensioner				
	Initial Overall		*Continuous Increase at*	*Increase Reduced Each Year After First by*			
II	*Increase*		*Rate in (2)*	*¾%*	*1%*	*2%*	*3%*
(1)	*(2)*	*Year*	*(3)*	*of Original Amount*			
(a)	$2.0825	1970	$50.58	$49.87	$49.64	$48.70	$47.76
(f)	2.6775	1970	56.53	55.62	55.32	54.12	52.91
(a)	2.0825	1990	92.23	85.43	83.17	74.11	65.05
(f)	2.6775	1990	110.08	101.34	98.43	86.78	75.13
(a)	2.0825	2010	133.88	114.74	108.36	82.85	57.34
(f)	2.6775	2010	163.63	139.03	130.83	98.03	65.23
(a)	2.0825	2030	175.53	137.81	125.23	74.94	24.65
(f)	2.6775	2030	217.18	168.68	152.51	87.85	23.19

VALUATION PROCEDURE

No attempt is here made to describe the details of the several valuations made for cost calculation purposes. There was a number of series of calculations.

1. Several series of present values, as of (a) the date of future age retirements for most active employees, and (b) the present ages of (i) pensioners (age and disability), (ii) active employees 65 and over, and (iii) active employees who have met the service qualification for a disability pension, of the cost of hospitalization for (1) a pensioner (age and disability, as appropriate) during his remaining life, and (2) his spouse, if married, during the shorter of (i) her own remaining lifetime, or (ii) that of the pensioner. In all calculations the number of days in hospital, up to a maximum of 120, was as-

sumed, in 1960, to be accurately stated for each year of age in Table 1. Any increase in cost was assumed to affect all days of hospitalization in identical ratio; and increases in utilization were taken as applicable equally at all ages. Any given percentage increase in utilization would therefore be equivalent to an increase of cost of an identical percentage, and in the calculations the two increases, where assumed, have been treated as if the two increases were a single, appropriately larger, increase in cost.

a. In the first series of calculations the cost of a day of hospitalization was assumed to be constant at the 1960 level, and no allowance was made for any increase in utilization.

b. In a second series the cost and utilization were assumed to increase, after 1960, by a constant percentage of the 1960 levels. Cost and utilization were combined in a single percentage equivalent to an identical cost increase, the calculations involving six combinations (five percentages, as summarized in the tabulation on page 32): 7, 7½, 8, 8½ and 9.

c. In the third series, cost and utilization (combined again in a single percentage) were assumed to increase, but with the increase in each year as compared to the last diminishing by a constant percentage of the original increase.

In the first series of calculations present values of the cost of hospitalization for (i) a pensioner, and (ii) his spouse varied by future pensioners' ages at retirement, with present pensioners and some active employees taken at their ages on the valuation date. Two series (one for pensioners, another for spouses) were obtained for the age pensioners, equated in effect to the earliest age of age retirement. With respect to employees already past the minimum age for age retirement, for disability pensioners generally, and for potential disability pensioners among active employees who have met the minimum service requirement for a disability pension, values had to be worked out for the whole range of possible ages at retirement.

In the second and third series of calculations the present values were needed for all the ages in the first series for every one of many years in the future.

Having calculated the present value of hospital costs as of the time of future retirement, these values must be related back to the valuation date, July 1, 1960. This was done, of course, by discounting the present values as of the various retirement dates from such dates to mid-1960 and making further modification to allow for the varying probabilities of employees of differing ages and periods of service qualifying for a pension. The probability of having a spouse at retirement is allowed for in the present value (as of the date of the pensioner's retirement) of the cost of the spouse's hospitalization. Where present pensioners are involved, the present values are, of course, taken as is.

2. a. The first series of calculations took a day of hospitalization as having a cost of 1, whether such day was in 1960, 1980, 2000 or some other year. These required modification where changes in costs were involved.

b. In the second series calculations were based upon constant annual

increases in the cost of a day of hospitalization equal to certain percentages of 1960 costs: 7, 7½, 8, 8½ and 9 (see the tabulation on page 32). These percentages are the sums of separate percentage increases, one resulting from the rise in the unit price, the other the increased utilization. If the total increase is 7 per cent, the cost in 1960 would be 1, in 1961 1.07, in 1962 1.14 and in 1963 1.21, and so on.

c. In the third series of calculations the increase was assumed to diminish each year by a constant percentage: ¾, 1, 2 or 3 (see the paragraph marked III on page 32). Thus if the 1960 cost per day of hospitalization was 1 and the first-year increase was .09, with the annual increases decreasing by 2 per cent each year [(.02)(.09) = .0018], the series of present values would be based on:

	Increase in Cost from Previous Year	*Cost in Year*
1960	—	1
1961	.09	1.09
1962	.0882	1.1782
1963	.0864	1.2646
1964	.0846	1.3492
1965	.0828	1.4320
	and-so on	

3. The several series of present values based on an initial cost of a day of hospitalization of 1 were translatable into any specified value by simple multiplication or, if values were to be varied as between pensioners and spouses or as between, for example, age and disability pensioners, by multiplying the appropriate series of values by whatever initial cost for the particular group was deemed proper.

All these calculations were, of course, shortened and simplified by the construction of numerous sets of commutation functions. But the next-to-end-product was the average value, as of the valuation date, of the cost of hospitalization of employees and their spouses under the plan during that part of the lifetime of employees which will remain after their retirement (or after the valuation date in case of employees already on pension). Commutation functions were used to get the present value, as of the valuation date, of a unit of contribution payable during the remaining active service of employees who were in such service on the valuation date. The present values of hospital costs and of a unit of contribution were determined for an average employee at each age-service cell.

The final step in the process was the multiplication of the average value of hospital costs and of contributions for an employee in each cell by the number of employees in such cell as shown by the census. To determine the 1960 entry-age normal, the values of costs at each age at 0 service, weighted by the number of employees in the census classified by their ages at the dates of employment, was divided by the value of a unit of contribution at each age at 0 service, identically weighted.

THE RESULTS OF COST CALCULATIONS

1. The total value, as of the valuation date, of benefits under the three sets of daily benefit costs in the first group of assumptions as to such costs,[16] the entry-age normals, the aggregate past service costs and the average past service cost per employee, all before loading, were, as indicated by a valuation as of July 1, 1960:

	1(a)		*1(b)*	
	Daily Benefit $29.75 (Pensioners) $27.80 (Spouses)		*Daily Benefit $26.00 (Pensioners) $24.30 (Spouses)*	
	Employees After Retirement	*Spouses*	*Employees After Retirement*	*Spouses*
Value of benefits	$38,020,563	$13,068,950	$33,228,055	$11,423,578
Annual entry-age normal	16.9521	5.6554	14.8153	4.9433
Past service cost	27,305,920	9,494,432	23,863,985	8,299,145
Average past service cost per employee	536.22	186.45	468.63	162.97

	1(c)	
	Daily Benefit $25 for Pensioners and Spouses	
	Employees After Retirement	*Spouses*
Value of benefits	$31,950,053	$11,752,653
Annual entry-age normal	14.2455	5.0858
Past service cost	22,946,128	8,538,153
Average past service cost per employee	450.60	167.67

The value, as of the valuation date, of a contribution of $1 per annum, payable continuously during the remaining active service of all employees in the census, was $632,054.

Under a pension plan the minimum funding required under Internal Revenue Regulations, for plans in which costs are calculated as here, is normal cost plus interest on the unfunded past service costs. The maximum for which a tax deduction is allowable is the normal cost plus one-tenth of the initial unfunded past service cost. These two costs with, in addition, the

[16] This group of assumptions used days of hospitalization and proportion of pensioners with spouses from Table 1 and allowed for no increase after 1960, either in the per diem cost or in utilization.

normal plus the amount required to amortize the initial unfunded past service costs over a period of 30 years from the valuation date, all on an annual basis and loaded 9 per cent of net, expressed as an amount per employee, are:

		Normal Plus		
	Benefits for	*Interest Only on Unfunded Past Service Cost*	*30-Year Funding of Past Service Costs*	*One-tenth of Initial Unfunded Past Service Costs*
I (a)	Pensioners	$35.76	$47.86	$76.93
	Spouses	12.17	16.38	26.49
	Both	47.93	64.24	103.42
I (b)	Pensioners	31.25	41.83	67.23
	Spouses	10.64	14.32	23.15
	Both	41.89	56.15	90.38
I (c)	Pensioners	30.05	40.22	64.64
	Spouses	10.95	14.73	23.82
	Both	41.00	54.95	88.46

Costs for pensioners are much higher than for their spouses because the spouse benefits never run longer than for pensioners and may terminate earlier; because after age 82 less than half the pensioners are assumed to be married; because the spouses are younger than the pensioners; and because the cost of a day of hospitalization for a spouse is less than for a pensioner. If the spouses' benefits ran for their lives, the costs would be substantially higher than are here recorded.

It should be noted that under all the assumptions the gross costs, when interest only is paid on past service costs, will be level indefinitely if employment remains constant. And given all the assumptions, the past service costs will be amortized in 30 years only under the same circumstances. The assumption that there will be no reduction in employment is probably not warranted.

II. In view of the rise over the last 25 years in the costs of a day of hospitalization and in the utilization of hospital services, the assumption of no change in either of these factors is not justifiable. This section deals with the costs under several differing assumptions as to the rate of change. The increases for which costs are here given were set out in the tabulation on page 32 and apply to the per diem costs assured under I (a) (i.e. $29.75 for pensioners and $27.80 for spouses). Increases for the per diem cost assumed in I (b) and (c), if the percentage increases were the same as those used for (a), would be in the same ratio as that of the per diem cost assumed for such cost in I (a). The results of the calculations, omitting the detail of aggregate values given for the three sets of benefits in the preceding section, are:

Increase as in (see page 32)	*Cost of Increased Benefits as Assumed in II for*			*Grand Total, Including Cost of Constant Benefit Amount [I (a)] and Utilization*
	Pensioners	*Spouses*	*Total*	
	Only Interest Paid on Past Service Liability			
II (a)	$70.94	$23.19	$94.13	$142.06
II (b)	76.00	24.85	100.85	148.78
II (c)	81.07	26.50	107.57	155.50
II (d)	81.07	26.50	107.57	155.50
II (e)	86.14	28.16	114.30	162.23
II (f)	91.20	29.81	121.01	168.94

Annual Additional Cost for Each 1 Per Cent Annual Increase (Not Compounded) in Hospital Costs Above 1960: $13.44

	30-Year Amortization of Past Service Liability			
(a)	$83.39	$27.19	$110.58	$174.82
(b)	89.35	29.13	118.48	182.72
(c)	95.30	31.07	126.37	190.61
(d)	95.30	31.07	126.37	190.61
(e)	101.26	33.02	134.28	198.52
(f)	107.21	34.96	142.17	206.41

Annual Additional Cost for Each 1 Per Cent Annual Increase (Not Compounded) in Hospital Costs Above 1960: $15.80

	Past Service Liability Amortized at Rate of One-tenth Each Year			
(a)	$113.29	$36.79	$150.08	$253.50
(b)	121.38	39.42	160.80	264.22
(c)	129.48	42.05	171.53	274.95
(d)	129.48	42.05	171.53	274.95
(e)	137.57	44.68	182.25	285.67
(f)	145.66	47.31	192.97	296.39

Annual Additional Cost for Each 1 Per Cent Annual Increase (Not Compounded) in Hospital Costs Above 1960: $21.45

If the costs of hospitalization increase for the indefinite future at the rate of the past few years, and if utilization moves upward much less rapidly than in the recent past [assumption II (a)], costs will be, if past service liability is amortized over 30 years, approximately $175 per year. For the reasons discussed in connection with the assumption of no increased costs, amortization at a slower rate would, in view of downward employment trends, be imprudent. Costs, if amortization of past service liability is to be at the maxi-

mum amount for which tax deductions are allowable, would be at least $250 per annum.

The most common concept of entry-age normal relates to what such normal would be on the valuation date if all the employees in service on that date had just been hired at their ages as of the actual employment dates: This concept has been modified slightly here to the extent that there has been substituted for the original hiring ages of all employees the assumption that all employees entered at the ages of those hired in the last 5 years.

There is another concept of entry-age normal which relates to employees to be hired in the future. In a situation when benefits are rising, the costs for future new employees will be higher than now and if consideration is given to this fact, overall costs will be increased; since the value of benefits for present employees is unchanged, the rise in normal costs will be offset in part by a reduction in past service costs.

Two sets of increases related to the higher costs for employees hired in the future have been calculated. In one, the calculation is based on the assumption that the effect of the higher costs is the same as if the normal costs for all employees, present and new, were based on what the per diem costs and utilization will be, under the several assumptions, in 1964. The other calculation follows the same procedure except that the per diem costs and utilization of 1967 are taken as the base. The several assumed increases in hospital costs and utilization operate, above the initial levels, as in the previous calculations. The annual costs per employee would be larger than those shown in the tabulation on page 39 by the following amounts (based on 30-year amortization of past service costs):

Increase as in (see page 32)	*Per Diem and Utilization for the Normal Cost Based on Projection to*	
	1964	*1967*
II (a)	$2.59	$4.54
II (b)	2.78	4.86
II (c)	2.97	5.19
II (d)	2.97	5.19
II (e)	3.15	5.51
II (f)	3.34	5.84

Under the termination rates used for these calculations the rate of replacement or present employees is not high and diminishes steadily, even if there is no reduction in the level of employment. The assumption that the average level of the cost of a day of hospitalization and of utilization will, for all employees, present and new, be as high as in 1967 in effect averages in all the new employees likely to be engaged for 15 to 20 years. This would appear to be sufficiently conservative in any case.

III. The estimates of funding costs in the preceding section indicate that for the company involved here an annual amount (at $175 per employee) of a little more than $8,900,000 is the minimum reasonable cost. The amounts are very likely to appear excessive to company officials. The fact that the overall rate of increase in costs for many years has been much larger than

7 per cent, and that 7 per cent, without compounding, is, over a generation, less than 4 per cent compounded, would not weigh much in comparison with the large sums involved. This section deals with the cost effects of projecting a decreasing rate of increase in costs and utilization.

The costs in the following tabulation relate to an initial cost of a day of hospitalization of $29.75 for pensioners and $27.80 for their spouses, with an initial annual increase of 8 per cent in daily cost and increased utilization combined [II (c) and II (d)], with such increase decreasing after the initial year by the four percentages outlined on page 32.

Rate of Decrease as in	*Cost of Decreasing Increased Benefits as Assumed in II(c) and III for*			*Grand Total, Including Cost of Constant Benefit Amount [I (a)] and Utilization*
	Pensioners	*Spouses*	*Total*	
	Only Interest Paid on Past Service Liability			
III (a)	$71.86	$24.00	$95.86	$143.79
III (b)	68.77	23.16	91.93	139.86
III (c)	56.49	19.82	76.31	124.24
III (d)	44.21	16.49	60.70	108.63
	30-Year Amortization of Past Service Liability			
III (a)	$86.52	$29.03	$115.55	$179.79
III (b)	83.59	28.35	111.94	176.18
III (c)	71.89	25.63	97.52	161.76
III (d)	60.19	22.90	83.09	147.33
	Past Service Liability Amortized at Rate of One-tenth Each Year			
III (a)	$121.74	$41.12	$162.86	$266.28
III (b)	119.17	40.80	159.97	263.39
III (c)	108.86	39.56	148.42	251.84
III (d)	98.55	38.31	136.86	240.28

Looking at costs under the 30-year amortization of past service liability, it is clear that small changes in the rate of increase of hospital costs have a fairly substantial impact on the indicated cost of a plan. If the 8 per cent initial annual increase is reduced to 7.94 per cent in the second year, 7.88 per cent in the third, 7.82 in the fourth, and so on, the annual cost is $179.79 as compared with $190.61 if the annual increase is uniformly 8 per cent. But if, after the first year's 8 per cent increase, the second year's were to be 7.76 per cent, the third 7.52 per cent, the fourth 7.28 per cent, and so on, the cost would be $147.33, or a little over 18 per cent less than under the first set of decelerating increases and almost 23 per cent less than the cost under the annual increase of 8 per cent without deceleration. All these percentages of increase apply, of course, to the initial cost; there is no compounding. Nor is there any adjustment for new entrants in the future; the effect of the deceleration would, with such adjustment, be slightly larger.

The initial increases assumed in the set of calculations was, taking utilization into account, equivalent to 8 per cent of the 1960 cost of a day of hospitalization. The same results could have been obtained, and much more easily, if, instead of a decreasing increase worked out by formula, the net effect of the decreases had been approximated. Thus a constant annual increase of 7.31 per cent of 1960 costs would have produced the same result as assumptions II (c) and III (a) taken together. For all assumptions made in this section, the equivalents are:

Initial Annual Increase (Percentage of 1960 Unit Cost)	*Annual Percentage of Reduction in Initial Annual Increase*	*Equivalent Uniform Annual Increase (Percentage of 1960 Unit Cost)*
II (c) 8	III (a) 0.75	7.31
II (c) 8	III (b) 1.00	7.09
II (c) 8	III (c) 2.00	6.17
II (c) 8	III (d) 3.00	5.26

IV. Any funding program involving so volatile a variable as hospital costs is bound to require frequent adjustment. The safest course—and the most expensive—would be to choose what seem to be conservative assumptions and hope that the adjustments would be the result of surpluses rather than deficits. Fortunately, a partial hedge is available which can be used to good effect. Some of the factors which have produced the rapid upward trend of hospitalization costs also operate on wages. Wages have risen much less rapidly than the cost of hospital care in the past and, in view of the demand for hospital service as compared with that for labor, that disparity seems likely to continue. If therefore, a program for funding hospital costs for retired employees were to be related to the wages of active employees by expressing the contribution commitment in terms of payroll, the extent of periodic adjustments should be appreciably diminished. There is no practical device by which adjustments can be eliminated.

The average annual compensation of active company employees in 1960 was $5200. The cost of benefits under I (a), i.e. with no allowance for future increases, using 30-year amortization of past service costs, was found to be $64.24 per employee per annum, or 1.24 per cent of average annual compensation. If compensation were to be constant and the cost were to increase as in assumption II (c) or II (d) (8 per cent of original cost each year), the constant percentage of compensation required under 30-year amortization would be 3.67. If compensation were to increase at the same rate as hospital costs and utilization, the 1.24 per cent of payroll contribution would cover the cost of the hospital benefit plan.

The preceding paragraph involves an over simplification. If the assumptions as to hospital costs hold and if the downward drift in employment is small, past service costs will have been amortized at some future date, probably deferred by a much longer period than 30 years. If costs rise by a little more than 8 per cent a year and employment holds steady, the past service cost would, in time, be amortized by a contribution of 3.67 per cent of a pay-

roll, without any change in average compensation. And, after the point of completion of past service amortization, costs would be much smaller since the contributions would need to cover only the normal.

The reference to a contribution of 1.24 per cent is intended to serve only as a benchmark. There is no justifiable basis on which it could be regarded as adequate.

The level of compensation in the United States has been rising, sometimes slowly, sometimes rapidly, ever since the nation was established. The long term trend can be expected to continue. And it is reasonable to make such an assumption in preparing a funding program.

Calculations have been made as to the percentages of payroll required to support the hospitalization benefits under the following conditions:

(1) Initial cost of a day of hospitalization, $29.75 for pensioners and $27.80 for their spouses;

(2) An annual increase in such daily cost (including an allowance for rising utilization) of $2.38 for pensioners and $2.224 for their spouses;

(3) Annual compensation of $4600 and $5200 for new employees in their first year of service and for all employees, respectively;

(4) A 30-year amortization period for funding past service liability, with a constant payroll during the period—i.e. the numbers of employees falling in the same ratio that average compensation increases;

(5) Annual increases in the average annual compensation (both of new employees and of present) of

(A) $152 (8 cents per hour for 1900 hours of pay);

(B) $200;

(C) $300.

Finally, these three annual increases will be used in connection with the assumption that the average annual compensation of both new employees when hired and of present employees will be $5200.

No account is taken of the rise, over the 1960 level, of hospital costs and utilization with respect to new entrants. It was found, as indicated, that the effect of such higher costs on the total contribution required for funding was slight. In these calculations based on payroll, it is assumed that newly hired employees will always have the same initial salary. The two omissions fairly well cancel each other out.

Under these several assumptions, and using the method developed by Latimer and Musher,[17] the percentages of total compensation required to fund the benefits are:

[17] See footnote [15], p. 31.

Annual Increase in Average Annual Salaries	*Average Annual Salary in 1960: $5200 Initial Annual Salary of New Employees: $4600*	*Average Annual Salary in 1960 and Initial Annual Salary of New Employees: $5200*
$152	3.25%	3.22%
200	3.14	3.12
300	2.97	2.96

When and if the past service costs are amortized, these percentages, under the assumptions given, would fall to:

Annual Increase in Average Annual Salaries	*Average Annual Salary in 1960: $5200 Initial Annual Salary of New Employees: $4600*	*Average Annual Salary in 1960 and Initial Annual Salary of New Employees: $5200*
$152	1.49%	1.36%
200	1.36	1.25
300	1.16	1.08

The recommendation made to the client was that if the hospital benefit plan were extended as proposed, a reserve be created for the payment of premiums on the coverage by contributing to such reserve (assumed to be a trust, with tax problems involved) an amount equal to 3.15 per cent of the compensation of active employees.

FITTING NEGATIVE BINOMIAL DISTRIBUTIONS BY THE METHOD OF MAXIMUM LIKELIHOOD

BY

LEROY J. SIMON

I—INTRODUCTION

Maximum likelihood solutions for negative binomial distributions have been worked out by a number of authors. The purpose of this paper will be to develop the solutions in an insurance context, and to investigate one phase that has not been touched upon in the literature. The formulas developed will be applied to some actual data.

Dropkin[1] has considered the process of fitting the negative binomial distribution by the method of moments, to a set of complete data. In this paper, the same problem will be treated using the method of maximum likelihood; but first, two problems will be solved where the number of observations in the zero case (claim-free insureds in insurance applications) is subject to some special condition.

One type of a special condition would be if the zero cases were suspected of having been censored in some manner. This censoring might arise because claim-free policy files were destroyed if they did not renew, while all other files were retained. Another example with a similar distortion in the zero case was considered by Harwayne[2] when it seemed likely that a number of zero cases would appear in the records of the California Motor Vehicle Department, for persons who did not actually drive at all in the state during the period covered by the study.

We will also consider the special condition of a truncated negative binomial. This will often arise in insurance applications because it is usually much easier to locate and study those policies which had one or more claims during the experience period, rather than checking the entire policy file. If a study is made of only the policies which had claims, we get a truncated distribution, where the zero case has been entirely eliminated.

Finally, it may be in order to comment on how the method of maximum likelihood compares with the method of moments. The method of moments uses as many moments of the distribution as are necessary to obtain a solution. Many of the mathematical models that we use are described by one or two parameters. Hence, one or two moments are sufficient for a solution. In an occasional problem, we may find that the third moment must be utilized. When the third moment is introduced, large sampling errors result, and the fits are not too satisfactory.

The method of maximum likelihood is based on the principle that the best estimate of the population parameters is that estimate which maximizes the

[1] Lester B. Dropkin, "Some Considerations on Automobile Rating Systems Utilizing Individual Driving Records," CAS, XLVI, p. 166 (1959).

[2] Frank Harwayne, "Merit Rating in Private Passenger Automobile Liability Insurance and the California Driver Record Study," CAS, XLVI, p. 192 (1959).

probability of obtaining the observed sample. This method avoids the use of moments, but often requires difficult and extensive calculations. It will usually produce answers which are very similar to the method of moments, if second-order moments are the highest needed for a solution by this latter method. However, when higher-order moments are introduced, the reduced sampling errors of parameters estimated by the maximum likelihood method easily off-set the calculating difficulty.[3]

II — MATHEMATICAL DEVELOPMENT

The form for dealing with the negative binomial which has been used in recent volumes of our Proceedings,[4] is cumbersome to manipulate in the manner desired in this paper; so, instead of using

$$f(x) = \left(\frac{a}{a+1}\right)^r \left(\frac{-1}{a+1}\right)^x \binom{-r}{x} \tag{1}$$

let's define

$$p = \frac{1}{a} \tag{2}$$

$$q = 1+p = \frac{a+1}{a} \tag{3}$$

and rewrite the binomial coefficient to produce

$$f(x) = \binom{r+x-1}{x} p^x q^{-r-x} \tag{4}$$

First we will treat the special condition where the zero case is subject to some distortion. Let $(1+\theta)$ be the measure of distortion in the zero case. Then the probability of observing x claims on a policy will be given by

$$\left.\begin{aligned} f(x) &= q^{-r}\,(1+\theta)/(1+\theta q^{-r}) && x=0 \\ f(x) &= \binom{r+x-1}{x} p^x q^{-r-x}/(1+\theta q^{-r}) && x=1,2,\ldots \end{aligned}\right\} \tag{5}$$

The denominators on the right side of (5) are necessary so that $\sum f(x) = 1$, thus making the total probability equal unity. Let n_0 be the number of sample cases in which $x=0$ and let N be the total of all cases in the sample. The likelihood function for such a sample is:

$$P(x_1,\cdots, x_N;\, q,\, \theta,\, r) = q^{-n_0 r}\,(1+\theta)^{n_0}\,(1+\theta\, q^{-r})^{-n_0} \prod_{x>0} \binom{r+x-1}{x} p^x q^{-r-x} (1+\theta\, q^{-r})^{-1} \tag{6}$$

The maximum likelihood solution is obtained by taking the logarithm of (6),

[3] F. N. David and N. L. Johnson, "The Truncated Poisson," *Biometrics*, VIII, pp. 275-85 (1952). On page 284 they illustrate that the standard error of the parameter p determined by the method of moments is eight times the standard error of p determined by the method of maximum likelihood.

[4] CAS, XLVI, p. 166 (1959) and CAS, XLVII, p. 1, p. 20, p. 37 and p. 55 (1960).

differentiating partially with respect to each parameter and setting the results equal to zero:

$$L = n_0 \log (1+\theta) + \sum_{x>0} \log \binom{r+x-1}{x} + \log p \sum x - Nr \log q$$
$$- \log q \sum x - N \log (1+\theta q^{-r}) \tag{7}$$

$$\frac{\partial L}{\partial \theta} = \frac{n_0}{1+\theta} - \frac{N q^{-r}}{1+\theta q^{-r}} = 0 \tag{8}$$

$$\frac{\partial L}{\partial q} = \frac{\sum x}{p} - \frac{Nr}{q} - \frac{\sum x}{q} + \frac{N \theta r q^{-r-1}}{1+\theta q^{-r}}$$
$$= \frac{\sum x}{pq} - \frac{Nr}{q(1+\theta q^{-r})} = 0 \tag{9}$$

The partial derivative of L with respect to r is less easily obtained,[5] but eventually leads to

$$\frac{\partial L}{\partial r} = \sum_{x>0} \left(\frac{1}{r} + \frac{1}{r+1} + \cdots + \frac{1}{r+x-1} \right) - N \log q + \frac{N \theta q^{-r} \log q}{1+\theta q^{-r}}$$
$$= \sum_{x>0} \left(\frac{1}{r} + \frac{1}{r+1} + \cdots + \frac{1}{r+x-1} \right) - \frac{N \log q}{1+\theta q^{-r}} = 0 \tag{10}$$

Solving (8) for θ we have

$$\theta = (n_0 q^r - N)/(N - n_0) \tag{11}$$

Substituting (11) in (9) and (10):

$$\frac{\sum x}{pq} - \frac{(N-n_0)\, r}{q(1-q^{-r})} = 0 \tag{12}$$

$$\sum_{x>0} \left(\frac{1}{r} + \frac{1}{r+1} + \cdots + \frac{1}{r+x-1} \right) - \frac{(N-n_0) \log q}{1-q^{-r}} = 0 \tag{13}$$

[5] It is helpful in the development of this partial derivative to know that:

$$\frac{\partial}{\partial r} \left[\log \binom{r+x-1}{x} \right] = \frac{\partial}{\partial r} \left[\log \frac{(r+x-1)!}{x!\,(r-1)!} \right]$$
$$= \frac{\partial}{\partial r} \left[\sum_{i=0} \log (r+x-1-i) - \sum_{i=0} \log (x-i) - \sum_{i=0} \log (r-1-i) \right]$$
$$= \sum_{i=0} \frac{1}{r+x-1-i} - \sum_{i=0} \frac{1}{r-1-i}$$
$$= \frac{1}{r+x-1} + \frac{1}{r+x-2} + \cdots + \frac{1}{r+1} + \frac{1}{r}$$

These equations cannot be solved directly and the values of q and r must be found by some iterative process. The difficulty of solving the maximum likelihood equations is the principal deterrent to their wide-spread use.

The second special condition that we will study is the case where $\theta = -1$ in (5); i.e., we have no measurement of the zero case. This is the situation in insurance where a study is made only of those policies which have claims on them. In this case no measurement is made of n_0, so let N' represent the total number of cases in the truncated sample in which n_0 is missing. Then,

$$f(x) = \binom{r+x-1}{x} p^x q^{-r-x}/(1-q^{-r}) \qquad x = 1,2 \ldots \tag{14}$$

$$P(x_1, \cdots, x_N; q, r) = \prod_{x>0} \binom{r+x-1}{x} p^x q^{-r-x} (1-q^{-r})^{-1} \tag{15}$$

$$L = \sum_{x>0} \log \binom{r+x-1}{x} + \log p \,(\Sigma x) - N' r \log q - \log q \,\Sigma x - N' \log (1-q^{-r}) \tag{16}$$

$$\frac{\partial L}{\partial q} = \frac{\Sigma x}{pq} - \frac{N'r}{q(1-q^{-r})} = 0 \tag{17}$$

$$\frac{\partial L}{\partial r} = \sum_{x>0} \left(\frac{1}{r} + \frac{1}{r+1} + \cdots + \frac{1}{r+x-1} \right) - \frac{N' \log q}{1-q^{-r}} = 0 \tag{18}$$

Comparing (17) with (12) and (18) with (13), the two are identical when we recall that N' and $(N - n_0)$ are the same thing; viz., the number of cases in the sample with the zero case excluded. This means that the two cases we have considered thus far are identical and if we have evidence that the zero case has been subject to distortion, we might as well throw it out and fit the curve as though our sample had the zero case censored out completely. This is not a surprising result since we must lose one degree of freedom in either event, so it makes little difference if we do it by adjusting an imperfect measure of n_0 or by entirely manufacturing an n_0.

For use in Section III—Application, we will now develop the formulas for fitting a truncated negative binomial by the method of moments. It has been shown[6] that the first three moments of the negative binomial are, in our notation:

$$\mu'_1 = rp \tag{19}$$

$$\mu'_2 = rp\,(q + rp) \tag{20}$$

$$\mu'_3 = rp\,(r^2p^2 + 3rp^2 + 3rp + 2p^2 + 3p + 1) \tag{21}$$

Notice that

$$\sum_{x>0} x^i = \sum_{x\geq 0} x^i \text{ for any } i > 0.$$

Since, $\Sigma x^2/\Sigma x$ from the truncated sample will be an estimate of μ'_2/μ'_1, and

[6] LeRoy J. Simon, "The Negative Binomial and Poisson Distributions Compared," *CAS*, XLVII, p. 20 (1960).

since $\sum x^3/\sum x$ from the truncated sample will be an estimate of μ'_3/μ'_1 we can set $\sum x^2/\sum x = rp\ (q + rp)/rp$ and (22)

$$\sum x^3/\sum x = rp\ (r^2p^2 + 3rp^2 + 3rp + 2p^2 + 3p + 1)/rp \tag{23}$$

Solve these two equations for r and p and get

$$1 + p = q = \frac{(\sum x)\ (\sum x^3) - (\sum x^2)^2}{(\sum x)\ (\sum x^2 - \sum x)} \tag{24}$$

$$r = \frac{2\ (\sum x^2)^2 - (\sum x^2)\ (\sum x) - (\sum x^3)\ (\sum x)}{(\sum x)^2 + (\sum x)\ (\sum x^3) - (\sum x^2)^2 - (\sum x^2)\ (\sum x)} \tag{25}$$

With q and r determined from either a maximum likelihood solution or by the method of moments, N can be calculated from

$$N = N' + n_0 = N' + Nq^{-r}$$

$$N = N'/(1 - q^{-r}) \tag{26}$$

The fitted curve is thus determined.

Let us now consider the problem of fitting a complete negative binomial distribution by the method of maximum likelihood. Equation (4) gives the probability distribution of x claims where $x = 0, 1, 2 \ldots$ The likelihood function gives $P\ (x_1, x_2, \cdots, x_N; q, r) = \prod_x \binom{r+x-1}{x} p^x q^{-r-x}$ (27)

Then,

$$L = \sum_x \log \binom{r+x-1}{x} + \log p \sum x - Nr \log q - \log q \sum x \tag{28}$$

$$\frac{\partial L}{\partial q} = \frac{\sum x}{pq} - \frac{Nr}{q} = 0 \tag{29}$$

$$\frac{\partial L}{\partial r} = \sum_{x>0}\left(\frac{1}{r} + \frac{1}{r+1} + \cdots + \frac{1}{r+x-1}\right) - N \log q = 0 \tag{30}$$

Solve (29) for q and substitute in (30):

$$q = \frac{\sum x}{Nr} + 1 \tag{31}$$

$$\sum_{x>0}\left(\frac{1}{r} + \frac{1}{r+1} + \cdots + \frac{1}{r+x-1}\right) - N \log\left(1 + \frac{\sum x}{Nr}\right) = 0 \tag{32}$$

Here again we are unable to get a direct solution for p. However Equation (32) has only one unknown and, therefore, can be solved by a trial and error process.

III — APPLICATION

To illustrate the application of the various formulas, refer to Table 1. The data in the first two columns is taken from a study by Blensley and Head.[7] Column (3) utilizes Dropkin's formulas[8] which are, in our notation and slightly rewritten:

$$q = \frac{N\sum x^2 - (\sum x)^2}{N\sum x} \tag{33}$$

$$r = \frac{(\sum x)^2}{N\sum x^2 - (\sum x)^2 - N\sum x} \tag{34}$$

Column (4) results from a solution of equation (32) by trial and error and substitution of that value in (31). The χ^2 tests on columns (3) and (4) indicate that the negative binomial is a good fit and illustrate that the two methods produce very similar answers when only the first two moments are used.

Column (5) comes from a solution of equations (24) and (25). It fits closely as indicated by the χ^2 value.

Column (6) was difficult to obtain because equations (17) and (18) must be solved simultaneously. Various methods were attempted, but the method suggested by David and Johnson[9] was modified slightly, and used. From (17) and (18) we have

$$\frac{\sum x}{r} = \frac{N'(q-1)}{(1-q^{-r})} \tag{35}$$

$$\sum_{x>0}\left(\frac{1}{r} + \frac{1}{r+1} + \cdots + \frac{1}{r+x-1}\right) = \frac{N' \log q}{1-q^{-r}} \tag{36}$$

Then (36)/(35) gives

$$\frac{r\sum_{x>0}\left(\frac{1}{r} + \frac{1}{r+1} + \cdots + \frac{1}{r+x-1}\right)}{\sum x} = \frac{\log q}{q-1} \tag{37}$$

The procedure then is to select a starting value of r and evaluate the left hand side of (37). Enter the center of Table 2 with this value and read out the corresponding value of q. Substitute this value together with the estimated r in

$$(\sum x)\ (1-q^{-r})/N'\ (q-1) \tag{38}$$

thus producing an improved estimate of r. Repeat the process until q and r become stable. Experience indicates that convergence is quite slow and much

[7] R. C. Blensley and J. A. Head, "Statistical Determination of Effect of Paved Shoulder Width on Traffic Accident Frequency," *Highway Research Board Bulletin*, CCXL, p. 4 (1959). A sample element is defined in the study to be a one mile section of level and tangent primary rural two-lane Oregon highway with lane width of 10′ or more, which had paved shoulders and 30% or less sight restriction taken for a one-year period.

[8] Dropkin, p. 166.

[9] David and Johnson, p. 284.

can be gained by "leap frogging" ahead in the direction indicated by the improved estimate of r. Care must also be exercised in carrying sufficient significant digits, especially when getting the value of q, otherwise false indications will be given on where the final solution lies. In the example used, it was found advisable to get q to three, or even four, decimal places.

Column (6) fits more closely than column (5) as indicated by the sharply reduced value of χ^2. Despite the calculating complexity, it would be the method to use in practice. Just in case anyone is tempted to compare columns (3) and (4) with column (5) and conclude that this disproves my contention that the maximum likelihood method is better, I suggest the reader change n_0 in column (2) from 99 to 68 and re-calculate column (3). The exercise will be revealing.

IV — CONCLUSION

If some distortion is known or suspected in the zero case, we conclude that we might as well discard the observations in the zero case and deal only with the remaining data.

A second major conclusion is that the method of moments and the maximum likelihood method produce essentially the same result when used for fitting complete curves with a negative binomial distribution. Therefore, the method of moments would be used in practice because of the ease in calculation; and equations (33) and (34) would be used to determine q and r.

For a truncated distribution the method of maximum likelihood gives substantially improved results, and therefore it is recommended despite the calculating difficulty. Equations (37) and (38) would be used to obtain successively improved approximations to q and r.

After dealing with a variety of sample distributions, it seems to the author that the negative binomial has a great deal of plasticity and will conform well to a great variety of empirical data.

TABLE 1

Distribution of Sample Elements by Number of Accidents*
and Negative Binomial Curves Fitted by Various Methods

(1)	(2)	(3)	(4)	(5)	(6)
		Calculated Frequencies of Negative Binomials			
Number of Accidents	*Number of Sample Elements*	*Method of Moments Regular*	*Maximum Likelihood Regular*	*Method of Moments Truncated*	*Maximum Likelihood Truncated*
x	f_0	f_t	f_t	f_t	f_t
0	99	95.3	95.8	—	—
1	65	76.1	75.9	74.7	69.0
2	57	50.6	50.4	49.7	51.1
3	35	31.4	31.3	30.9	33.2
4	20	18.8	18.8	18.5	20.1
5	10	11.0	11.0	10.8	11.6
6	4	6.4	6.4	6.3	6.5
7	0				
8	3				
9	4 } 8	} 8.4	} 8.4	} 8.1	} 7.5
10	0				
11	1				
Total	298	298.0	298.0	199.0	199.0
χ^2		4.07	4.06	3.98	2.21
d.f.		5	5	4	4
Probability		.55	.55	.40	.70
r		1.4974	1.476	1.4983	2.1610
q		2.1407	2.157	2.1402	1.8817
Equations used		(33) & (34)	(31) & (32)	(24) & (25)	(37) & (38)

Summary Statistics

$N = 298$ $\quad \sum x^2 = 1959$ $\quad N' = 199$

$\sum x = 509$ $\quad \sum x^3 = 10643$ $\quad \bar{x} = 1.70805$

$\sigma^2 = 3.65638$

* See Footnote 7 in text.

TABLE 2

Value of log q/(q–1)

q	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09	Proportional Parts 1	2	3	4	5
1.0	—	.9950	.9900	.9853	.9805	.9758	.9712	.9666	.9620	.9576	5	10	14	19	24
1.1	.9531	.9487	.9444	.9402	.9359	.9317	.9276	.9235	.9195	.9155	4	8	12	17	21
1.2	.9116	.9077	.9039	.9000	.8963	.8926	.8889	.8853	.8816	.8781	4	8	11	15	19
1.3	.8745	.8711	.8676	.8642	.8608	.8574	.8541	.8508	.8476	.8444	3	7	10	13	17
1.4	.8412	.8380	.8349	.8318	.8287	.8257	.8227	.8197	.8168	.8138	3	6	9	12	15
1.5	.8109	.8081	.8052	.8024	.7996	.7968	.7941	.7914	.7887	.7860	3	6	8	11	14
1.6	.7833	.7807	.7781	.7755	.7730	.7704	.7679	.7654	.7629	.7605	3	5	8	10	13
1.7	.7580	.7556	.7532	.7508	.7485	.7462	.7438	.7415	.7392	.7370	2	5	7	9	12
1.8	.7347	.7325	.7303	.7281	.7259	.7238	.7216	.7195	.7174	.7153	2	4	6	9	11
1.9	.7132	.7111	.7091	.7070	.7050	.7030	.7010	.6990	.6970	.6951	2	4	6	8	10
	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9					
2.	.6932	.6745	.6571	.6407	.6253	.6109	.5972	.5843	.5720	.5604					
3.	.5493	.5388	.5287	.5191	.5099	.5011	.4927	.4846	.4768	.4693					
4.	.4621	.4552	.4485	.4420	.4358	.4297	.4239	.4183	.4128	.4075					
5.	.4024	.3974	.3925	.3878	.3833	.3788	.3745	.3703	.3662	.3622					
6.	.3584	.3546	.3509	.3473	.3438	.3403	.3370	.3337	.3305	.3274					
7.	.3243	.3213	.3184	.3155	.3127	.3100	.3073	.3047	.3021	.2995					

PROCEEDINGS

NOVEMBER 15-17, 1961

PRESIDENTIAL ADDRESS BY WILLIAM LESLIE, JR.

Once again I have the honor to address you as has been the custom for each President to do. This occasion marks the completion of my second term and I would not leave office without again thanking you for the honor. I can report to my successor that in several senses the Society seems more healthy today than it did two years ago. The financial position of the Society has been greatly enhanced by the introduction of the Invitational Program and the adoption of a schedule of registration fees in connection with the semi-annual meetings. Largely due to our improved financial position the Council of the Society has authorized the employment of a Secretary-Treasurer on what most of us hope will be a long term basis.

I once again call your attention to the increase in not only the number of papers presented to us but in the very substantial upgrading of their content. The work now being done by many of our members in the area of risk theory, for example, a matter to which I will refer later in this address, will, I am sure, bring considerable added lustre to the Society.

There seems little doubt that in some measure due to the cohesion produced by the Society's standards and status the influence of many of our members in the insurance business is steadily increasing.

One of the more intriguing but as yet unfinished projects which will surely absorb some of the time of your next President will be the furthering of the already substantial efforts to bring about closer coordination and cooperation among the several actuarial bodies and quite specifically between the Casualty Actuarial Society and the Society of Actuaries.

In today's address I wish to touch on a subject about which one reads many comments being made by insurance industry spokesmen with great frequency. The word "chaos" or its equivalent is being used over and over again to describe one or more problems today facing the insurance industry. Responsible executives with several decades of experience behind them are reporting that today's conditions represent the need to solve problems the like of which they have not seen previously in their careers.

There seem many aspects to this report of chaotic conditions. We hear it in discussions of the problems of independent companies viz a viz rating

bureaus. A year ago bureaus were alleged to be blocking progress which was sought to be brought to the public by companies operating independently of the bureaus and this year we hear that the bureau companies are "walking arm and arm through the marketplace" leaving a trail of trouble behind; competitively that is.

We hear of this chaos being talked of in the broader concept of competition in which there is sincere and open puzzlement as to whether homeowners rates, private passenger automobile rates, surplus lines rates and package policy rates, for example, have not by now departed from the realm of actuarial soundness and represent instead full evidence of a serious rate war.

We are aware of the degree of debate going on as respects prior approval as against no prior approval, in some cases involving almost emotional outbursts from one or more regulatory authorities or producers or company executives in expounding his particular position in the matter.

Almost forgotten in all of this lament is perhaps the most important of all complaints; that, as an industry, we are currently failing or have recently failed in several very important lines of insurance to make a sufficient underwriting profit. Private industry which does not make profit is in great trouble indeed, and if there is chaos which is leading to this result then it certainly deserves our serious attention. The proposition could be better put perhaps the other way around. All segments of the insurance industry should be deeply concerned that they are in a position to engage in this business at a proper profit. If the current or recent activities of some segments of the business have been such as to have damaged the opportunity of the efficient units in our industry to make a profit, then certainly now is the time for all such positions to be re-examined in a most statesmanlike manner.

Almost all of the so-called chaotic conditions being decried today stem from one single aspect of our business and that is ratemaking in concert. It would seem that the concept of ratemaking in concert, taken I am sure almost for granted by all participants in the insurance field, is now either badly misunderstood in some places or its basic premises are being conveniently overlooked.

There seems clear evidence indeed that the very fundamental economic function being performed by insurance has been forgotten. Recall, if you will, that insurance arises out of and is a necessary part of the economic enterprise of a free people. It has an inherent nature related to the needs of that economy which cannot be altered without the prior alteration of the economy itself. Given the manner in which property is owned, livelihoods are earned, and family financial responsibilities are fixed, then the nature of the insurance business is established, and there is no law which any Congress or any legislature can pass to alter or obliterate that nature. There is no decision which any court can hand down which can change that nature. There is no ruling that any administrator may make or any opinion which any Senator may utter which can transform the inherent nature of the insurance business and, finally, and far more important, there is no way whatsoever for the management of any insuring unit successfully to operate contrary to this natural aspect of the business for any appreciable length of time.

Now everyone knows that insurance has to do with risk and specifically with the transference of risk but what seems to have been forgotten is that the insurance does not create the risk—except in a most limited sense it does not in any way affect the risk, and in any and all events it does not "manufacture" or produce the risk.

Let's deal with a simplified example. A certain house has a certain risk of burning. This risk of burning will be different from that of other kinds of houses burning due to many factors. But the difference in risk will not be due to where the insurance is placed. The house's risk of burning was generated when the house itself was built and it is entirely related to the existence of the house. The risk of burning would be there whether there was or whether there was not the insurance. Using the proper sort of yardstick, a measurement of that risk can be made and two different people making that measurement properly will come up with the same quantity of risk as being one of the inherent characteristics of that house. While the methods may be more difficult to apply, this is no more difficult a concept than that a pound of butter is a pound of butter no matter who weighs it.

If, therefore, the quantity of risk to be transferred is an inherent natural aspect of the house, how can anyone believe that competition among insurers can change that risk? You may hasten to say that nobody does believe that, and on reflection this may be true, but there are many things being said today and many things going on today that give the uncomfortable appearance of this fact of risk being overlooked. In New York, for example, in the important line of workmen's compensation insurance, the experience of a particular carrier was sought to be eliminated from the total experience being used to determine the average of all compensation risks in the state. It was asserted that the rates, including the experience of this one carrier, would be excessive if used by other carriers. Now this carries the necessary implication that, given accurate accounting practices, the workmen of a particular employer would either be injured more often or more severely if they were insured with one carrier rather than with another. The charge of poor safety service or poor claim service, which might conceivably have affected employer or employee attitudes to the point where some difference in experience could be explained, was never alleged. There was simply left hanging the inaccurate impression that rates were made for insurance companies when in fact they are made for risks.

A more frequently heard area in which this basic misunderstanding seems continually to crop up is, as mentioned before, a preoccupation in some quarters with the idea that depending on how efficient and competitive they are, different insurers will measure the same risk and come up with different answers, with presumably the more efficient one of the two coming up with a lesser answer. This is not only an error, it is a very dangerous error. It has in the past led to failures of insurance companies and it will again in the future. And be reminded that the failure of an insurance company, like the failure of a bank, affects many more people than merely the management and the stockholders.

How is risk properly to be measured and what, if anything does the proper measurement of risk have to do with ratemaking in concert? The measure-

ment of risk is just exactly what actuarial science is all about. I would like to put forth the proposition that ratemaking in concert is an inherent necessity of the proper operation of the insurance business. That it stems from the nature of risk itself, which in turn is something that exists wholly apart from the insurance industry. Further, I would propose that since ratemaking in concert is related to the inherent nature of the insurance transaction and is totally unlike any cost measurement in any other economic transaction, that the anti-trust laws were never intended to and should never have been made to apply to the insurance business. I am not saying that the business does not require regulation and indeed some degree of supervision in order to make certain that it is being carried on in an accurate and equitable way, but I am saying that the concept that lies behind the Sherman Act cannot be made to apply to ratemaking in concert in the insurance business.

In order to determine the amount of risk which any particular object presents it may be necessary to look at the record of a great many similar objects over some considerable period of time. In respect of other objects and other ways in which financial loss may show up, different numbers of events may be necessary to be observed at different periods of time. With respect to certain hazards thus it is conceivable that a single insurer may annually be presented with enough instances to be able to determine reasonably closely what the inherent risk is. In other cases only the combination of the results available to many carriers can possibly give a suitable answer. In either case, however, since what will be measured is an inherent characteristic of the object which had the risk, it will not only be reasonable but necessary that all insurers accord that risk the same measurement. It is the same. It will be of great danger to the insuring public should any insurer or group of insurers depart from that mark either upward or downward. The establishment of this common market among great numbers of insurers, therefore, while due in part to their need to combine experience in order to find the truth, is just as importantly due to the need that, once having found the measure of the risk, they each must recognize this same measure in their respective insurance transactions. Ratemaking in concert in the insurance business comes about not only because generally many losses need to be observed before the inherent hazard can be measured, but also because once the inherent hazard has been measured it is the same for every insurer.

The problem of competitive chaos, of course, may still exist even when all of these things about the nature of risk are understood, believed and followed. When the risk has been transferred to an insurance company it will be necessary to charge over and above the cost of the risk itself, known to be the same for all when properly measured, an amount sufficient to cover the costs of the transfer, that is to say, the costs of operating the insurance industry. As it stands today, through dividends of participating companies or deviations on the part of non-participating companies, or both, cost differences relating to different ways of handling the insurance transaction itself, can be and are introduced into the ratemaking system by companies otherwise joined in ratemaking in concert. Certainly ratemaking in concert cannot and should not rule out these differences. Most ratemaking organizations have always understood this quite well and have patterned their operations

in a realistic fashion to account for differences on the expense side of the premium dollar.

If all of the above has some basis for being doctrine which ought not to be overlooked in the operation of the insurance business, then it would seem that the matter of bringing chaos under control and producing order ought really to be fairly simple. Indeed reasonably good examples of it now exist. It would seem that a prescription for the sort of program which should be followed might consist of the following inter-related things.

First and foremost, the direct need for ratemaking in concert should be recognized and all insurers should contribute their thought and effort and fair share of expense in operating the necessary organization or organizations properly to bring this about.

Next, concerted ratemaking should be made to generate a completely thought out and thoroughly refined classification system. True differences among hazards should be recognized and in most lines the number of different classes probably should be greater than they are today. By having a practical but thoroughly refined classification system there could be little doubt that the inherent hazards of the insured objects were being properly measured and that universal respect by all insurers should be accorded this measurement.

Thirdly, in order to safeguard a classification system and at the same time protect the public, insurers should retain the right to try out experimentally different classification breakdowns. As a practical matter if the original classification job has been done thoroughly there will probably be very little temptation to do this, but the fact of experimental possibility will itself go a long way toward insuring that the original job will be done well.

Fourth, all of this classification and hazard measurement work should be done within the framework of a system of standard forms. If, as will be suggested, competition among different marketing methods is to be maintained, then it is vital that there be not only proper and agreeable measurement of hazard, but that there also be well worked out standardization of the insuring agreements. These latter are, after all, the conduits through which the hazard or risk is transferred to the insurer. Just as when there are to be many plumbers competing there must be standard sizes of pipe and standard methods of threading, so also to do this insurance job properly there must be standard forms for the offering of insurance.

Finally, having footed their practices upon sound forms and soundly determined classified pure premiums, the industry can engage in fair and healthy competition in the field of marketing and administrative efficiency and service. In this climate the best will be successful and the worst will risk failure, but for the long run an insurance industry in which the public can have confidence should thrive.

In today's market the line of insurance most nearly conducting its affairs along these lines seems to be workmen's compensation where there is a highly refined class system, where there is almost universal concerted ratemaking for the proper establishment of inherent hazard, where policy forms are standardized, but where the price differences created by different marketing methods have long been well recognized.

You will see by this that it is my belief that while on the one hand there is no such thing as an independent company, that on the other it does not seem necessary to lock in all insurers to the same final rate. I am sure that work so far done in this Society concerning Theory of Risk, which will be augmented in the future will be of tremendous help in developing ever better methods of classification and statistical reporting. This also will go far toward clearing the air of many of the aspects of chaos now felt to exist in the property and casualty insurance field. As practitioners and students of the actuarial art, let us do all we can to help restore and maintain reasonable prosperity to the efficient units within the insurance business.

EXPERIENCE RATING REASSESSED

BY

ROBERT A. BAILEY

Introduction

The heterogeneity of risks and the need for experience rating is a widespread problem and is not confined only to insurance or to casualty insurance. An illustration is the familiar passage: "Beware of false prophets, which come to you in sheep's clothing, but inwardly they are ravening wolves. Ye shall know them by their fruits." (Matthew 7:15)

The development of commercial package policies with their combination of a broad spectrum of property and casualty coverages has brought about the need for reassessing the different experience rating plans which we presently use in the various separate lines of insurance. When one policy embraces several lines of insurance the question naturally occurs as to which of the present experience rating plans, if any, is appropriate for the package. These new packages probably need experience rating more than the separate coverages where the rates, classifications and coverages have been seasoned by many years of experience. Just as the experience incurred under the homeowners policies led to a number of changes in the coverage and rating of those policies, so also the experience under these new commercial package policies will undoubtedly lead to modifications and changes in the original programs. In such a transitional period the experience incurred by an individual risk is of particular value in adjusting the rate closer to the inherent hazard of that risk.

There is quite a variety of experience rating plans to choose from, ranging from the multiple location experience rating plan for fire insurance on contents to an interesting one which is used for Bankers and Brokers Blanket Bonds which sets the modification equal to .500 plus ½ the loss ratio plus the square of the loss ratio, subject to certain limitations. The rationale of the latter plan, while based on sound principles, must certainly seem elusive to some of the policyholders and agents. Nevertheless the various experience rating plans have several things in common although in varying degrees. Every plan limits the effect of a single large loss. This is accomplished in many ways—such as by credibility factors and/or limitations on the largest loss or on all large losses. In addition the compromise is often evident between the desire to give the best risks as large a credit as possible and the desire to prevent large fluctuations in the rating.

Fundamental Criterion for Experience Rating

It is not accidental that the various experience rating plans have these common features. These common features all represent attempts to satisfy the fundamental criterion for experience rating, which is:

I. Each dollar of loss, or absence thereof, should contribute to the risk's adjusted rate an amount equivalent to the amount of information it pro-

vides regarding the future losses of the same risk for the same amount of exposure.

A number of other criteria are imposed which are in the nature of limitations on this fundamental criterion. They are:

II. The risk's premium should not fluctuate widely from year to year. If it fluctuates too widely, the purpose of insurance is defeated.

III. One dollar of actual loss should not increase the adjusted losses by more than one dollar. Otherwise the insured might find it to his advantage to pay his own losses. (The term "adjusted losses" means the weighted average of the actual and the expected losses which is used to determine the adjusted rate for the risk.)

IV. The experience rating plan should not be too expensive to administer.

Basic Formula of Experience Rating

Letting f_t represent the frequency of losses of t dollars or more (which is the same as the frequency of the t-th dollar of each loss), E the expected losses contemplated by the tariff or standard rates, M the experience rating modification, K a constant, ω the size of the largest possible loss, $\underline{E}$ ( ) the expected value of whatever is inside the parentheses, and Z_t the multiple regression coefficient between f_t and ME, the basic formula would be:

$$ME = K + \sum_{t=1}^{\omega} Z_t f_t$$

or

$$ME = E + \sum_{t=1}^{\omega} Z_t [f_t - \underline{E}(f_t)] \qquad (1)$$

since $K = E - \sum_{t=1}^{\omega} Z_t \underline{E}(f_t)$, if $\underline{E}(ME) = E$; that is, the plan should balance.

(Ideally, the experience period should be subdivided into several time intervals with different Z_t for each interval.) The fundamental criterion would be satisfied if we had sufficient data available to calculate these multiple regression coefficients. The difficulty is that we will probably never have sufficient data available to calculate all or even many of these regression coefficients. It is rare that we get enough data to calculate even one coefficient.

If we do get enough data to calculate one coefficient it is usually Z_1 which corresponds to the claim frequency. Automobile merit rating statistics have been one such source where risks have been classified according to their claim frequency and where we can obtain Z_1. For example, using the data on page 163 of [5] for class 1 private passenger cars in Canada, we find

M = .945 for risks which had no losses of 1 dollar or more during an experience period of one year.

$E = 25.44$ (That is, \$84,607,000/3,325,714)
$\underline{E}(f_1) = .087$ (Equivalent to the average claim frequency)
Our formula is $ME = E + Z_1[f_1 - \underline{E}(f_1)]$. Putting in the known values we obtain $.945 \times 25.44 = 25.44 + \overline{Z}_1(0 - .087)$
$Z_1 = 16.08$

This illustrates that when we calculate only a single regression coefficient for f_1, which is the claim frequency, we can usually expect a value for Z_1 which far exceeds 1.000. The other Z_t exist, of course, but when we classify risks according to their claim frequency and disregard the size of each loss, our implicit assumption is that all Z_t except Z_1 are equal to zero, and hence we throw all the weight on Z_1. For the approximately 90% of all Canadian automobile liability insurance claims which exceed \$16.08, this presents no problem. But for any loss less than \$16.08, we are adding more than one dollar to the adjusted losses for each dollar of actual loss. As a natural consequence, some of these small losses are not reported to the insurers by the insureds.

If we had sufficient data to calculate more than one Z_t, the value of Z_1 would undoubtedly be less. But if we had sufficient data to calculate many or all Z_t, we would have so much data that in all likelihood our classification plans would be so thoroughly refined and the rates so accurate that the need for experience rating would be considerably reduced. This could be termed the Actuarial Theory of Indeterminancy which would state that when we get sufficiently refined statistics in sufficient volume to be able to determine the correct values for an experience rating plan, we won't use the information that way because we can then determine a far better class plan instead. It is when the data is limited and hence the rates less accurate that the need for experience rating is greater. And the need for experience rating is greatest when we have no data at all, such as the case with new commercial multiple line packages. So it appears that in practice we will have to rely heavily on judgment to establish our Z_t.

The True Values of Z_t

If the inherent severity of claims is the same for every risk, and the only difference among risks is in their inherent frequency, general reasoning tells us that f_1 would include all the information contained in the experience, and hence Z_1 would be a large positive number, its size dependent on the amount of dispersion in the inherent frequencies, and all other Z_t would be zero. But we know that risks differ in their inherent severity of claims.

If the inherent severities of claims vary by risk but are independent of the inherent frequencies, we can conclude that each f_t provides additional information and that each f_t is positively correlated with the total inherent hazard of the risk, hence all Z_t would be greater than zero and Z_1 would be much less than under the previous assumption. The values of Z_t would depend on the dispersion of the inherent frequencies and severities.

The assumption of independence between frequency and severity has been customarily made by authors who have discussed the mathematical distribu-

tions of actual losses, that is, the mathematical theory of risk. See [8], Sections 3.1 and 6.1. See also [4], p. 22, "The Unsolved Problem". The assumption of independence greatly simplifies the mathematics. While it is not an inappropriate assumption in collective risk theory, it is an inaccurate assumption for the experience rating of individual risks. This paper by no means solves "the unsolved problem" but just because we cannot solve the mathematical theory behind a problem does not mean that we are free to ignore the problem.

If the inherent frequencies and inherent severities vary by risk and if they are correlated either positively or negatively, the values of some Z_t can easily be less than or equal to zero. Some can also be greater than 1.000. This can be verified by the reader by setting up some simple models and calculating the values of Z_t.

It can be seen that the true values of Z_t for a class of risks may have a considerable range, are not restricted to $0 \leq Z_t \leq 1$, and that they would not necessarily be constantly increasing or decreasing, all depending on the nature of the variation in the inherent hazards of the risks. However our knowledge of the variation in the inherent frequencies and severities and the correlation between them is incomplete, to say the least. In such a situation we must use our best judgment to estimate the values of Z_t. While our estimates will probably be incorrect to some extent in every case, if our estimates produce a rate for each risk which is sufficiently more accurate than the tariff or standard rates to justify the expense of experience rating we will have accomplished our purpose. And strange as it may seem, our chances of accomplishing this are greatest when the least data is available, that is, when the tariff or standard rates are themselves based largely on judgment.

Estimates of Z_t

One possible method of estimating the values of Z_t is to proceed as follows. Let us ask ourselves what is the indicative value of the t-th dollar of each loss. For a single risk, the actual number of such losses will follow a Poisson distribution. In the case of a Poisson distribution it has been shown, [4] pp. 14 & 15, that the best unbiased linear estimate of the true expected number of losses, T, (the inherent hazard of the risk) per unit of exposure when we have observed n losses in N exposures is

$$\underline{E}\left(\frac{T}{N}\middle|\frac{n}{N}\right) = Z\frac{n}{N} + (1\text{-}Z)m \tag{2}$$

and that

$$Z = \frac{Nm}{Nm + \frac{m^2}{\sigma^2}} \tag{3}$$

where: m and σ^2 are the mean and variance of T per unit of exposure for all risks in the same rating class, and Nm is the expected number of losses for a risk with N exposures. (For many lines of insurance, premium could be used as the measure of exposure.)

Returning to the t-th dollar of each loss, we find that it should be given a weight of

$$Z_t = \frac{Nm_t}{Nm_t + \underbrace{m^2_t}_{\sigma^2_t}} = \frac{\underline{E}\ (f_t)}{\underline{E}\ (f_t) + \underbrace{m^2_t}_{\sigma^2_t}} \qquad (4)$$

where m_t and σ^2_t are the mean and variance of the *inherent* number of losses of t dollars or more per unit of exposure. σ^2_t can be estimated from an analysis of variance by subtracting m_t from the variance of the *actual* number of losses of t dollars or more per unit of exposure, since m_t equals the part due to chance of the variance of the actual number of losses. σ^2_t/m^2_t can also be estimated by using the technique used in [6].

We will assume that m^2_t/σ^2_t is constant for all t. We make this assumption because it produces credibilities which meet Mr. Perryman's axioms (See below) which are an expression of our intuitive sense of credibility. If we were able to calculate Z_t or m^2_t/σ^2_t from actual experience we would modify this assumption to fit our data, but in the absence of any data, this seems to be a reasonable assumption, and it produces reasonable results.

Mr. Perryman's Axioms

The weight given to a loss of C dollars would be $\sum_{t=1}^{C} Z_t$. Expressed as an average credibility factor, Z, it becomes: $Z = \frac{\sum_{t=1}^{C} Z_t}{C}$ Formula (4) for Z_t is such that Z meets all three of Mr. Perryman's axioms. [10], p. 63.

"(i) the credibility should be not less than zero and not greater than unity.

(ii) the credibility should increase (or more strictly speaking not decrease) as the size of the risk increases.

(iii) As the size of the risk increases, the percentage charge for any loss of given size should decrease."

Somewhat as an extension of Mr. Perryman's axioms, we should observe that formula (4) for Z_t also satisfies the following conditions for an individual risk.

(iv) A loss of t dollars has more value than a loss of t-1 dollars.

(v) A loss of 2t dollars has less than twice the value of a loss of t dollars, and far less when t is large in proportion to the size of the risk's expected losses, and almost the same value as a loss of t when t is very large.

(vi) Two losses amounting to a total of t dollars have more value than one loss of t dollars, and similarly three losses totalling t dollars have more value than two losses totalling t dollars.

All this does not necessarily mean that these estimates of Z_t are the best estimates, or even good estimates. All it means is that they are not unreasonable

estimates. As mentioned above, it is possible that the actual data may not conform to Mr. Perryman's axioms and the three extensions, but when we do not know what the actual data is, we feel inclined to make our estimates conform to these "axioms". Any measurement of how good these estimates are would require an analysis of the actual experience of experience rated risks. For some studies of the experience of experience rated risks, see [5], [6], [9], [11] and [12].

Primary Losses

If we give a weight of Z_t to the t-th dollar of each loss, the experience rating formula becomes:

$$M = \frac{\sum_{t=1}^{\omega} Z_t A_t + \sum_{t=1}^{\omega} (1-Z_t)\, E_t}{E} = \frac{A_p + E_e}{E} \tag{5}$$

where

$$A_p = \sum_{t=1}^{\omega} Z_t A_t \tag{6}$$

A = actual losses
E = expected losses
t subscript refers to the t-th dollar of each loss
p subscript = primary
e subscript = excess
ω is the maximum size of loss.

It would be interesting to determine the values of A_p produced by $Z_t = \frac{E(f_t)}{E(f_t) + \frac{m^2_t}{\sigma^2_t}}$ using some actual data. The primary losses shown below were calculated on the basis of the actual distribution of 139,458 Workmen's Compensation losses during the first half of 1956 in Michigan, and assuming $m^2_t/\sigma^2_t = 1$ for all t. The distribution and some examples of the calculations are shown in the Appendix.

	Primary Loss				
Actual Loss	*E = 107* $E(f_t) = 1$	*E = 1,070* $E(f_t) = 10$	*E = 10,700* $E(f_t) = 100$	*E = 107,000* $E(f_t) = 1000$	$f_t \div f_t$
10	4	9	10	10	.450
100	17	64	94	99	.100
500	38	204	430	492	.034
1,000	50	300	779	971	.018
5,000	81	587	2,466	4,458	.0039
10,000	92	693	3,347	7,811	.0014
50,000	99	768	4,050	12,545	.00001
110,000	100	774	4,110	13,139	0
average	7.4	29.8	66.1	94.1	

It would usually be considered impractical to have a different table of primary losses for each size of expected losses, particularly if the tables extended down to the most frequent sizes of loss. So let us consider the various possible approximations for primary losses.

The experience rating plan used in most states for Workmen's Compensation insurance probably is the best multi-split plan that can be devised on the basis of judgment and with the restriction that there can be only one table of primary losses. This plan has one table of primary losses for all sizes of risk, and introduces variations by size of risk through a multiplier (called a credibility factor) which varies by size of risk. The combined operation of the table of primary losses and the primary and excess credibility factors adds the following amounts to the adjusted losses for each actual loss. The primary losses shown in the previous table are comparable to the following amounts, since the previous table was developed on the basis that the credibility factors were 1 for the primary losses and 0 for the excess losses.

	Addition to Adjusted Losses (WC Plan — 1961 Revision — Mich.)			
Actual Loss	*E=107**	*E=1,070*	*E=10,700*	*E=107,000*
10	0	1	6	10
100	1	12	59	96
500	7	62	294	478
1,000	13	117	552	917
5,000	33	293	1,383	3,121
10,000	41	360	1,708	5,115
50,000	48	424	2,037	11,730
110,000	48	424	2,037	11,730
average	1.0	8.8	41.3	79.3

*This size not eligible for experience rating.

These additions to the adjusted losses used in WC fulfill all of Mr. Perryman's axioms and the first extension. And they fulfill the second and third extensions for t greater than $750. But they have what appears to be one serious defect. They give insufficient weight to small losses. While a $1000 loss may deserve to add only 117 dollars or 552 dollars respectively to the adjusted losses for risks of size E = $1070 and E = $10,700, certainly a $10 loss should add more than $1.25 and $5.88 respectively to the adjusted losses for risks of these sizes. In other words, a $10 loss on risks of these sizes should be treated as fully credible. Half of all WC losses in Michigan in 1956 were $10 or less. In fact, if it were not for criterion III, we might even be tempted to add more than $10 to the adjusted losses for a loss of $10.

In other casualty lines of insurance the actual losses are limited to an amount that varies by size of risk and then multiplied by a credibility factor which also varies by size of risk. This suffers from the same defect as mentioned above for WC.

Comparisons of the Additions to the Adjusted Losses

Shown below are some comparisons of the amounts added to the adjusted losses. The primary losses calculated from $\sum_{t=1}^{C} Z_t$ are used as the standard for comparison. Compared with this are the amounts added to the adjusted losses by (1) the experience rating plan used in most states for WC, a multi-split plan, (2) the experience rating plan used in Pennsylvania for WC, taken as an example of a single-split plan and (3) a modified single-split plan using 100% of the first I dollars.

Size of Loss	Standard $E(f_1) = 1$ $\bar{E} = 107$	Equal Average: WC $E = 890$	Equal Average: 100% of first 11	Equal Average: WC-Pa $E = 1600$ 8½% of first 4674	Minimum Error: WC $E = 440$	Minimum Error: 100% of first 8	Minimum Error: WC-Pa $E = 946$ 5% of first 4500
10	4	1	10	1	1	8	1
100	17	11	11	9	6	8	5
500	38	53	11	43	28	8	25
1,000	50	99	11	85	52	8	50
5,000	81	248	11	397	129	8	225
10,000	92	306	11	397	159	8	225
50,000	99	360	11	397	187	8	225
110,000	100	360	11	397	187	8	225
Average	7.4	7.4	7.3	7.4	3.9	5.9	4.3
Average Error	0	5.4	5.2	6.4	4.6	5.0	5.4

Size of Loss	Standard $E(f_1) = 10$ $\bar{E} = 1070$	Equal Average: WC $E = 5540$	Equal Average: 100% of first 188	Equal Average: WC-Pa $E = 8200$ 32½% of first 6334	Minimum Error: WC $E = 4040$	Minimum Error: 100% of first 210	Minimum Error: WC-Pa $E = 4800$ 22% of first 5481
10	9	4	10	3	4	10	2
100	64	43	100	33	35	100	22
500	204	213	188	163	175	210	110
1,000	300	399	188	325	328	210	220
5,000	587	996	188	1,625	820	210	1,100
10,000	693	1,226	188	2,059	1,010	210	1,206
50,000	768	1,444	188	2,059	1,189	210	1,206
110,000	774	1,444	188	2,059	1,189	210	1,206
Average	29.8	29.8	29.8	30.0	24.5	31.3	19.8
Average Error	0	11.5	11.7	18.0	10.7	11.6	16.7

Size of Loss	Standard $E(f_1) = 100$ $\bar{E} = 10{,}700$	Equal Average: WC $E = 47{,}700$	Equal Average: 100% of first 1680	Equal Average: WC-Pa $E = 32{,}000$ 65% of first 12,215	Minimum Error: WC $E = 47{,}700$	Minimum Error: 100% of first 2320	Minimum Error: WC-Pa $E = 24{,}500$ 59% of first 10,428
10	10	9	10	7	9	10	6
100	94	88	100	65	88	100	59
500	430	440	500	325	440	500	295
1,000	779	833	1,000	650	833	1,000	590
5,000	2,466	2,378	1,680	3,250	2,378	2,320	2,950
10,000	3,347	3,383	1,680	6,500	3,383	2,320	5,900
50,000	4,050	6,025	1,680	7,940	6,025	2,320	6,153
110,000	4,110	6,025	1,680	7,940	6,025	2,320	6,153
Average	66.1	66.1	66.1	66.0	66.1	72.4	58.8
Average Error	0	3.7	13.9	21.2	3.7	12.6	20.5

Size of Loss	Standard $E(f_1) = 1{,}000$ $\bar{E} = 107{,}000$	Equal Average: WC $E = 199{,}400$	Equal Average: 100% of first 7,000	Equal Average: WC-Pa $E = 83{,}000$ 89% of first 23,402	Minimum Error: WC $E = 211{,}000$	Minimum Error: 100% of first 10,000	Minimum Error: WC-Pa $E = 95{,}000$ 92½% of first 25,658
10	10	10	10	9	10	10	9
100	99	99	100	89	99	100	93
500	492	494	500	445	495	500	463
1,000	971	968	1,000	890	973	1,000	925
5,000	4,458	4,091	5,000	4,450	4,208	5,000	4,625
10,000	7,811	7,605	7,000	8,900	7,913	10,000	9,250
50,000	12,545	20,467	7,000	20,828	21,560	10,000	23,734
110,000	13,139	20,467	7,000	20,828	21,560	10,000	23,734
Average	94.1	94.1	94.1	94.2	95.8	99.1	98.0
Average Error	0	5.2	7.9	10.5	5.0	6.4	9.9

It can be seen from these comparisons that the single-split plan uniformly produces the poorest fit, as might be expected. The multi-split plan produces an excellent fit in the central range of sizes but in the remainder of the comparisons it is about equalled by the modified single-split. Moreover, all three plans produce poor fits at the smallest sizes, indicating the need for special techniques for small risks. (Small risks present other problems as well, because the assumption of a linear regression formula becomes inaccurate for small risks, as indicated in [2] p. 18 and [4] p. 19.)

The size of E for the "standard" would be changed if we changed our assumption regarding σ^2_t/m^2_t since E is inversely proportional to σ^2_t/m^2_t. For example, if we assumed that $\sigma^2_t/m^2_t = \frac{1}{2}$ for all t, then the same "standard" primary losses would be shown for twice the size of E. That is, $E = 107$ would become $E = 214$. From this we can determine the approximate assumptions in the two WC plans regarding σ^2_t/m^2_t. For the multi-split plan, σ^2_t/m^2_t is assumed to be about $\frac{1}{8}$ for the smallest sizes of E, increasing to $\frac{1}{2}$ for the largest sizes. For the single-split plan it increases from $\frac{1}{16}$ for the smallest sizes to more than 1 for the largest sizes. It seems unreasonable that σ^2_t/m^2_t should increase with the size of the risk, but this result was probably produced by the attempt to limit the maximum effect of a single loss. There is some available evidence that σ^2_t/m^2_t is larger than what is implicitly assumed by these two plans for the smaller sizes of E. For example, see [6]. But to assume larger values would increase the maximum effect of a single loss and would cause the risk's premium to fluctuate too widely, contrary to criterion II. If we had reason to believe that σ^2_t/m^2_t had larger values and we wanted to recognize them but we still wanted to limit the maximum fluctuation caused by a single loss to the present amounts, we would approach rather closely to the modified single-split which assumes high values of σ^2_t/m^2_t for small and medium sized losses but limits the effect of a single loss to a fixed amount. The modified single-split in effect would ignore the indications of large losses in excess of a certain amount, in order to limit the effect of a single loss. The two WC plans used for comparison have reduced the credibility of all losses, large and small, in order to limit the maximum effect of a single loss, rather than reducing the credibility of only the large losses. This is what has caused the insufficient weights to be given to the small losses.

The consequences of giving a loss less credibility than it deserves were mentioned in [2] where it is stated that "if an arbitrarily chosen credibility . . . is less than:"

$$\frac{\underline{E}\,(f_t) - \dfrac{m^2_t}{\sigma^2_t}}{\underline{E}\,(f_t) + \dfrac{m^2_t}{\sigma^2_t}} \qquad \text{(in my symbols)}$$

"it can be shown . . . that the use of the arbitrary credibility has produced a greater error-variance than would have resulted from giving each observation 100% credibility." This situation frequently occurs in WC and elsewhere for the smaller sizes of loss. For example, if the credibility of a $100

loss should be 94% as developed for $E = 10{,}700$, then any credibility less than 88% will produce a greater error-variance than would have resulted from using a credibility of 100%. For a $100 loss when $E = 10{,}700$, the WC plan gives 59% credibility and the WC—Pa. plan gives 38.5% credibility.

The difference between reducing the credibility of all losses and reducing the credibility of only the large losses can be illustrated from Workmen's Compensation. The average D ratio ($D = E_p \div E$) under the WC experience rating formula (1961 revision) is about .600. For a risk with $Z_p = .25$, the proportion of losses which affect the rating is $.600 \times .25 = .15$, and the maximum effect of a single loss is about $\$3400 \times .25 = \$850$. A modified single split using 100% of the first $850 would permit about .500 of the losses to affect the rating instead of only .15, and even 100% of the first $500 would permit about .450 of the losses to affect the rating. This may not be much of a problem in Workmen's Compensation insurance where the D ratios are high. But a commercial package policy has considerably lower D ratios because of the greater catastrophe hazards. Hence the maximum possible effectiveness of experience rating measured by the portion of losses which affect the rating is correspondingly less. For commercial package policies, therefore, we need to conserve all the effectiveness we can, and any substantial reduction such as would be caused by an arbitrary reduction in the credibility of small claims as well as large claims could easily prove fatal to the whole experience rating plan for a multiple line policy.

Basing Experience Rating on Experience

The previous comparisons have been made with the assumption that the "standard" formula is correct. While we have good reason to believe that that "standard" is more appropriate than any of the other formulas, there is little reason to believe that it is anywhere near correct. The only way to know would be to analyze the actual experience of experience-rated risks, which unfortunately is either unavailable or difficult to obtain. While we should do the best we can under the circumstances, we should recognize that the extensive use of highly refined and technical judgment can be like straining at gnats, and if we don't use some actual experience to modify our judgment, we may swallow a camel unawares.

An experience rating formula which is not based on experience is somewhat of an anomaly. The merit rating plans in use in private passenger automobile insurance may appear crude in comparison to a highly refined multi-split experience rating formula, but at least they are or will be based on actual experience. And an experience rating formula which is based on experience has a substantial advantage over any experience rating formula based entirely on judgment no matter how carefully refined that judgment may be.

The extensive use of judgment in the design of the experience rating plans in WC insurance where the size of the credits and debits to be given for various specified losses or lack of losses has been based almost entirely on judgment, is comparable to the extensive use of judgment in establishing the size of the credits and debits given in fire insurance for various safety or hazardous features of the risk. In fact a general comparison can be made between

WC and fire insurance on their entire rate making methods. In both lines the statewide rate level and some statewide class relativities are based on experience. From these class rates in both lines, credits and debits are given to recognize the peculiarities of individual risks, and the size of the credits and debits are based in both lines almost entirely on judgment. In WC insurance the credits and debits are for the presence or absence of certain previous losses and in fire insurance they are for the presence or absence of certain safety or hazardous characteristics of the risk. While the details are different of how the experience and judgment are used in the two lines, the basic role of judgment is the same. In both cases the judgment used to determine the size of the credits and debits and the relationships among the various credits and debits has been very carefully refined. Both systems are probably equally as sound and both probably would benefit equally as much from the use of more experience, which unfortunately is equally difficult to obtain in both lines of insurance.

When the Tariff Rate is Not Based Entirely on Experience

Another assumption made in the previous developments is that the manual rate is equal to the average true rate for all risks with the same manual rate. In the formula

$$\underset{-}{E}\left(\frac{T}{N}\,\middle|\,\frac{n}{N}\right) = Z\frac{n}{N} + (1 - Z)\,m \qquad (2)$$

m was assumed to be

$$m = \underset{-}{E}\left(\frac{T}{N}\right)$$

This is a good assumption when the tariff rate is based on experience. But it is a questionable assumption in the particular case of a new commercial package policy where modifications in rates and coverages have been based on judgment, and it is questionable also in the case of many long-standing property insurance rates where the relativities for many important elements in the rates, such as for watchman service, non-standard floor openings, size of building, and protection are based largely on judgment.

When the m in formula (2) is not equal to the mean for the class or at least has limited credibility, what kind of experience rating formula should we use? (Enter Judgment again.)

Criterion I places considerable reliance on the tariff rate in keeping with the assumption that the tariff rate is a reliable average of the risks in the class. When we cannot make such an assumption it seems that the best course of action would be to place less reliance on the tariff rate, in fact, as little as possible. To do this we should base as much of the rate as possible on the experience, consistent with the credibility of the experience, and use judgment to estimate the remainder of the rate. This is equivalent to revising the fundamental criterion for experience rating shown at the beginning of this paper to read as follows:

Ia. The proportion of total losses which influences the rating, $\frac{E_p Z_p + E_e Z_e}{E}$, should be as large as possible. This is the same as saying that the average credibility, $DZ_p + (1\text{-}D)\ Z_e$, should be as large as possible.

Criterion Ia alone would make $Z_p = Z_e = 1$ which obviously is too high. So we must define what we mean by "consistent with the credibility of the experience". Let us define this as follows:

IIa. A maximum single loss should not increase the adjusted losses by more than a predetermined percentage, h, of the expected losses, E.

It will be noted that IIa is an approximation to criterion II, an approximation which is more definite and somewhat narrower in scope, and one which is used in many experience rating plans.

Now let us state criterion III mathematically as follows:

IIIa. $Z \leq 1$

Criterion IV is not capable of precise mathematical expression so let us leave that one to judgment.

Derivation of the Plan From the Criteria

The three criteria expressed mathematically are as follows:

$DZ_p + (1\text{-}D)\ Z_e$ is a maximum
$IZ_p + (C\text{-}I)\ Z_e \leq Eh,\ C > I$
$Z \leq I$
where I = the loss limitation which defines primary losses

$$D = E_p \div E = \frac{\int_0^I Cf_C\ dC + I \int_I^\infty f_C\ dC}{\int_0^\infty Cf_C\ dC}$$

f_C = number of claims of size C

In [7] Mr. Borch shows that if we are presented with the problem of reducing the variation in the expected losses as much as possible with the transfer to a reinsurer of a minimum amount of expected losses, we should buy a 100% excess of loss contract (assuming that the expense and contingency loadings would be the same percentage for any type of re-insurance contract). The point at which the reinsurance would attach would be selected so that both the variation of the retained losses and the expected amount of the ceded losses would be within acceptable bounds. In other words, for a selected level of stability and assuming the same percentage for expense and contingency loadings, a 100% excess of loss contract will require the smallest transfer of premium to the reinsurer. Or, for a selected amount of reinsurance

premium and assuming the same expense and contingency loadings, a 100% excess of loss contract will produce the greatest reduction in the variation of the retained expected losses. While Mr. Borch's paper deals with stop loss reinsurance (yearly aggregate) the reasoning is equally applicable for our purposes for excess of loss (each loss) reinsurance. Mr. Borch's conclusion is the same as saying in our criterion Ia that Z_c should equal zero. It means that in order to retain in the portfolio (or in the rating) as large a portion of the total losses as possible and at the same time to make that portion meet a selected level of stability, we should include 100% of all losses within an appropriately selected limitation and exclude 100% of the excess losses. This is the modified single split discussed earlier. It should be obvious, just from general reasoning, that 100% of the first \$100 of each loss represents a larger portion of total losses and has a smaller coefficient of variation, $\frac{\sigma}{m}$, than for example, 10% of the first \$1,000 of each loss, although both would produce the same h.

For the moment, let us use a single split, at I, of losses and set $Z_c = 0$ in criterion Ia but defer consideration of the fact that the conclusions of Mr. Borch's paper seem also to specify that $Z_I = 1$.

We may now express the three criteria as follows:

$$DZ \text{ is a maximum} \tag{7}$$

$$IZ = Eh \tag{8}$$

$$Z \leq 1 \tag{9}$$

We seek the best simultaneous solution of these three criteria. From (8) we obtain $Z = \frac{Eh}{I}$. Substituting in (7) we obtain $\frac{D\,Eh}{I}$ is a maximum, or $\frac{D}{I}$ is a maximum since Eh is a constant. From inspection of the definition of D it is evident that D is a function of I and that

$\frac{D}{I}$ is continuous,

$$\frac{d}{dI}\frac{D}{I} \leq 0,$$

$$\lim_{I\to 0}\frac{D}{I} = \lim_{I\to 0}\frac{\int_0^I \frac{C}{I} f_C\, dC + \int_I^\infty f_C\, dC}{\int_0^\infty C\, f_C\, dC} = 1 \div \text{average claim cost}$$

and $\lim_{I\to\infty}\frac{D}{I} = 0$

Therefore in order to make $\frac{D}{I}$ as large as possible we should make I as small as possible. From (8) we see that this is done by making Z as large as possible consistent with (9). Hence we obtain $Z = 1$ which is in agreement with

the result derived by Mr. Borch and discussed above. We also obtain $I = Eh$. Thus it appears that the experience rating formula which represents the best simultaneous solution of the three criteria listed above is

$$M = \frac{E + A_p - E_p}{E} = \frac{A_p + E_e}{E} \tag{10}$$

Where $I = Eh$

and $A_p = 100\%$ of the first Eh dollars of each loss.

The part of the rate based on actual experience is $\frac{A_p}{E}$ and the part based on judgment is $\frac{E_e}{E} \cdot \frac{A_p + E_e}{E}$ will be a better estimate of the true rate for the risk than E will be if A_p is correct and if we are able to estimate E_e with less absolute error than E. A_p will not be precisely correct, but it has a high probability of being closer to the true value than E_p. Moreover, A_p is unbiased over the long run, unlike E_p. A_p is subject to some chance variation, but with a proper choice of h, this variation will be within acceptable limits. E_p has no variation unless we consider the variation between the values of E_p estimated by different ratemakers for the same risk. If it were not for the restrictions imposed by rate regulation, this latter variation in E_p could easily be greater than the chance variation in A_p. Finally, it seems reasonable that we should be able to estimate part of the rate, E_e, with less absolute error than we can estimate the whole rate, E.

Criterion I puts less weight on the small losses because Criterion I assumes that the present rate is reasonably accurate and puts more reliance on it. Criterion Ia puts as little weight as possible on the present rate in keeping with the assumption that the present rate may not be very accurate at all.

Rationale

The formula $\frac{A_p + E_e}{E}$ is similar to an excess of loss contract or a deductible plan or a retrospective rating plan without a minimum where the insured pays the full cost of losses below his retention and buys insurance at a fixed cost above his retention. It also is similar to the Comprehensive Medical insurance plans which have become widespread in recent years as a replacement for the conventional hospital and surgical plans which provide first dollar coverage and limit the benefits per day and per procedure.

The formula $\frac{A_p + E_e}{E}$ is also a very simple formula. Oddly enough, its simplicity may be a drawback, because this plan is just a small step away from self-insurance. The small step is the expense loading that the company applies to the losses which the insured will weigh against the value he receives for the services rendered. The complexity of most other plans, along with their credibility weighting, obscures the expense loading and confuses everyone alike, including the insured.

Alternate Derivations

The same result as formula (10) can also be derived as follows. When the m in formula (2) is not equal to the mean for the class or at least has limited credibility, that is, when the tariff or standard rates are not based on a reliable volume of data for that class, σ^2_t/m^2_t will be increased if σ^2_t is measured from the class rate, rather than from m_t, the true class average. Hence Z_t will be correspondingly increased. This is in keeping with the concept that the less reliable the tariff rate is, the more weight we should put on the actual experience for the risk. However, even though the credibility for experience rating would justify large weights to be put on the risk's experience, we should not permit the weights to be so large that they violate criterion II. In effect, we are seeking the best compromise between the "Greatest Accuracy" credibility and the "Limited Fluctuation" credibility discussed in [1] pp. 63-65 in the chapter on "Two Kinds of Credibility". If we apply a limitation on the effect of each loss of Eh as in criterion IIa, but use the full weight justified by the experience rating credibility for smaller losses, we obtain something very close to the modified single-split of 100% of the first Eh dollars of each loss. How close it is can be seen by truncating the theoretical primary losses shown above for E = 107, E = 1,070, E = 10,700 and E = 107,000 at selected values of Eh, and considering the effect of increased values of σ^2_t/m^2_t.

Another derivation of formula (10) can be based on [4] pp. 21 & 22, "Primary and Excess Values" where it was shown that the first J dollars of each loss should be given 100% credibility and that the excess portions should be given a lesser weight. If we limit the maximum effect of a single loss to Eh in order to meet criterion IIa, we obtain formula (10) since h is usually less than 1, and J as defined in [4] is close to E.

Comparison With Other Experience Rating Formulas

A number of comparisons have already been made, but a comparison with the plans which have widespread use in Workmen's Compensation and the liability lines would be of interest. These are formula plans and permit a ready comparison. Many of the other lines of insurance use tabular plans which are more difficult to compare exactly, although the tabular plans generally are based on similar underlying formulas.

The formula developed above is:

$$M = \frac{E + (A_p - E_p)}{E} = \frac{A_p + E_e}{E} \qquad (10)$$

This compares with (when $Z_e = 0$):

$$M = \frac{E + (A_p - E_p)\, Z_p}{E} \qquad \text{(WC)}$$

$$M = \frac{E + (A_p - E)\, Z_p}{E} \qquad \text{(WC-Pa)}$$

$$M = \frac{E + (A_{pb} - E_b)\, Z_b + E_i \dfrac{A_{pb} - E_b}{E_b} Z_b}{E} \qquad \text{(Liability)}$$

and (when $Z_e > 0$): (Z_e never > 0 for WC-Pa and for liability in many states)

$$M = \frac{E + (A_p - E_p)\, Z_p + (A_e - E_e)\, Z_e}{E} \qquad \text{(WC)}$$

$$M = \frac{E + (A_{pb} - E_b)\, Z_b + (A_{pi} - E_i)\, Z_i + E_i \dfrac{A_{pb} - E_b}{E_b} Z_b\, (1 - Z_i)}{E}$$

(Liability, in some states)

where the subscripts mean:

p primary
e excess
pb primary basic limits
b basic limits
pi primary increased limits
i increased limits

The loss limitation, I, is constant in the WC plan but varies by size of premium in the other plans. All these plans have a built-in limitation on the effect of a single large loss (usually about 25%).

D Ratios

Any experience rating plan which uses a loss limitation must cope with D ratios. This is a vexing problem but an unavoidable consequence of loss limitations. Some plans, such as the plans used in Workmen's Compensation in Pennsylvania and in other casualty lines, do their best to ignore this complication by assuming that the D ratios equal 1.000, that is, that $E_p = E$, or $E_{pb} = E_b$. Probably this is because D ratios would increase the complexity of these plans to an intolerable level. Not much harm is done anyway if the D ratios are close to 1.000. But in the plan (10) developed above, D ratios are important because of the low loss limitations. In addition, D ratios are doubly important for any policy which includes fire insurance because of the large portion of premium devoted to excess losses.

For a new commercial package policy, judgment must play a significant role in establishing proper D ratios just as it has in establishing the rates, at least until a large volume of experience has been accumulated under these new package policies. Claim distributions for fire insurance on commercial properties are difficult to obtain because of the practice in conventional fire insurance of insuring the same building pro-rata in several different policies. The limited data available on the value of deductibles, large and small, is useful. Claim distributions are more readily available for casualty lines and can be used in proportion to their share of the package premium.

For both property and casualty insurance, D ratios will vary by rate class. But for property insurance, D ratios will also vary by size of building (or by size of the probable maximum loss). To some extent, this is true also for casualty insurance as is illustrated in Homeowners insurance where a large portion of policyholders with high valued homes take increased limits for comprehensive personal liability, but where practically none of the policyholders with low valued homes take increased CPL limits. The policyholders with high valued homes evidently believe they have a greater probability of having a large CPL claim, which is equivalent to believing they have lower D ratios, and they are probably correct. However, the problem in property insurance is more serious than in casualty insurance because the variations in the D ratios by size of building for property insurance are more direct.

The claim distributions of many casualty lines can be closely approximated by a log-normal curve. Some available data indicates that this is true also for fire insurance. Because of this, the log-normal curve can be used as an additional guide for establishing the D ratios and also as a graduating device. Methods for fitting the log-normal curve to actual data, and calculating primary and excess ratios from the fitted curve are discussed in [1], p. 58 ff and [4], p. 20 ff. Some other techniques of calculating D ratios are presented in [3].

Summary

The changes and developments which have taken place in the insurance business in recent years have created the need for reassessing our procedures for the experience rating of individual risks, particularly in reference to multiple line policies which include both property and casualty coverages. Are we to cease experience rating the casualty portion of a package policy or are we to begin experience rating the property portion? It seems unreasonable to experience rate only half of a package.

If a package included only casualty coverages it would be easy to find an appropriate experience rating plan. But when it includes both property and casualty coverages, it is a different matter, because property coverages have not usually been experience rated.

When we think of experience rating, most of us think of the type of experience rating used in casualty insurance. Casualty experience rating plans, however, do not work well for property insurance, simply because property insurance is different from casualty. Property insurance has lower claim frequencies and higher catastrophe hazards. So it is not surprising that the casualty experience rating plans do not work well for property insurance.

The same thing is true in other lines of insurance when an experience rating plan is designed especially for a certain type of policy, and such a plan often is unsuitable for other types of policies. For example, take the experience rating plan used in individual life insurance. We don't usually think of the rating plan used in ordinary life insurance as experience rating, but actually it is. The rates for ordinary life insurance are based almost entirely on the length of the insured's own claim-free experience period. The only differ-

ence is that the longer the claim-free experience period, the higher the rate. We could never apply an experience rating plan like that to casualty insurance.

So if the experience rating plan used in ordinary life insurance does not fit casualty insurance, it is not surprising that the experience rating plans designed for casualty insurance do not fit property insurance. It's the same old problem of not being able to put new wine into old bottles. But we should not let that prevent us from designing a new bottle.

In this paper, the attempt has been made to go back to the fundamental principles of experience rating and to develop from them the basis for an experience rating plan which will cope with the problems of low claim frequencies and high catastrophe hazards, and which therefore will work well for property insurance, and for combinations of property and casualty.

Experience rating is widely accepted as a sound rating tool. Its soundness can be demonstrated both from the actual experience of experience rated risks and also from actuarial and statistical theory. But we can't just blindly use any experience rating plan. We have to use one which is suited to the type of risk to be experience rated. Some plans are better than others. So we aim for the best plan possible. But we will never have a perfect plan because of the necessity to compromise between actuarial precision and the practical need for simplicity. In the mathematical-actuarial parts of the paper it is shown that one of the best compromises for a commercial multiple-line package policy from a theoretical standpoint and also from a practical standpoint is a type of plan which works very much like a deductible.

A loss limitation per occurrence is established for each risk. The size of the loss limitation is related to the size of the premium for the risk. The risk's actual losses during an experience period of, say, three years are given full credibility up to the loss limitation, and the losses, if any, in excess of the limitation are given no credibility. In effect the premium for the risk is self-rated for coverage up to the limitation, and the portion of the premium for coverage in excess of the limitation is unaffected by the risk's loss experience.

If the risk over the past three years, say, has incurred an average amount of losses within its loss limitation, it gets regular manual rates. If it has had less losses than average within its limitation, or more than average, its rate is correspondingly adjusted. If it has had no losses, it gets credit for the full value of the corresponding deductible.

Multiple-line policies, which are now becoming an important factor in the non-personal lines, present an unusual opportunity for a carefully designed experience rating plan to perform a valuable and much needed function.

Acknowledgment

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APPENDIX

Cumulative Claim Frequency

Michigan — Workmen's Compensation — First Half of 1956

t	$f_t \div f_1$	t	$f_t \div f_1$	t	$f_t \div f_1$	t	$f_t \div f_1$	t	$f_t \div f_1$	t	$f_t \div f_1$
1	1.000	41	.180	160	.076	620	.029	3,100	.0069	26,000	.00006
2	1.000	42	.177	170	.073	640	.028	3,200	.0067	27,000	.00006
3	.850	43	.174	180	.070	660	.027	3,300	.0065	28,000	.00005
4	.750	44	.172	190	.068	680	.026	3,400	.0063	29,000	.00005
5	.660	45	.170	200	.067	700	.025	3,500	.0061	30,000	.00005
6	.600	46	.167	210	.066	720	.024	3,600	.0059	40,000	.00003
7	.550	47	.164	220	.064	740	.023	3,700	.0057	50,000	.00001
8	.510	48	.162	230	.063	760	.022	3,800	.0055	80,000	.00001
9	.470	49	.160	240	.061	780	.022	3,900	.0053	110,000	.00001
10	.450	50	.158	250	.059	800	.021	4,000	.0052	110,001	.00000
11	.430	52	.154	260	.058	820	.021	4,100	.0050		
12	.410	54	.150	270	.056	840	.020	4,200	.0049		
13	.390	56	.146	280	.054	860	.020	4,300	.0047		
14	.370	58	.143	290	.053	880	.019	4,400	.0046		
15	.355	60	.140	300	.052	900	.019	4,500	.0044		
16	.344	62	.137	310	.051	920	.019	4,600	.0043		
17	.333	64	.134	320	.050	940	.019	4,700	.0042		
18	.322	66	.131	330	.049	960	.018	4,800	.0041		
19	.311	68	.129	340	.048	980	.018	4,900	.0040		
20	.300	70	.127	350	.047	1,000	.018	5,000	.0039		
21	.291	72	.124	360	.046	1,100	.016	6,000	.0034		
22	.282	74	.122	370	.045	1,200	.015	7,000	.0025		
23	.273	76	.120	380	.044	1,300	.014	8,000	.0020		
24	.264	78	.118	390	.043	1,400	.013	9,000	.0016		
25	.255	80	.116	400	.043	1,500	.013	10,000	.0014		
26	.249	82	.114	410	.042	1,600	.012	11,000	.0012		
27	.243	84	.112	420	.041	1,700	.011	12,000	.0010		
28	.237	86	.110	430	.040	1,800	.011	13,000	.0009		
29	.232	88	.108	440	.039	1,900	.010	14,000	.0008		
30	.227	90	.107	450	.039	2,000	.010	15,000	.0007		
31	.222	92	.105	460	.038	2,100	.0097	16,000	.00055		
32	.217	94	.103	470	.037	2,200	.0094	17,000	.00039		
33	.212	96	.102	480	.036	2,300	.0091	18,000	.00032		
34	.207	98	.101	490	.035	2,400	.0088	19,000	.00024		
35	.202	100	.100	500	.034	2,500	.0085	20,000	.00020		
36	.198	110	.095	520	.033	2,600	.0082	21,000	.00017		
37	.194	120	.091	540	.033	2,700	.0079	22,000	.00012		
38	.190	130	.087	560	.032	2,800	.0076	23,000	.00009		
39	.186	140	.083	580	.031	2,900	.0073	24,000	.00008		
40	.183	150	.079	600	.030	3,000	.0071	25,000	.00007		

This table is based on the actual distribution of 139,458 claims compiled by the National Council on Compensation Insurance. The actual distribution was grouped into various size intervals, for example, 0-$499, $500-$599. These intervals were subdivided graphically using log-normal graph paper in such a manner as to reproduce the same number and amount of claims in each interval. For simplicity it was assumed that f_t between any two intervals shown in the table above was the same as the f_t shown for the larger end of the interval. That is, $f_t \div f_1 = .016$ for $1001 \leq t \leq 1100$. Hence some $f_t \div f_1$ shown in the table for the end of each interval are slightly higher than the values calculated from the actual claim distribution for t equal to the end of the corresponding interval. The average claim produced by this table is 107.2 compared to 107.4 for the actual distribution.

The primary losses were calculated as follows:

	$f_1 = 1$			$f_1 = 10$		
t	f_t	$Z_t = f_t \div (f_t + 1)$	Primary Loss $= \sum_{t=1} Z_t$	f_t	$Z_t = f_t \div (f_t + 1)$	Primary Loss $= \sum_{t=1} Z_t$
1	1.000	.500	.500	10.00	.909	.909
2	1.000	.500	1.000	10.00	.909	1.818
3	.850	.459	1.459	8.50	.895	2.713
4	.750	.429	1.888	7.50	.882	3.595
5	.660	.398	2.286	6.60	.868	4.463
6	.600	.375	2.661	6.00	.857	5.320
7	.550	.355	3.016	5.50	.846	6.166
8	.510	.338	3.354	5.10	.836	7.002
9	.470	.320	3.674	4.70	.825	7.827
10	.450	.310	3.984	4.50	.818	8.645

etc.

The primary loss, rounded to the nearest dollar, for an actual loss of $10 is $4 for $f_1 = 1$ and $9 for $f_1 = 10$. These are the values shown in the table of primary losses included in the body of the paper in the section, "Primary Losses".

REFERENCES

[1] Bailey, A. L., "Sampling Theory in Casualty Insurance," *PCAS* 1943, p. 31

[2] ———— "A Generalized Theory of Credibility," *PCAS* 1945, p. 20

[3] ———— "Workmen's Compensation D-Ratio Revisions," *PCAS* 1948, p. 26

[4] ———— "Credibility Procedures—La Place's Generalization of Bayes' Rule and the Combination of Collateral Knowledge with Observed Data," *PCAS* 1950, p. 7

[5] Bailey, R. A. & Simon, L. J., "An Actuarial Note on the Credibility of Experience of a Single Private Passenger Car," *PCAS* 1959, p. 159

[6] Bailey, R. A., "Any Room Left for Skimming the Cream?," *PCAS* 1960, p. 30

[7] Borch, K., "An Attempt to Determine the Optimum Amount of Stop Loss Reinsurance," *XVI International Congress of Actuaries*, 1960, Vol. I, p. 597

[8] Cramér, H., *Collective Risk Theory*, Scandia Insurance Company, Stockholm, 1955, Sections 3.1 and 6.1

[9] Dorweiler, P., "A Survey of Risk Credibility in Experience Rating," *PCAS* XXI (1934), p. 1

[10] Perryman, F. S., "Experience Rating Plan Credibilities," *PCAS* XXIV (1937), p. 63

[11] Stevens, W. A., "A Review of the Experience of Massachusetts Workmen's Compensation Experience Rated Risks," *PCAS* 1959, p. 87

[12] Wittick, H. E., "The Canadian Merit Rating Plan for Individual Automobile Risks," *PCAS* 1958, p. 214

RECENT TRENDS AND INNOVATIONS IN INDIVIDUAL HOSPITAL INSURANCE

BY

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One of the nation's leading multiple line insurance companies underwrites almost every conceivable type of personal insurance. The major exception is Accident and Health insurance. The agents of this company pride themselves on their complete coverage for any hazard except accident and sickness. Most of these men will not even advise their clients where to obtain such protection. This attitude stems from the belief that an accident and sickness policyholder will eventually become dissatisfied with his company. If he has no claim, he feels his money has been taken for nothing; and if he has a claim, he feels he has not been fully compensated for his loss. Why risk losing a man's auto, fire, and personal liability premiums by trying to provide a type of coverage which is not profitable anyhow?

Recent occurrences, such as governmental restrictions and programs providing medical care for large groups of our population, plus a trend toward excessive use of medical facilities when the cost is to be borne by an insurance company, have not weakened the position of the carrier mentioned above. Why then, are so many insurance companies making optimistic plans for the future in the field of Accident and Sickness insurance?

To attempt to answer this question in detail would be quite a task. There are so many phases of the Accident and Sickness field that it would require a whole book to study each one. There is Group insurance, Credit insurance, Special Risks including Travel Accident, Student, and Sports insurance, and Individual insurance. Each of these can be further subdivided into finer divisions. Probably the most widely publicized recently has been the area of Individual Hospital insurance. Government regulations on the State level, particularly in New York, and Federal proposals for "Socialized medicine" make daily reading material in our newspapers and magazines. Increased attention has also been focused on this field by recent developments among the various Blue Cross and Blue Shield types of organizations. Here, then, is an area where we can direct our attention and find clues to the whole problem of Accident and Sickness insurance.

THE PROBLEM

Insurance has been defined as the pooling of risk by a group of individuals, each exposed to a common hazard. Through the operation of the law of large numbers, the chance of a large loss is replaced with a small known charge. These charges, or premiums, are pooled in order to reimburse those members of the group who actually suffer the loss insured against. This conception of insurance is easily discernible in such coverages as ocean marine, fire, and personal liability.

The earliest form of insurance covering medical expenses was that offered to train passengers in the 1840's. A lump sum was paid in event of death or

serious injury due to an accident occurring while the insured was a passenger on a railroad. Here, also, the elements of insurance, as defined above, were present. Soon the idea of insurance against loss due to accidents spread, so that protection was provided against almost any type of accident.

Aside from the assistance rendered by the ancient trade guilds to their members in event of sickness, insurance providing for the reimbursement of losses incurred due to illness was not actually available until the late 1840's. However, all attempts to establish a sound health insurance program failed until late in the 1890's, when the established accident carriers expanded into this field. The early policies were strictly loss of time forms, providing weekly indemnities for disability. Soon, however, provisions were added granting additional benefits, as reimbursement for certain surgical procedures. Later, policies were sold which also provided for special benefits to be paid while the insured was hospitalized.

Gradually accident and sickness contracts merged into single policies. Until the 1930's, however, coverage for medical, surgical, or hospital benefits was provided to an individual as a supplement to loss of time benefits. During this decade, the seeds were sown which were to become the present hospital insurance field. Protection was made available to family members, as well as to individual insureds. Special policies offering rather comprehensive hospital, surgical and medical provisions were developed. In 1939, the first state-wide voluntary prepayment medical care plan was instituted in California.

In 1940, less than 10% of our population had any form of health insurance protection. By 1950, this figure had risen to 50%. In 1959, nearly 128 million people, or 72% of the U. S. population had some form of health insurance. While in 1950 the premium dollars paid for this protection were split almost equally between individual policies and group contracts, in 1959 individual coverages accounted for less than 40% of the total premiums.

Today's typical health insurance plan bears only slight resemblance to an insurance which comes under the definition presented earlier. Even the most minor occurrence is covered, and then the choice of whether there is to be a financial loss is left up to the insured. He can choose to seek medical attention or not. He can enlarge his family at the expense of his insurance carrier —an event which by no stretch of the imagination could be classified as a financial hazard. The very serious disability, which is truly an insurable hazard, is usually not covered because "Such things always happen to somebody else".

Some of the specific problems which have arisen, as our insurance "Topsy" has grown up over the past twenty years, are quite serious. There is a public demand for policies which provide for a continuation of coverage for the lifetime of the insured. Why terminate the protection when a person reaches a given age or when his health fails? When the need for protection against a real financial loss arises, the availability of that protection is withdrawn. Why not make adequate protection available to those already suffering from some substandard health condition and those already in the twilight of their lives?

Another serious problem is the abuse of insurance. Included here is over-

utilization of medical facilities, inflated charges, false or exaggerated claims, and over-insurance. These abuses are spawned by misunderstanding of the basic intent of the insurance contract, by the hypochondriac tendencies in many of us, and by the desire to make an "easy dollar" at the expense of an insurance company, that "is in business to give away money". The sales pressures and techniques of many insurance agents have been known to encourage these abuses by failing to create the proper attitude on the part of the public toward the health insurance program. A very pressing problem facing hospital insurance carriers is the threat of socialized medicine. This interesting paragraph dated 1916 is quite revealing:

> "A number of persons with socialistic tendencies are at this time engaged in a propaganda for sickness insurance in the interest of the working class, with premium contributions divided between the employer, employee, and State, and it is not unlikely that this propaganda will get headway in the near future. It will, at least, have the effect of hastening the introduction of ideal sickness insurance with premiums graduated to the attained age of the insured, as in life insurance and with policies carrying no cancellation clause." (Note: This paragraph has appeared annually in the *Cyclopedia of Insurance in the United States,* published by The Index Publishing Company of New York.)

THE ANSWER

To anyone not acquainted with the intricacies of the health insurance field the answer to these problems is obvious. It is to offer the best possible coverage at the lowest possible price and to educate everyone how to use this ideal contract; to find out how much money people are going to pay for all medical expenses for a year and divide the cost among all of the people: to add a small amount of administrative expenses, and collect the same amount for each person; and to remember to caution people that they must only obtain the same treatment and care that they would have obtained if they had had to pay the expenses out of their own pockets.

The two basic fallacies in this utopian scheme are the grouping of all people together as one class and the expectation that total costs will not increase if the bills are to be paid by someone else. Even the minimum classification for rating hospital forms provides for distinctions by age, sex, and health condition. Other classes are based on occupation, earnings, residence and marital status. A study made a few years ago by the Health Information Foundation indicates that the average expenses incurred by those families without insurance coverage were less than half of those incurred by families with insurance. When one considers that many of those who had no insurance were elderly persons or those whose health was too poor for them to qualify for coverage, and that these people are most susceptible to disability, these figures are very revealing. Apparently the need for medical care is not as important in determining the treatment to be obtained as is the source of income to pay for the treatment.

Is socialized medicine the answer then? If private insurance is going to fuss about spreading the cost by class, and complain about abuses or non-

critical use of their plans, why not have Uncle "Robin Hood" Sam come in and provide adequate care for all according to need, paid for by taxes on those who can afford to pay? (Great Britain has had such a scheme for some years now. It leaves much to be desired.) The result would be a plan similar to the utopian one presented above except that the charges would not be equally distributed. Also, the red tape involved would run the small administrative costs up to major proportions. The problem of abuses would be multiplied. Medical professional standards would be lowered. A little more of the individualism, which helped make our nation so great, would be traded for a false security.

Getting back to basic fundamentals, isn't a return to sounder insurance principles, plus an extension of coverage to every person in our society what we need? By dividing the situation into three parts, we can answer each one on the basis of its own problems. First, we must offer true insurance protection against the hazard of financial catastrophe caused by severe disability. Second, we should offer a satisfactory program for prepaid medical care for those who must exist on a restricted budget. Third, we must provide adequate protection for those persons who, because of age or health conditions, are, or will become, substandard health risks.

THE METHODS

Just as there is no one medicine to cure all ailments, there is no one plan of insurance to meet the needs of all people. Since some people are confronted with more than one of the three insurance needs just mentioned, there are more than three distinct methods or plans of insurance. Seven plans appear worthy of consideration. Each one is currently being sold by leading companies. Because they are all relatively new, none is presumed to be perfect, not even as an answer to the specific need for which it was developed. However, each shows promise and can be bettered through trial and error. In order to learn how to improve a product, research is necessary. Statistics are the tools of the health insurance researcher, the Actuary. Therefore, a sound statistical program is essential to the future of any insurance program.

The plans which will be taken up here include (1) Major Medical coverage, (2) Hospital coverage with a deductible, (3) Comprehensive scheduled plans, (4) Guaranteed Renewable hospital coverage, (5) paid-up Hospital plans, (6) Substandard coverage, and (7) Over-age plans. After a discussion of each and notation of certain statistical problems or comments, a discussion of general statistical considerations will be taken up.

MAJOR MEDICAL COVERAGE

Every year the cost of sickness and accidents goes up. (See Appendix 1) Rising medical costs, new methods of treatment, and our aging population all contribute to this trend. Each year more than half a million American families have medical bills which are larger than their total yearly income. Even the more robust are not immune to a severely fractured leg which requires a lengthy hospital stay or to a respiratory infection due to the capricious

habits of a flu bug. The medical expenses for either of these incidents could well run over $500. A heart attack, cancer, or any severe injury could easily cost thousands of dollars. This would be a financial catastrophe. Thus a need for catastrophe medical expense insurance is evident. It seems surprising that such coverage has only recently become widely available. Probably the answer lies in the problems confronting those carriers already in this business.

Necessity alone is not the only mother of invention of an insurance form. Adequate and fair rates have to be determined. The policy has to be written and administered so as to provide proper coverage with a minimum of red tape and controversy. The plan must be rated so that it will be acceptable to the potential insured. The agent must be sold on the merits of the plan.

Major Medical insurance has presented certain unique problems. It was known that many doctors set fees based on a patient's ability to pay. Where an insurance company was to foot the bill, what standards should be used? People have varying medical requirements based on their socio-economic status, on their past medical experiences, on their psychological attitude toward infirmities, and on their geographic location. Just because a person preferred to spend three weeks at a special clinic when ten days in his local hospital would have been sufficient, can he be denied full insurance coverage on the grounds that the additional expense was unnecessary?

In order to meet the different requirements of individuals, and to guard against over-utilization, Major Medical plans are usually sold with a choice of deductibles, an element of co-insurance, an inner limit on certain charges, and restrictive language defining reimbursement expenses. Rates are based on age, sex, earnings, and residence.

In spite of these refinements, insurers complain that there are still many unsolved problems of Major Medical insurance. Abuses due to excessive charges are being handled through meetings with medical groups or by scheduled fees. Over-insurance, where overlapping coverage is provided by some other type of policy, is being controlled through better underwriting. Over-utilization is being controlled by larger co-insurance factors and better insurer education.

Problem areas which still remain include bills for drugs or medical fees which are too small to investigate, but could invite fraud or padded expenses. There is the question of whether or not to re-rate a policyholder whose salary or residence has changed since his policy was issued. There is also a problem concerning cancellation of a policy, when the holder has presented a rather large claim. Most carriers do not cancel, unless there is evidence of abuse on the part of the insured.

If the Major Medical plans are to be considered as quasi-guaranteed renewable, however, shouldn't reserves be established? What about rates based on projected costs? Of interest here is the fact that medical costs have shown a tendency to rise faster than the increase in costs due to the increased age of the insured. Thus the rates for a policy which is guaranteed renewable should be higher for a younger person than for an older one.

Probably the best solution here is to set rates based on a leveling off in

the trend of medical costs and for insurance companies to join with others in the fight to control the super-inflationary trend in this area.

Besides keeping statistics on all Major Medical forms, in detail, regarding the rating classes and underwriting categories previously mentioned, data should be recorded by type of charge paid (i.e. hospital room and board, hospital extras, physician's fees, surgeon's charges, nurse's fees, special medicines, etc.). Also, a breakdown of claims into cause of loss categories would be very useful. The effect of medical advances in certain fields, such as cancer or heart conditions, could then be taken into consideration in re-rating or revising a form. Such data would also be helpful in providing special catastrophe type policies which would cover specific conditions.

HOSPITAL COVERAGE WITH A DEDUCTIBLE

The principal reason for the existence of the Major Medical plan is that it provides true insurance. Medical charges, which do not impose a severe financial burden on the insured, are borne by him. The portion of the expense of more serious conditions, which would create a financial strain, is shifted to the insurance company. Most Americans, however, have been educated to think of hospital insurance as a prepayment plan. They prefer to set aside a few dollars a month for a health insurance plan that would be adequate for most disabilities. There is really nothing wrong with this budget plan, except that medical expenses have risen faster than the average American's personal income. An adequate insurance plan now costs more than the average budget allows for this item.

There is a simple solution to this dilemma. By using a small deductible on health insurance forms, premiums can be reduced considerably. The deductible on automobile collision insurance has long been accepted. Everyone knows that the claims cost for every little claim under $50 would increase the rates for first dollar coverage on collision insurance to a fantastic figure. It is not hard to transfer the same logic to Health insurance.

The following quotation from Charles N. Walker of the Lincoln National Life Insurance Company appears in a release by the Health Insurance Association of America.

> "Would you be interested in a hospital policy which cost a third less than the one your company now offers, yet paid the policyholder more money when he had a claim? Would you be interested in a hospital policy which cut claim administration costs in half? Would you be interested in a hospital policy which costs a third less than the one your company now offers, yet paid your agents just as much commission as they now receive? Deductible hospital insurance will do all these things."

There are two separate types of deductible plans. The first is a deductible applicable only to hospital room and board charges. Usually, surgical, medical, or miscellaneous expenses under this plan are provided by riders, so it is easier to rate and administer the plan when the deductible is applied to the basic coverage only. The second plan is one where all benefits are provided

in the basic policy and the deductible applied to all expenses. Here a certain amount of sales flexibility is lost, but the complete comprehensive program is usually easier to administer.

One advantage of the hospital deductible plan is that it is a step toward the Major Medical catastrophe plan. Once the idea of a deductible is accepted, it should not be too difficult to increase the amount that the insured is to bear, as his ability to absorb larger losses increases with economic advancement. Thus, this plan seems to be the answer for the young family of today. A $25 deductible plan can later be increased to a $100 deductible with higher or more comprehensive benefits, and then replaced with a $300 deductible Major Medical plan. Of interest is the fact that the cost of a $25 deductible plan sold to a family with three children would cost about $25 a year less than the same plan providing first dollar coverage. Thus, even if the family had a claim during the year, the deductible plan would not cost them any more than their old plan. If there were no claims, the $25 would be saved, or perhaps used to purchase additional coverage for the next year.

The following chart was used to help rate one deductible plan. It is based on experience under a first dollar hospital plan sold only to risks under age 65. The policy provided 18 weeks' coverage. These figures exclude hospitalization due to maternity.

Given Day of Hospitalization	*% of Total Hospitalization Contributed to By Given Day*	*Accumulation of Preceding Column*
1	10.0	10.0
2	8.8	18.8
3	7.7	26.5
4	6.7	33.2
5	5.8	39.0
6	5.0	44.0
7	4.3	48.5
8	3.7	52.0

COMPREHENSIVE SCHEDULED PLANS

In order to provide supplementary coverage to an existing policy with another carrier, many companies have marketed special Surgical or Surgical and Medical plans. This type of policy has been used lately as a supplement to a limited group plan, which covered hospitalization and provided a small surgical indemnity, but contained no medical coverage. With the advent of free hospital insurance in Canada, the use of a scheduled plan built around the basic Provincial plan became the only way to sell medical expense insurance there. Now that hospital insurance dollars are collected as taxes, the insurance agent has had to find a means of replacing his lost income.

Since only about one-fourth of all expenses for medical care each year go to hospitals, it is not difficult for an energetic agent to show the need for

insurance to cover medical expenses other than those billed by the hospital. The ideal place to start is with Surgical insurance. Add on medical coverage to provide for doctor's calls, reimbursement for ambulance charges, anesthetists' fees, X-ray or laboratory expenses incurred when not hospitalized, and special nurse's care, and you have quite a comprehensive package. Throw in a special benefit to provide payment for obstetrical fees to appeal to the young married prospects and you have an ideal replacement for hospital insurance. Now the government pays the hospital bills and the insurance company pays the rest.

If such a program could be developed to meet the needs of the Canadian population who were convinced to purchase the plan by ambitious salesmen, why couldn't a similar comprehensive plan be developed to fit the insurance needs of any other large group of people? Why couldn't a catastrophe type comprehensive plan be developed? Such a plan would provide for all of the favorable features of the present Major Medical plan, the scheduled policy and the straight hospital form without many of their shortcomings.

An over-all deductible should be applied to eliminate small, non-serious claims. There could be a choice of two or three surgical schedules, with liberal benefits to meet the needs of various insureds. Inner limits on hospital indemnities and nurse care would provide the co-insurance feature deemed essential. An allowance for special drugs could be provided if there was an itemized list from the pharmacy giving the prescription number, the doctor's name and the type of drug. A maximum benefit limitation should be imposed so that there will be a maximum stated liability and a point at which a company could close out an extremely serious case.

GUARANTEED RENEWABLE HOSPITAL COVERAGE

In 1959, the State of New York enacted legislation which made every individual hospital policy sold there a Guaranteed Renewable form. A two year period for each policy is allowed during which time a policy may be cancelled and a few exceptions are allowed; but for all practical purposes, the forms are not cancellable at the option of the company until a stated age is attained. The effect of these "Metcalf Provisions" is still to be ascertained. The initial response by the various companies doing business in New York has been varied. Some increased rates only slightly and took a "wait and see" attitude. Some companies came out with forms rated somewhere between their old cancellable policies and their true Guaranteed Renewable policies. Others decided to sell only the true Guaranteed Renewable forms, with full reserves.

One problem in developing and rating a Guaranteed Renewable policy is the reserve. Fortunately, there are tables and methods for establishing such a reserve which have been approved by the NAIC. A problem, which is tied to the reserves, however, is that of persistency. Studies show that the lapse rate on Guaranteed Renewable forms is not too much lower than that on a good commercial form. Since the policyholder has no claim to any reserve, the company need not refund any cash value to him. Because the reserve, as in Life insurance, builds up slowly, the small amount relinquished in the early

years can be taken over by the company to offset the expense of cancelling the policy and to pay for any deficiency due to high acquisition expenses.

What should a company do when a policyholder lets his policy lapse after the reserve has been built up to an amount more than adequate for these contingencies? Some carriers take this lapse rate into account in rating their forms and need not worry about individual cancellations. Other companies do not make rate adjustments for anticipated lapses because they feel that there is no savings to the company when a policy is lapsed. They point out that the policyholders who retain their coverage are probably poorer risks in general than those who drop their coverage each year. Therefore, the reserve released on those policies which are dropped should be used to cover the anticipated increased liability on those who have retained their policies.

The Metcalf legislation in New York was not the work of radical politicians. For years, people had complained that insurance companies were being unfair in cancelling their protection when they became ill, or when they reached an age where they could not buy replacement protection. The companies have always maintained that they rated their forms on the basis of insureds in good health. Since the contract was a short term one, they had every right to protect themselves and their other policyholders by eliminating potential bad risks. Guaranteed Renewable forms seemed to be the answer. But most people didn't understand all of the technicalities of the various plans, and many agents did not fully understand the situation either. The new plans cost more and offered only a few sentences of complex terms in return for the additional premium.

The New York decision to eliminate the cancellable form may prove to be a boon to both the insureds and the insurers. The public has what it always wanted, guaranteed protection.

The carriers can establish reserves to provide for "aging" of policies so that they are not faced with the unpleasant task of asking for rate increases every few years on forms which are not being subsidized by new insureds each year. Agents trying to sell the Guaranteed Renewable forms need not worry about competition from "cheap" cancellable policies.

While it is true that Guaranteed Renewable forms have not shown as good a persistency record as most carriers have anticipated, there are some good reasons for this situation. The earlier policies were probably "over-priced". As the force of competition and more adequate statistics led to lower rates, many persons probably switched their coverage to take advantage of better rates. Also, many earlier forms called for fairly broad age categories. The trend has been toward fewer age brackets, with a resulting lower premium for younger persons. Thus a man would save money by transferring his coverage to another plan, if he could profit by the more refined premium tables. It is assumed that this picture will change in New York State where there is no competition from cancellable forms, where carriers are fairly well controlled, and where competition has forced rates to be fairly consistent between companies. When a person finds that his current coverage can not be duplicated by another carrier for a lower premium, chances are that he will hold on to his policy.

PAID-UP HOSPITAL PLANS

The Life insurance field for many years has featured plans which call for premiums to be paid-up before the policy matures as an endowment or before the insured retires and no longer can afford to continue to build up a death benefit fund. The Twenty Pay Endowment at age 65 provided a good means of building up a retirement fund for a young man who planned ahead and thought of diverting his income after the twenty years to education for his children or special investments, once his life insurance program was complete. The Life Paid-Up at 65 policy offered a good value in insurance without the burden of continuing payments after retirement. The problem of transferring this innovation to the Hospital insurance field has been a challenge. Mortality statistics have been available for many more years than morbidity data. When many companies were uncertain as to the premiums for Hospital insurance for the present, how could they compute premiums for the future? A paid-up hospital policy could not be cancellable and the rates could not be increased on existing policyholders who were no longer paying premiums. The experience of non-cancellable policies during the Depression was a deterrent to any type of guaranteed premium plan.

With more statistics concerning morbidity in general and hospitalization in particular, a few companies have broken through the barrier of uncertainty and have come out with paid-up hospital plans. Some of the fears regarding this type of policy can be dispelled by providing a definite scheduled benefit to be paid. Then the major unknown factor in rating becomes the expected frequency. Recent statistics provide a very good picture of this experience. Actuarial functions for expected losses, lapses, mortality, interest on reserves, expenses, and so forth can be developed just as they are for Life insurance.

Thus we have a hospital policy which can be paid for while the insured is capable of paying the relatively high premiums, but which will provide hospital benefits after he has retired. This type of policy is ideal for the man who takes pride in his careful considerations for the future. He need not fear that disability will disrupt his retirement plans, at least not financially. Also, he has removed any uncertainty concerning the availability of insurance in his later years. There have been too many men who find that they can not obtain adequate hospital insurance at a reasonable rate after they retire.

A consideration of no little importance in the selection of such a plan, however, is the benefit level to be used. The buyer wants to have adequate protection and the insurance company wants to have a satisfied client. So both should be concerned with the recent trend in increased medical expenses. The increasing costs of medical care, especially hospital charges (see Appendix I), are frightening. Here again is a good reason why the public and the insurance companies should work together with members of the medical profession to halt this situation. There will be no value in having a paid-up hospital policy, if the coverage afforded will only pay for one pill and perhaps the use of the glass to hold water with which to wash it down.

Statistics which provide data by the attained age of the insured are es-

sential in rating and continuing to analyze this type of policy. Since policy reserves must be kept, it is extremely important to have accurate and detailed studies of expected future payments. These can only be obtained by a careful study of past experience. Benefit studies by age of claimant are most helpful. Statistical trends, sex differences, and lapse studies would be vitally important in analyzing these policies.

SUBSTANDARD COVERAGE

One of the reasons why many persons have been dissatisfied with commercial insurance companies has been the denial of coverage to those not in perfect health. Even the use of waivers, allowing a person with some substandard condition to obtain insurance for all other conditions, has not been graciously accepted. For years, persons with medical histories which make them substandard risks have complained that their insurance should cost them less than average because they are aware of their health and take better care of themselves. While this has proved true for many individuals, there is still the medical fact that most of the chronic conditions which cause a person to be classed as substandard are degenerative in nature. The original condition may recur or the total physical system may be weakened so that susceptibility to other ailments is increased.

Of interest, statistically, is the fact that the actual experience of carriers offering Substandard Hospital coverage has fallen between the optimistic hopes of those persons who have argued that they should be above average risks and the early underwriters who foresaw only the worst experience for substandard hospital insurance. Probably the same advances in medical techniques which have caused hospital costs to rise so rapidly of late have helped curb the serious effects of previously crippling conditions.

Now, there are very few persons who cannot obtain some sort of hospital coverage, regardless of past medical history. Of course, the rates for certain conditions are still quite high. The trend in this field however, has been toward lower rates and more liberal coverage. It is even possible for a person with a substandard condition to qualify for standard rates and forms after favorable experience under a substandard policy. If the insured can prove that his health condition and his health attitude make him a good risk through favorable claim experience, he can have his coverage transferred to a standard policy form. This idea works well in the automobile field, where insureds are rewarded for good claim experience by lower rates or lower deductibles.

In evaluating the results of a Substandard Hospital insurance program, quite detailed statistics are necessary. Appendix V is a suggested list of conditions on which individual experience should be kept. Appendix VI is a list of rate-up factors, ranging from the less severe (1) to the more serious conditions (7). By coding each policy according to the rate-up factor used, a statistical analysis of the substandard underwriting selection can be obtained. This is especially valuable when the rate-up factor used may be varied at the discretion of the underwriter. Also, the combination of this code with the substandard condition code provides all of the detail necessary for making

a good analysis of substandard insurance by condition and severity, which should be the ultimate basis for underwriting and rating.

OVER-AGE PLANS

Just as the sale of Substandard plans to those who formerly were uninsurable because of health has helped fill half the hole created by former standard commercial insurance practices, the creation of special Over-Age plans promises to complete the process. Now no person need be denied hospital insurance because of health or age. There have always been plans available for those persons over age 65 who were in good health who could pay the high premiums asked. Under the pressures of government regulation or competition, some of the leading carriers have developed low cost plans for the elderly segment of our population. By offering coverage similar to group insurance, with no initial underwriting, and expenses pared down by volume sales, companies can provide millions of people over age 65 with adequate hospital insurance at a reasonable price. Continued protection is offered, even if a serious condition develops. The basis for the rates for this type of insurance is not dependent on the good health of the insureds but rather on the total health picture of all older people. Statistics have indicated that as a person grows older the tendency toward over-utilization of medical care because of insurance benefits become less. By providing a co-insurance factor, this tendency is further discouraged.

Thus, for an annual charge of about $75 per person, payable monthly if desired, a generous hospital plan can be purchased. Even providing guaranteed renewable coverage, this allows about 10 or 15 per cent to the insurance company for expenses. By keeping commissions down to a minimum and through volume accounting procedures, the program has proven financially self-sufficient.

While certain people within the insurance industry have objected to these plans on the grounds that they break from the traditional agent-client relationship of the American Agency System, the program seems to be moving ahead. There still is a demand for government subsidized insurance for the aged, but some of the former critics of private insurance have softened their views, due to this new concept. As long as the private carriers keep up with the needs and demands of the people, the fear of socialized health insurance need not be any greater than it was in 1916.

STATISTICS

The problem of insurance statistics is two-fold. First, statistics have to be gathered to rate a new form. Then, statistics on the form must be kept to support the rate structure and to provide for internal company requirements and external industry studies. Some people wonder how a new form can be rated if no similar form has ever been sold by a given company. Sometimes rates for such policies are based on the rates charged by competitors, tempered with experience on related forms offered by the company. However, there

are quite a few sources of statistical data available which can be used in arriving at rates for a new policy form.

Of special interest in this regard is an annual publication of the Department of Health, Education and Welfare entitled *"Sources of Morbidity Data"*. This booklet lists various studies made or being made by governmental agencies, schools, private research organizations and others. A brief description of each survey is presented along with any publication plans and the person who could provide further information on the project.

The following is a list of source documents which have proven quite useful as reference material for statistical studies of morbidity. It is by no means a complete list of available sources, but rather is representative of the material published in the past few years.

Compendium on Risk Selection for Individual and Family Accident and Health Insurance—published by the Health Insurance Association of America.

Health Statistics from the U. S. National Health Survey—a series of reports prepared by the U. S. Department of Health, Education and Welfare.

Voluntary Health Insurance and the Senior Citizen—a report prepared by the State of New York Insurance Department.

Journal of the American Hospital Association—Guide Issue—an annual report published on August 1 each year by the American Hospital Association.

Health Costs of the Aged—Report No. 20—Published by the Social Security Administration of the U. S. Department of Health, Education and Welfare.

Accident Facts—An annual publication of the National Safety Council.

Source Book of Health Insurance Data—Published by the Health Insurance Institute.

HIC Action Kit—monthly series of bulletins and reports prepared by the Health Insurance Council.

Family Medical Costs and Voluntary Health Insurance by Anderson and Feldman published by McGraw Hill, 1956.

Comprehensive Medical Services Under Voluntary Health Insurance by Darksy, Sinai, and Axelrod; published by the Harvard University Press, 1958.

With the advent of new electronic data processing equipment, the accumulation of adequate morbidity statistics within a company has been transformed from a tedious task to an interesting experience. The errors of manual records and the lack of time and space inherent in older statistical systems are no longer a hindrance to a sound statistical program. The following is an outline of the premium accounting and statistical card and the claim accounting and statistical card which are to be used in gathering information for future analysis in one company. As inferred in the title of the cards, they are to serve as both Accounting Department sources and Actuarial Department statistical records.

Premium and Accounting Statistical Card

Size of Field	*Card Columns*	*Title of Field*	*Explanation*
1	1	Accounting Month	
3	2-4	Accounting Book	Collection Department Record
7	5-11	Policy Number	
5	12-16	Due Date	Month, Day, Year
2	17-18	Term or Mode	Premium Period in Months
3	19-21	Paid to Date	Month, Year
7	22-28	Agent Code	General and Sub-Agent
2	29-30	State Code	
3	31-33	Coverage	See Note I
4	34-37	Policy Form Number	
3	38-40	Issue Date	Original month and year of issue
2	41-42	Year of Birth	Of principal insured
1	43	Sex	See Note 2
1	44	Dependents	Number of Persons covered other than principal insured
7	45-51	Policy Size, etc.	See Note 3
4	52-55	Special data	See Note 4
1	56	Initial or renewal	
1	57	Adjustment	Special Accounting Field
1	58	Transaction	Special Accounting Field
7	59-65	Premium Paid	
5	66-70	Commission	Rate and Plan
8	71-78	Name	Last name of insured
1	79	Billing Method	
1	80	Card Code	Tabulating Dept. use

Note 1: The coverage code is set up so that the first digit indicates the type of business (i.e., Individual Hospital, Individual A & S, Group A & H, Credit A & H, etc.) The second digit subdivides the type into such categories as Regular Hospital, Guaranteed Renewable Hospital, Substandard Hospital, etc. The third digit is used to indicate the extent of coverage within these classes. For example, a Regular Hospital form could provide very limited room and board benefits, or it could offer long term benefits plus surgical, medical and miscellaneous coverage. (See Appendix II).

Note 2: The sex code is based on the following categories:

1 Male only
2 Female only

3 Male, principal insured, and female
4 Female, principal insured, and male
5 Male, principal insured, female and children
6 Female, principal insured, male and children
7 Male and children
8 Female and children

Note 3: The coding of information in this field will be such that pertinent data may be recorded on various types of policies. Different information will be necessary on different types of policies. On Major Medical forms, the codes will indicate (1) the deductible amount called for, (2) the geographic area used in rating the policy, (3) the maximum limits of the policy, and (4) the salary classification of the principal insured. On other policies any or all of the following may be coded: (1) principal sum, (2) maximum miscellaneous coverage available, (3) amount of deductible, (4) maximum duration of benefits, (5) daily room and board benefit allowance, and (6) maximum amount of surgical schedule applicable.

Note 4: The special data field will be used for special policies, such as Substandard, Franchise, or Associations. There will be codes to provide for future analysis of experience by occupational groups or by substandard conditions. Appendix V contains an illustrative system for coding various substandard conditions by bodily system and major impairment within the system. This is based on the *"Standard Nomenclature List of Physical Impairments*—1956" published by the Health Insurance Association of America. Appendix VI provides a guide for rate-up codes which can be used for rating and for statistical purposes, as well. The information obtained in studies based on such a coding plan can be used for internal rating or for inter-company studies.

Claim Accounting and Statistical Card

Size of Field	*Card Columns*	*Title of Field*	*Explanation*
4	1-4	Accounting Date	Month, Day, Year
7	5-11	Policy Number	
6	12-17	Claim Number	
2	18-19	Reported Date	Month, Year
2	20-21	Loss Date	Month, Year
7	22-28	Agent Code	General and Sub-Agent
2	29-30	State Code	
3	31-33	Coverage	See Premium Card
4	34-37	Policy Form Number	
3	38-40	Issue Date	See Premium Card
2	41-42	Year of Birth	See Premium Card
1	43	Sex	See Premium Card

Claim Accounting and Statistical Card (cont.)

Size of Field	*Card Columns*	*Title of Field*	*Explanation*
1	44	Member	See Note 5
1	45	Reinsurance	Type of reinsurance, if any
1	46	Claim History	See Note 6
5	47-51	Policy Size, etc.	Same as Premium card col. 47-51
4	52-55	Special Data	Same as Premium card col. 52-55
2	56-57	Cause of Loss	See Note 7
1	58	Reserve Status	See Note 8
1	59	Type of payment	Initial, partial, final, additional
2	60-61	Period of Indemnity	In days
4	62-65	Form of specific	Policy or rider form under which payment is made
2	66-67	Benefit Code	See Note 9
6	68-73	Payment Amount	
6	74-79	Check number	
1	80	Examiner	Claim Examiner's Code number

Note 5: The code for member will be used to distinguish between a claim on the insured and one on his dependents. The following system is to be used on the Individual Hospital business:

1 Male, principal insured
2 Female, principal insured
3 Male, spouse
4 Female, spouse
5 Male, child
6 Female, child

Note 6: The use of a special code for claim history will serve a dual purpose. It provides a general cause of loss code which can be combined with the specific cause of loss to give a detailed breakdown of claims. Also, it is the key for special studies of Substandard Hospital Policy experience, and for policies providing maternity or accidental death and dismemberment benefits. The codes to be used are:

1 Specific Loss (A.D. and D.)
2 Maternity
3 Accident Claim—related to substandard condition
4 Accident claim—all other
5 Sickness Claim—related to substandard condition
6 Sickness Claim—all other

Note 7: The cause of loss code for Sickness will be the first two digits of that suggested by the HIAA as an illustrative set of codes for cause of disability under their 1958 statistical plan. The two digit code plan is shown in Appendix III. The code, as it is to be used for accidents, will vary from the HIAA code. Since it is not to be used in detail with Hospital policies, the code is not presented here.

Note 8: The code for Reserve Status is to be used in determining the type of reserve to be applied to a pending claim. The following are the codes to be used:

0 Regular pending reserve (factor)
1 Accidental death reserve
2 Lifetime contingency reserve
3 Legal reserve
4 Special reserve

Note 9: The Benefit Code has been developed to provide a basis for cost analysis of each provision in a policy. The coverages provided by each form have been outlined, and a code assigned to each one. Appendix IV illustrates how such a code can be developed.

APPENDIX I

CONSUMER PRICE INDEXES FOR MEDICAL CARE ITEMS

(1947-49 = 100)

Year	*All Medical Care Items*	*General Practitioners' Fees*	*Surgeons' Fees*	*Dentists' Fees*	*Optometric Examination and Eyeglasses*	*Hospital Room Rates*	*Prescriptions and Drugs*
1935	71.4	73.9	73.8	68.2	80.5	47.1	83.0
1936	71.6	74.3	74.1	68.3	80.7	47.5	82.8
1937	72.3	74.6	74.3	69.9	81.2	48.8	83.3
1938	72.5	74.6	74.6	70.0	81.3	49.9	83.8
1939	72.6	74.6	74.8	70.1	81.9	50.1	83.5
1940	72.7	74.7	74.0	70.1	82.6	50.4	83.2
1941	73.1	74.9	74.7	70.3	82.8	51.4	83.9
1942	75.1	76.6	76.8	72.1	83.9	55.4	85.8
1943	78.7	81.3	81.3	75.4	87.5	59.8	86.4
1944	81.2	84.8	84.5	79.6	89.6	62.5	87.2
1945	83.1	86.8	86.9	83.0	90.8	64.4	87.9
1946	87.7	91.1	90.9	87.9	92.5	73.3	89.5
1947	94.9	96.9	96.2	95.2	96.2	87.4	96.1
1948	100.9	100.6	101.0	100.3	100.2	102.1	101.2
1949	104.1	102.5	102.9	104.4	103.5	110.4	102.7
1950	106.0	104.0	104.5	106.9	104.5	114.6	103.9
1951	111.1	108.0	107.3	110.9	109.2	126.9	106.9
1952	117.2	113.0	111.5	113.3	110.5	139.5	107.9
1953	121.3	116.1	113.9	117.0	109.4	148.2	108.9
1954	125.2	119.9	115.2	120.9	108.0	156.8	110.1
1955	128.0	124.3	116.4	122.0	109.5	164.4	111.2
1956	132.6	128.4	118.2	124.4	111.2	173.3	113.7
1957	138.0	134.5	120.9	127.4	115.5	187.3	116.7
1958	144.4	139.3	122.7	131.4	116.7	198.0	120.7

Source: United States Department of Labor Bureau of Labor Statistics.

APPENDIX II

COVERAGE CODE

First Digit

1 Accident only
2 A & H
3 Hospital
4 Group A & H
5 Students
6 Credit A & H
7 Credit Life
8 Ind. Life
9 Group Life

Second Digit

10 Accident only—obsolete forms
11 " " —Loss of time
12 " " —Principal sum only
13 " " —B A M R & P. S.

20 Accident & Sickness—obsolete forms
21 " " —Regular L/T
24 " " —Substandard
25 " " —Guaranteed Renewable
22 " " —Franchise type

30 Hospital—obsolete forms
31 " —Regular
32 " —Franchise Type
33 " —Special*
34 " —Substandard
35 " —Guaranteed Renewable

Third Digit

10-20-30 = All require "0"
11 - 1 = All risk-short term—no hospital coverage
- 2 = " " " " —with " "
- 3 = " " " " —with surgical or surgical & hospital coverage
- 4 = " " long " —no hospital coverage
- 5 = " " " " —with " "
- 6 = " " " " — " surgical or surgical & hospital coverage

12 - 0 = All risk—renewable
or - 1 = " " —single term
13 - 2 = Specified risk—renewable
- 3 = " " —single term
- 4 = Single flight air travel

21 - 1 = Short term—no hospital coverage
- 2 = " " —with " "
- 3 = " " — " surgical or surgical & hospital coverage
- 4 = Long " — " no hospital coverage
- 5 = " " — " hospital coverage
- 6 = " " — " surgical or surgical & hospital coverage
- 7 = Over-age —no hospital coverage
- 8 = " —with " "
- 9 = " — " surgical or surgical & hospital coverage

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* Includes Major Medical, Medical-Surgical, Specified Diseases, and Accident only.

22 - 1 = Regular Franchise—no hospital coverage
- 2 = " " —with " "
- 3 = " " — " surgical or surgical & hospital coverage
- 4 = Special " —no hospital coverage
- 5 = " " —with " "
- 6 = " " — " surgical or surgical & hospital coverage
- 7 = True Ass'n Group —no hospital coverage
- 8 = " " " —with " "
- 9 = " " " — " surgical or surgical & hospital coverage

24 - 0 = All policies

25 - 0 = Short term
- 1 = Long term

31 - 0 = Short term—with room & board only*
34 - 1 = " " —plus surgical only
or - 2 = " " — " miscellaneous only
35 - 3 = " " — " surgical & miscellaneous
- 4 = Long " —with room & board only
- 5 = " " —plus surgical only
- 6 = " " — " miscellaneous only
- 7 = " " — " surgical & miscellaneous
- 8 = Any Hospital form with A & H riders
- 9 = Over-age Hospital forms

32 - 0 = Regular Franchise—with room and board only*
- 1 = " " —plus surgical only
- 2 = " " — " miscellaneous only
- 3 = " " — " surgical & miscellaneous
- 4 = True Ass'n Group —with room and board only
- 5 = " " " —plus surgical only
- 6 = " " " — " miscellaneous only
- 7 = " " " — " surgical & miscellaneous
- 8 = Special Group forms

33 - 0 = Major Medical
- 1 = Surgical only
- 2 = Surgical and medical
- 3 = Polio only
- 4 = Specified disease (no cancer)
- 5 = " " (including cancer)
- 6 = Accident only
- 7 = Surgical-Medical with Hospital coverage by rider

Notes: Short term Accident forms are those providing coverage for one year or less. Short term Accident and Sickness forms are those providing one year coverage or less for each benefit. (A five year Accident and one year Sickness plan would be long term.)
Short term Hospital coverage includes all forms where the duration is less than 90 days. (90 day coverage is long term.)

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* Medical riders do not affect the coverage code.

APPENDIX III

CAUSE OF LOSS CODES

Sickness Code	*Cause of Loss*
01	Tuberculosis of the respiratory system
02	Tuberculosis other specified form
03	Syphilis and its sequelae
04	Gonococcal infection
05	Dysentery, all forms
06	Infectious diseases commonly arising in the intestinal tract, including food poisoning
07	Certain diseases common among children Scarlet fever Diphtheria Whooping Cough Meningococcal infections Acute Poliomyelitis Smallpox Measles Chickenpox Mumps
08	Other diseases attributable to viruses *Note:* When virus is not otherwise specified and is reported with a respiratory condition, *always* code the case according to the respiratory condition. For example "virus infection, acute sinusitis" would be coded as sinusitis, i.e. 34
09	Malaria
11	All other diseases classified as infective and/or parasitic
12	Malignant neoplasms (tumors) including neoplasms of lymphatic and haematopoietic tissues including Hodgkins disease Leukemia and aleukemia
13	Neoplasms (tumors), benign and of unspecified nature
14	Allergic disorders (includes hay fever, asthma, eczema, etc.)
15	Diseases of the thyroid gland
16	Diabetes mellitus
18	Anaemias
19	Psychoneuroses and psychoses (includes nervous exhaustion)
20	Diseases of the nervous system Vascular lesions affecting central nervous system (includes cerebral hemorrhage, cerebral embolism and thrombosis, etc.) and Other diseases of the central nervous system, nerves and peripheral ganglia
21	Inflammatory and other diseases of the eye
22	Diseases of the ear and mastoid process
23	Rheumatic fever
24	Chronic Rheumatic heart disease
25	Non-rheumatic heart disease Heart disease specified as involving the coronary arteries Angina pectoris Arteriosclerotic heart disease, chronic endocarditis and other myocardial degeneration Acute and subacute endocarditis, acute myocarditis, acute pericarditis, and functional heart disorders Other and unspecified non-rheumatic heart disease
26	Hypertensive disease
27	Diseases of arteries and veins

29	Acute Tonsillitis, Hypertrophy of tonsils and/or adenoids
30	Influenza, Grippe
31	Pneumonia (including alcoholic pneumonitis)
34	All other respiratory diseases (including croup, chronic pneumonitis)
35	Ulcers and other non-cancerous diseases of the stomach and duodenum (includes acute gastritis)
36	Appendicitis
37	Hernia of the abdominal cavity
38	Diarrhea and enteritis
39	Diseases of gallbladder and bile ducts
40	Other diseases of digestive system (including diseases of rectum, intestinal obstruction, spastic colon)
41	Diseases of the urinary system Nephritis and nephrosis Infections of the kidney (includes acute pyelitis) Calculi of kidney, ureter and other parts of the urinary system Other diseases of the urinary system
42	Diseases of genital organs
43	Deliveries, complications of pregnancy childbirth and the puerperium
44	Boil, carbuncle, abscess, cellulitis and other skin infections
45	Other diseases of skin and subcutaneous tissue
46	Arthritis and rheumatism, except rheumatic fever
47	Diseases of bones and other organs of movement
48	Congenital malformations and diseases peculiar to early infancy
49	Other specified and ill-defined diseases

APPENDIX IV

BENEFIT CODE

A.	*Illness Indemnity*	
I	Confining Illness	11
II	Non-confining Illness	12
III	Hospital Confinement	13
IV	Indemnity for graduate nurse service	14
B.	*Accident Indemnity*	
I	Total Disability	21
II	Partial Disability	22
III	Surgeon's fees for non-disabling injury	23
IV	Hospital Confinement	24
V	Blanket Expense	25
VI	Fracture settlement	26
C.	*Hospital Benefits*	
I	Room and Board	31
II	Special Services & Supplies	32
III	Graduate Nurse Service	33
IV	Maternity Benefit	34
V	Emergency doctor's fees	35
VI	Female disorders	36
VII	Drugs and Dressings	37
VIII	Recuperative Indemnity	38
IX	Supplementary Accident expense	39
D.	*Surgical Benefit*	
I	Scheduled Benefit	41
II	Non-scheduled Benefit	42
III	Obstetrical Benefit	43
E.	*Medical Benefit*	
I	Scheduled Benefit	51
II	Non-scheduled Benefit	52
III	Miscellaneous Expense	53
F.	*Specific Losses*	
I	Loss of Life	61
II	Loss of Limb	62
III	Loss of Sight	63
G.	*Miscellaneous*	
I	Natural Death Benefit	71
II	Pilot Refunds	72
III	Polio Policy Coverage	73
IV	Conversion costs	74
V	Waiver of Premium—Strike	75
VI	Waiver of Premium—Total Disability	76
VII	Premium Refund—Accidental Death	77
H.	*Compromise Settlement*	80
I.	*Dread Diseases*	
I	Tularemia	78
II	Psittacosis	79
III	Scarlet Fever	81
IV	Tetanus	82
V	Lukemia	83
VI	Encephalitis	84
VII	Cancer	85
VIII	Spinal Meningitis	86
IX	Diptheria	87
X	Small Pox	88
XI	Rabies	89
K.	*Claim Expenses*	
I	Hospital Records	90
II	Investigation Expense	91
III	Medical Examinations	92
IV	Legal Services	93
V	Court Costs	94
VI	Miscellaneous Expense	95

APPENDIX V

SPECIFIC IMPAIRMENT CODES

Brain

Important Subdivision	
00	N.O.C.
01	Infectious
02	Epilepsy, catalepsy, narcolepsy, etc.
03	Fractures
04	Headaches
05	Psychoses
06	Neuroses
07	Moral Hazards
08	Concussion
09	Vertigo

Nervous System

Important Subdivision	
10	N.O.C.
11	Neuralgia, neuritis
12	Paralysis
13	Reflexes
14	Sclerosis
15	Spinal Cord
16	Tremors

Cardio-vascular System

Important Subdivision	
20	N.O.C.
21	Anemia
22	Aorta
23	Arteries, veins, except Aorta
24	Heart Disease except coronary artery disease
25	Blood Pressure
26	Coronary artery disease
27	Murmurs
28	Pulse
29	Spleen

Ear

Important Subdivision	
30	Deafness, total
31	Meniere's disease, labyrinthitis otosclerosis, mutism

Eye

Important Subdivision	
32	Major eye troubles, N.O.C.
33	Partial loss of sight
34	Total loss of sight
35	Cataract
36	Eye diseases, general
37	Glaucoma
38	Myopia, detached retina, etc.

Gastro-intestinal Tract

Important Subdivision	
40	N.O.C.
41	Mouth
42	Esophagus
43	Upper G.I., except peptic ulcers
44	Peptic ulcers
45	Gall Bladder
46	Liver
47	Hernias, internal
48	Large intestine
49	Rectum

Genito-Urinary System, Breast Disorders and Female Disorders

Important Subdivision	
50	V.D. and Genito-urinary, N.O.C.
51	Bladder, ureters, urethra
52	Breasts
53	Kidneys
55	Pregnancy
56	Prostate
57	Testes and scrotum
58	Urine
59	Uterus and adnexae

Glands of Internal Secretion and Metabolism

Important Subdivision	
63	Adrenal
64	Diabetes Mellitus
65	Pancreas, other
66	Parathyroid
67	Pituitary
68	Thyroid
69	N.O.C.

Miscellaneous

Important Subdivision

70 N.O.C.
73 tbc, non-pulmonary
74 Overweight
75 Other build abnormalities
76 Fevers
77 Skin affections
78 Benign tumors
79 Malignant tumors

Respiratory System

Important Subdivision

80 Abscess
81 Allergies
82 Respiratory disease, major, except tbc
83 Respiratory disease, minor
85 Pneumonia
86 Pleurisy
87 Pneumothorax, non-therapeutic
88 tbc, minimal
89 tbc, more than minimal

Skeletal and Muscular System

Important Subdivision

90 N.O.C.
91 Arthritis, rheumatism
92 Ankylosis, bursitis, other joint disorders except dislocations
93 Back, except lumbosacral
94 Lumbosacral
95 Deformities
96 Dislocations and fractures
97 Hernias
98 Amputations

APPENDIX VI

TABLE OF SUBSTANDARD IMPAIRED CONDITION RATE-UP CODES

1. GENERAL CONDITIONS

Allergies	1
Arthritis	1
Bone or joint disorder	2
Breast, disorders, malignant	3
Brucellosis	5
Cataracts	1
Diabetes	3
Ear disorder	1
Glaucoma	1
Gout	2
Hearing, impaired	1
Infectious Mononucleosis	1
Lumbago	1
Malaria	1
Malignancy, internal	3
Malignancy, skin	1
Metabolic disorders, not listed elsewhere	3
Osteomyelitis	2
Overweight	2
Rheumatism	1
Sarcoidosis	6
Syphilis	3
T. B. other than pulmonary	4
Thyroid disorders	2
Tumors, cysts, non-malignant	1
Underweight	2
Vision, impaired	1

2. BRAIN AND NERVOUS

Abscess or Tumor, non-malignant	2
Bell's Palsy	1
Central Nervous System Syphilis	7
Encephalitis	2
Epilepsy, Grand Mal	4
Epilepsy, Petit Mal	3
Fractured Skull	1
Headaches, Migraine	2
Headaches, not Migraine	1
Meningetities	2
Multiple Sclerosis	7
Neurasthenia, Psychoneurosis	2
Neuritis and Neuralgia	1
Paralysis, Agitans	3
Sciatica	1
Vertigo or Syncope	3

3. HEART AND CIRCULATORY

Angina Pectoris	3
Aneurysm	4
Arteriosclerosis	2
Cerebral Vascular Accident	3
Coronary Artery Disease	3
Coronary Occlusions	5
Endocarditis	2
Hemophilia	4
High Blood Pressure	2
Hodgkin's Disease and other Lymphomas	7
Leukemia, chronic	7
Low Blood Pressure	1
Murmur, functional	1
Murmur, organic	2
Myocardial Infarction	5
Peripheral Vascular Disease	4
Pernicious Anemia	3
Purpura	5
Rheumatic Fever	2
Varicose Veins	1

4. RESPIRATORY

Asthma	2
Bronchitis	1
Emphysema	2
Pleurisy	1
Pneumoconiosis	3
Pneumonia	1
Pneumothorax	3
Pulmonary Tuberculosis	3
Sinusitis	1
Tumor or Cyst, non-malignant	1

5. DIGESTIVE

Achylia gastrica	1
Cirrhosis of Liver	3
Colectomy, non-malignant	2
Colitis, ulcerative	3
Colitis, not ulcerative	1
Duodenal Ulcer, no complications	2
Gall Bladder, disorder of	2
Hernia, Diaphragmatic	3
Hernia, inguinal, femoral or internal	1
Liver, disorder of	2
Intestinal Obstructions	1
Malignancy, lower gastro-intestinal tract	3
Malignancy, upper gastro-intestinal tract	4
Pancreas, disorder of	3
Pilonidal cyst	1
Rectum, disorders of	2
Tumors or cysts, non-malignant	1

6. KIDNEY AND GENITO-URINARY

Bladder, disorder of not listed elsewhere	2
Cystitis	1
Floating Kidney	2
Genito-urinary Stone or Colic	1
Gonorrhoea	1
Kidney, disorder of not listed elsewhere	2
Nephrectomy	2
Nephritis	2
Nephrotomy	2
Prostatitis	2
Pyelitis	1
Testicle, disorder of	2
Transurethral Resection	3
Tumors or Cysts, non-malignant	2
Varicocele, Hydrocele	1

OBSERVATIONS ON THE LATEST REPORTED STOCK INSURANCE COMPANY EXPENSES FOR 1960

BY

FRANK HARWAYNE

The Loss and Expense Ratios booklet published annually by the New York Insurance Department summarizes pertinent figures for all companies and for each line of business. It serves as a handy guide for comparisons among companies and has also been used either directly or indirectly for ascertaining the reasonableness of expense loadings which are used by rating organizations.

If a company's expenses vary by amount of written premiums, then, due to the fact that expense loadings are determined from average experience of the past, there is a possibility that some companies could be charging rates which afford inadequate allowances for expenses. Conceivably, the converse might also be true. To the writer's knowledge, there has nowhere appeared any summary of expenses which compares companies according to size of premium volume written.

Out of curiosity and in order to shed some light on questions raised relative to size of premium, the latest reported insurance company expenses which covers calendar year 1960 experience was compiled according to premium size. First, stock companies listed in the loss and expense ratio booklet for 1959 automobile bodily injury liability was used for each line of business. 1960 experience was compiled separately for various lines of business. The lines of business appear in the following exhibits: Exhibit 1: auto liability (bodily injury); Exhibit 2: auto liability (property damage); Exhibit 3: auto fire, theft, and comprehensive; Exhibit 4: auto collision; Exhibit 5: liability other than auto (bodily injury); Exhibit 6: liability other than auto (property damage); and, Exhibit 7: all lines combined. Each line of business was summarized according to certain expense items related to adjusted direct premiums. The ratio items follow, together with identifying sections of each exhibit:

Section A—General Expenses (related to earned premium)
Section B—Other Acquisition (related to written premium)
Section C—Other Acquisition and General Expense Ratios Combined
Section D—Commission and Brokerage (related to written premium)
Section E—Total Expenses (excluding taxes and loss adjustment)

In the case of all lines of business combined, loss adjustment expenses related to net earned premiums were also summarized, and are shown as Exhibit 7, Section F.

After a preliminary examination of the range of size of premium by company, a reasonable number of class intervals was determined by selecting a size interval and doubling it to obtain the next succeeding interval. The logarithms of the class interval midpoints thus produced are in arithmetic progression. In the case of auto liability (bodily injury), the first premium interval selected was 1 to 2 (million dollars), and the succeeding interval was 2 to 4 (million dollars), etc. For auto liability (property damage) and auto

collision, the first interval selected was one-half that of the one for auto liability (bodily injury); for auto fire, theft, and comprehensive, the first selected interval was one-fourth. For liability other than auto (bodily injury), the selected interval was the same as that for auto liability (property damage). For liability other than auto (property damage), the first interval was one-fourth that for liability other than auto (bodily injury). For all lines combined, the first interval selected was $5 million to $10 million. Leaving out the lowest and highest expense ratio in each size group (except where the number of companies was four or less) a straight arithmetic average was computed. The midpoint of the class was assumed in computing the total average. Comparative total averages are shown on Exhibits 8 and 9.

The various tables of expense ratios mostly show a graduation of expenses as the insurance carrier's premium volume increases. This is best observed in the total expense ratios, Section E, of Exhibits 1-7. In the individual expense items, there appears to be some offset of lower commissions, Section D, by higher other acquisition expense, Section B, and vice versa. In the case of total expenses, Section E, only the net effect is observed.

We next come to the question of how does premium volume affect expenses. We observe auto liability bodily injury, Exhibit 1, and we find the highest group average is 31.96%, or 4.78 percentage points above the total average. For auto liability property damage, Exhibit 2, the comparable figure is 4.74 percentage points above the total average. Considering that rating organizations aim for 5.0% for profit or contingencies, it will be seen that even the smallest "average" company may expect the actual expense and profit allowance to at least cover its actual expenses. This appears also to be true for collision coverage, Exhibit 5, where the group with the highest expense ratio is 5.73 percentage points above that of the total average. For fire, theft and comprehensive coverage, Exhibit 4, the figure is 10.22 percentage points above the average but this may be due to the fact that the interval selected covers companies with $250,000 to $500,000 of premium volume. None of the groups above a million dollars produced average total expense which was as much as 4 percentage points higher than the total average.

For liability other than auto, the comparable figures are 2.89 percentage points (bodily injury), Exhibit 5, and 5.10 percentage points (property damage), Exhibit 6, above the total average.

If the extraordinary Allstate Insurance Group is excluded from the automobile averages of General Expense and Other Acquisition Ratios of Section C, new total averages may be compared with the highest average of any group as follows:

	New Total Average	*Highest Average*	*Difference*
Auto Liability (Bodily Injury)	10.3%	12.2%	1.9%
Auto Liability (Property Damage)	11.0	12.7	1.7
Auto Fire, Theft and Comprehensive	11.7	14.9	3.2
Auto Collision	11.0	13.1	2.1

If commission contracts (negotiated between companies and producers) can be considered apart from general expense and other acquisition expense, the difference between the new total average and the highest average would be less than the 2.5% for profit or contingencies which was used until the early 1950's in the auto liability rate structure and less than the 5.0% built into the auto physical damage rates.

The tables also show the extreme expense ratios and the extent to which these ratios vary from the mean average for the class interval. It is apparent that the allowance for profit or contingencies is not enough to cover the added cost incurred by the least efficient companies.[1] At the same time, it is likewise apparent that present profit or contingencies allowances enable the most efficient carriers to produce such large expense savings as to question whether part of the savings ought not to be passed on to the policyholder.

To the foregoing should be added a note regarding competition. The influence of competition makes itself felt in many ways, and in the writer's view, its effect has been to reduce expense loadings slightly.[2] For example, on auto liability, the rating organization does not use actual production cost which, according to the exhibit, would be 21.1%. Instead, the rates contemplate 20.5% (0.5% for the transfer of certain general expense items to other acquisition when uniform accounting was adopted). In addition, rating organizations base their expense loadings on the experience of their member companies which tends to be somewhat higher than average. Offsetting this, most rating organizations make no formal allowance for reduced premium income which results from the application of premium discount plans.

The application of the method of "quasi-least squares" to the automobile bodily injury liability data may be of some interest. For general, other acquisition and commission expenses combined, the resulting equation is

$$y = .3235 - .03252 \log_{10} P - .00044 (\log_{10} P)^2$$

where y is the expense ratio above described and P is expressed in millions of dollars. Upon dropping the last term, the equation becomes

$$10^y P^{.03252} = 2.1062$$

Similar application to the general and other acquisition expenses combined yields the following formula

$$10^x P^{.01844} = 1.3450$$

where x is the expense ratio as described and P is expressed in millions of dollars.

---

[1] If investment income is recognized as a source of funds, then almost all of the worse than average companies derive sufficient income to offset their higher expenses.

[2] The reduction of general agents commissions from 25% to 20% is a well known recent illustration.

EXHIBIT 1

CALENDAR YEAR 1960 AUTO BODY INJURY LIABILITY EXPENSE RATIOS

No. Cos.	Premium Range (in Millions)	Section A — General Expense Ratios					Section B — Other Acquisition Ratios					Section C — General Expense & Other Acquisition Ratios				
			Extreme Expense Ratios		Extreme Ratios to Mean			Extreme Expense Ratios		Extreme Ratios to Mean			Extreme Expense Ratios		Extreme Ratios to Mean	
		Avg.*	Lowest	Highest	Lowest	Highest	Avg.*	Lowest	Highest	Lowest	Highest	Avg.*	Lowest	Highest	Lowest	Highest
10	1-2	6.63%	2.2%	9.3%	—67%	+40%	5.47%	2.1%	7.6%	—62%	+ 39%	12.08%	4.3%	16.3%	—64%	+35%
14	2-4	6.90	3.5	10.1	—49	+46	4.94	2.2	9.9	—55	+100	12.17	7.1	16.9	—42	+39
14	4-8	6.80	3.7	10.8	—46	+59	4.96	1.6	10.4	—68	+110	11.43	8.0	18.5	—30	+62
11	8-16	6.73	6.1	8.1	— 9	+20	4.02	2.3	6.7	—43	+ 67	10.64	8.4	13.7	—21	+29
9	16-32	5.90	5.1	7.2	—14	+22	3.96	3.1	5.4	—22	+ 36	9.99	8.2	11.8	—18	+18
6	32-64	5.65	4.5	7.0	—20	+24	3.98	2.2	5.7	—45	+ 43	9.88	6.2	13.6	—37	+38
4	64-128	6.00	4.2	6.8	—30	+13	4.10	3.1	5.1	—24	+ 24	10.10	9.3	11.0	— 8	+ 9
1	128-256	5.5	—	—	—	—	9.9	—	—	—	—	15.4	—	—	—	—
	Total..	5.99%					4.96%					11.01%				

No. Cos.	Premium Range (in Millions)	Section D — Commission & Brokerage Ratios					Section E — Total Expense Ratios				
			Extreme Expense Ratios		Extreme Ratios to Mean			Extreme Expense Ratios		Extreme Ratios to Mean	
		Avg.*	Lowest	Highest	Lowest	Highest	Avg.*	Lowest	Highest	Lowest	Highest
10	1-2	19.23%	16.2%	21.0%	—16%	+ 9%	30.34%	21.5%	37.0%	—29%	+22%
14	2-4	19.69	6.6	25.1	—66	+27	31.96	20.8	39.4	—35	+23
14	4-8	20.34	15.3	21.9	—25	+ 8	31.69	21.4	39.0	—32	+23
11	8-16	19.04	17.4	21.7	— 9	+14	29.49	27.2	35.6	— 8	+21
9	16-32	17.57	15.1	19.0	—14	+ 8	27.58	24.7	29.1	—10	+ 6
6	32-64	16.55	14.4	18.8	—13	+14	26.50	23.8	28.7	—10	+ 8
4	64-128	16.53	13.7	18.1	—17	+ 9	26.63	23.0	29.1	—14	+ 9
1	128-256	8.6	—	—	—	—	24.0	—	—	—	—
	Total..	16.18%					27.18%				

* Lowest and highest cos. in all groups except last two have not been included in determination of averages. Total average is average of all cos.

NOTE: Expenses are expressed as ratios to adjusted direct premiums earned except commissions and other acquisition expenses which are expressed as ratios to written.

CALENDAR YEAR 1960 AUTO PROPERTY DAMAGE LIABILITY EXPENSE RATIOS

No. Cos.	Premium Range (in Millions)	Section A — General Expense Ratios					Section B — Other Acquisition Ratios					Section C — General Expense & Other Acquisition Ratios				
			Extreme Expense Ratios		Extreme Ratios to Mean			Extreme Expense Ratios		Extreme Ratios to Mean			Extreme Expense Ratios		Extreme Ratios to Mean	
		Avg.*	Lowest	Highest	Lowest	Highest	Avg.*	Lowest	Highest	Lowest	Highest	Avg.*	Lowest	Highest	Lowest	Highest
5	½-1	5.98%	2.4%	8.8%	—60%	+47%	4.82%	1.9%	8.2%	—61%	+ 70%	11.26%	4.6%	14.6%	—59%	+30%
17	1-2	6.76	2.8	9.7	—59	+43	5.08	1.7	11.1	—67	+119	11.76	5.7	16.7	—52	+42
14	2-4	7.30	4.5	10.2	—38	+40	5.33	2.9	9.0	—46	+ 69	12.66	8.6	19.2	—32	+52
13	4-8	6.75	4.7	8.4	—22	+35	4.42	2.3	6.4	—48	+ 45	11.22	8.2	15.0	—27	+34
8	8-16	6.44	5.0	8.7	—20	+39	4.48	3.3	5.8	—26	+ 29	11.50	9.2	13.9	—20	+21
3	16-32	5.50	3.8	7.0	—31	+27	3.50	2.2	4.7	—37	+ 34	9.00	6.0	10.6	—33	+18
4	32-64	6.55	5.1	7.5	—22	+15	4.33	3.1	5.4	—28	+ 25	10.88	10.1	11.6	— 7	+ 7
1	64-128	5.4	—	—	—	—	9.9	—	—	—	—	15.3	—	—	—	—
	Total	6.31%					5.25%					11.66%				

No. Cos.	Premium Range (in Millions)	Section D — Commission & Brokerage Ratios					Section E — Total Expense Ratios				
			Extreme Expense Ratios		Extreme Ratios to Mean			Extreme Expense Ratios		Extreme Ratios to Mean	
		Avg.*	Lowest	Highest	Lowest	Highest	Avg.*	Lowest	Highest	Lowest	Highest
5	½-1	20.24%	18.0%	21.7%	— 11%	+ 7%	29.74%	21.3%	35.5%	—28%	+19%
17	1-2	21.11	15.8	25.0	— 25	+18	33.09	25.6	40.0	—23	+21
14	2-4	19.91	0.5	23.5	—100	+18	32.61	10.7	40.5	—67	+24
13	4-8	19.05	15.8	21.4	— 17	+12	29.99	26.2	32.1	—13	+ 7
8	8-16	17.89	14.5	20.2	— 19	+13	28.91	23.8	31.7	—18	+10
3	16-32	18.73	16.5	20.0	— 12	+ 7	27.73	25.7	30.4	— 7	+10
4	32-64	17.40	15.5	18.7	— 11	+ 7	28.28	26.0	30.0	— 8	+ 6
1	64-128	8.6	—	—	—	—	23.9	—	—	—	—
	Total..	16.80%					28.35%				

* Lowest and highest cos. in all groups except last three have not been included in determination of averages. Total average is average of all cos.

NOTE: Expenses are expressed as ratios to adjusted direct premiums earned except commissions and other acquisition expenses which are expressed as ratios to written.

CALENDAR YEAR 1960 AUTO PHYSICAL DAMAGE EXPENSE RATIOS

Fire, Theft & Comprehensive

No. Cos.	Premium Range (in Millions)	Section A — General Expense Ratios					Section B — Other Acquisition Ratios					Section C — General Expense & Other Acquisition Ratios				
			Extreme Expense Ratios		Extreme Ratios to Mean			Extreme Expense Ratios		Extreme Ratios to Mean			Extreme Expense Ratios		Extreme Ratios to Mean	
		Avg.*	Lowest	Highest	Lowest	Highest	Avg.*	Lowest	Highest	Lowest	Highest	Avg.*	Lowest	Highest	Lowest	Highest
7	¼-½	9.21%	2.5%	17.9%	—73%	+94%	6.07%	0.9%	11.2%	—99%	+85%	14.91%	6.3%	22.8%	—58%	+53%
10	½-1	8.03	5.4	10.0	—33	+25	6.00	3.8	8.2	—37	+37	14.22	10.8	17.4	—24	+22
19	1-2	7.00	3.6	10.3	—49	+47	4.67	2.0	7.5	—57	+61	11.63	8.6	15.5	—26	+33
17	2-4	6.95	3.7	9.9	—47	+42	4.51	2.0	7.4	—56	+64	11.58	6.9	16.1	—40	+39
8	4-8	6.50	4.7	8.7	—28	+34	4.68	2.4	5.9	—49	+26	11.13	6.9	14.1	—38	+25
4	8-16	6.08	4.3	7.6	—29	+25	4.50	3.1	7.5	—37	+53	10.98	7.7	13.2	—30	+20
3	16-32	6.57	5.4	7.4	—18	+13	5.67	5.1	6.6	—10	+16	12.23	10.7	14.0	—13	+14
1	32-64	5.6	—	—	—	—	9.9	—	—	—	—	15.5	—	—	—	—
	Total...	6.49%					5.72%					12.28%				

No. Cos.	Premium Range (In Millions)	Section D — Commission & Brokerage Ratios					Section E — Total Expense Ratios				
			Extreme Expense Ratios		Extreme Ratios to Mean			Extreme Expense Ratios		Extreme Ratios to Mean	
		Avg.*	Lowest	Highest	Lowest	Highest	Avg.*	Lowest	Highest	Lowest	Highest
7	¼-½	25.64%	21.3%	31.0%	—17%	+21%	42.37%	33.6%	63.2%	—21%	+49%
10	½-1	25.07	24.2	27.9	— 3	+11	39.49	36.1	44.6	— 9	+13
19	1-2	24.42	16.8	27.4	—31	+12	36.12	26.4	42.6	—27	+18
17	2-4	22.95	21.0	27.8	— 8	+21	34.35	28.9	39.1	—16	+14
8	4-8	21.66	16.1	23.9	—26	+10	32.69	26.5	37.0	—19	+13
4	8-16	20.28	17.1	22.2	—16	+ 9	31.25	29.9	33.7	— 4	+ 8
3	16-32	21.23	20.7	22.1	— 2	+ 4	33.47	31.4	34.9	— 6	+ 4
1	32-64	8.6	—	—	—	—	24.1	—	—	—	—
	Total.....	19.88%					32.15%				

* Lowest and highest cos. in all groups except last three have not been included in determination of averages. Total average is average of all cos.

NOTE: Expenses are expressed as ratios to adjusted direct premiums earned except commissions and other acquisition expenses which are expressed as ratios to written.

CALENDAR YEAR 1960 AUTO PHYSICAL DAMAGE EXPENSE RATIOS

Collision

No. Cos.	Premium Range (in Millions)	Section A — General Expense Ratios					Section B — Other Acquisition Ratios					Section C — General Expense & Other Acquisition Ratios				
			Extreme Expense Ratios		Extreme Ratios to Mean			Extreme Expense Ratios		Extreme Ratios to Mean			Extreme Expense Ratios		Extreme Ratios to Mean	
		Avg.*	Lowest	Highest	Lowest	Highest	Avg.*	Lowest	Highest	Lowest	Highest	Avg.*	Lowest	Highest	Lowest	Highest
11	½-1	7.27%	2.1%	14.1%	—71%	+94%	5.95%	0.9%	12.4%	—98%	+108%	13.08%	6.8%	21.1%	—48%	+61%
11	1-2	7.52	5.0	11.8	—34	+57	4.35	2.7	6.2	—38	+ 43	12.18	7.7	16.1	—37	+32
21	2-4	6.88	4.3	10.1	—37	+47	4.80	2.6	7.6	—46	+ 58	11.72	8.5	17.3	—27	+48
11	4-8	6.38	4.7	7.8	—26	+22	4.21	1.4	6.3	—67	+ 50	10.47	6.7	12.6	—36	+20
9	8-16	5.69	4.0	7.2	—30	+27	4.61	2.4	5.8	—48	+ 26	10.69	6.9	13.5	—35	+26
2	16-32	5.55	4.2	6.9	—24	+24	3.25	3.1	3.4	— 5	+ 5	8.80	7.6	10.0	—14	+14
3	32-64	5.97	4.1	7.3	—31	+22	5.63	4.9	6.5	—13	+ 15	11.60	9.6	13.8	—17	+19
1	64-128	5.5	—	—	—	—	9.9	—	—	—	—	15.4	—	—	—	—
	Total...	6.02%					5.67%					11.76%				

No. Cos.	Premium Range (in Millions)	Section D — Commission & Brokerage Ratios					Section E — Total Expense Ratios				
			Extreme Expense Ratios		Extreme Ratios to Mean			Extreme Expense Ratios		Extreme Ratios to Mean	
		Avg.*	Lowest	Highest	Lowest	Highest	Avg.*	Lowest	Highest	Lowest	Highest
11	½-1	23.55%	13.0%	28.1%	—45%	+19%	36.11%	27.7%	43.2%	—23%	+20%
11	1-2	24.85	22.3	30.3	—10	+22	36.98	35.3	39.7	— 5	+ 7
21	2-4	23.99	20.6	25.7	—14	+ 7	35.73	31.5	43.0	—12	+20
11	4-8	21.62	16.9	23.5	—22	+ 9	32.40	26.6	37.7	—18	+16
9	8-16	20.86	16.4	23.9	—21	+15	31.62	26.8	34.4	—15	+ 9
2	16-32	21.75	21.3	22.2	— 2	+ 2	30.55	29.8	31.3	— 2	+ 2
3	32-64	21.03	20.3	22.1	— 3	+ 5	32.63	29.9	34.5	— 8	+ 6
1	64-128	8.6	—	—	—	—	24.0	—	—	—	—
	Total..	19.45%					31.25%				

* Lowest and highest cos. in all groups except last three have not been included in determination of averages. Total average is average of all cos.

NOTE: Expenses are expressed as ratios to adjusted direct premiums earned except commissions and other acquisition expenses which are expressed as ratios to written.

CALENDAR YEAR 1960 BODILY INJURY LIABILITY OTHER THEN AUTO EXPENSE RATIOS

No. Cos.	Premium Range (in Millions)	Section A — General Expense Ratios					Section B — Other Acquisition Ratios					Section C — General Expense & Other Acquisition Ratios				
		Avg.*	Extreme Expense Ratios		Extreme Ratios to Mean		Avg.*	Extreme Expense Ratios		Extreme Ratios to Mean		Avg.*	Extreme Expense Ratios		Extreme Ratios to Mean	
			Lowest	Highest	Lowest	Highest		Lowest	Highest	Lowest	Highest		Lowest	Highest	Lowest	Highest
9	½-1	8.80%	4.3%	13.5%	—51%	+53%	4.68%	2.8%	7.2%	—40%	+54%	14.20%	9.8%	19.9%	—31%	+40%
14	1-2	9.27	6.0	12.2	—35	+32	6.09	2.3	12.6	—62	+107	15.76	10.2	24.0	—35	+52
10	2-4	9.49	5.7	12.9	—40	+36	5.55	3.8	6.9	—32	+24	14.44	9.5	18.7	—36	+26
8	4-8	10.95	7.8	13.6	—29	+24	4.34	3.7	6.4	—14	+47	15.23	12.5	17.6	—19	+15
9	8-16	11.49	9.6	14.0	—16	+22	4.83	2.7	7.6	—44	+57	16.34	13.3	19.0	—19	+16
3	16-32	9.97	8.0	11.9	—20	+19	4.17	4.0	4.4	— 4	+ 6	14.30	12.2	16.8	—15	+17
3	32-64	11.07	10.3	11.9	— 7	+ 7	4.60	3.6	5.2	—22	+13	16.10	15.5	16.8	— 4	+ 4
	Total..	10.74%					4.70%					15.60%				

No. Cos.	Premium Range (in Millions)	Section D — Commission & Brokerage Ratios					Section E — Total Expense Ratios				
		Avg.*	Extreme Expense Ratios		Extreme Ratios to Mean		Avg.*	Extreme Expense Ratios		Extreme Ratios to Mean	
			Lowest	Highest	Lowest	Highest		Lowest	Highest	Lowest	Highest
9	½-1	22.48%	17.8%	30.7%	—21%	+37%	36.71%	27.9%	43.3%	—24%	+18%
14	1-2	23.46	19.4	26.7	—17	+14	39.09	27.8	49.4	—29	+26
10	2-4	23.49	22.0	25.3	— 6	+ 8	38.04	31.5	42.8	—17	+13
8	4-8	21.00	16.2	24.4	—24	+16	36.43	30.5	41.1	—16	+13
9	8-16	21.86	19.1	23.4	—13	+ 7	38.32	33.8	41.7	—12	+ 9
3	16-32	20.63	19.4	22.3	— 6	+ 8	36.00	34.8	37.0	— 3	+ 3
3	32-64	18.43	16.2	20.0	—12	+ 9	33.80	32.9	35.5	— 3	+ 5
	Total	20.61%					36.20%				

* Lowest and highest cos. in all groups have not been included in determination of averages. Total average is average of all cos.

NOTE: Expenses are expressed as ratios to adjusted direct premiums earned except commissions and other acquisition expenses which are expressed as ratios to written.

CALENDAR YEAR 1960 PROPERTY DAMAGE LIABILITY OTHER AUTO EXPENSE RATIOS

No. Cos.	Premium Range (in Millions)	Section A — General Expense Ratios					Section B — Other Acquisition Ratios					Section C — General Expense & Other Acquisition Ratios				
			Extreme Expense Ratios		Extreme Ratios to Mean			Extreme Expense Ratios		Extreme Ratios to Mean			Extreme Expense Ratios		Extreme Ratios to Mean	
		Avg.*	Lowest	Highest	Lowest	Highest	Avg.*	Lowest	Highest	Lowest	Highest	Avg.*	Lowest	Highest	Lowest	Highest
6	⅛-¼	8.83%	2.7%	11.8%	—69%	+34%	5.75%	2.4%	9.1%	—58%	+58%	15.32%	11.7%	19.6%	—24%	+28%
11	¼-½	10.05	6.3	14.1	—37	+40	6.17	2.8	9.8	—55	+59	16.29	9.6	23.9	—41	+47
9	½-1	9.81	5.2	15.3	—47	+56	5.52	3.1	7.8	—44	+41	15.14	10.3	21.1	—32	+39
10	1-2	12.96	9.9	17.0	—24	+31	4.46	2.5	6.7	—44	+50	17.32	12.6	23.2	—27	+34
6	2-4	11.45	8.6	12.8	—25	+12	4.87	3.4	6.1	—30	+25	16.65	13.5	18.7	—19	+12
2	4-8	9.70	7.7	11.7	—21	+21	3.75	3.1	4.4	—17	+17	13.45	10.8	16.1	—20	+20
4	8-16	11.98	10.6	13.5	—12	+13	6.15	5.4	7.0	—12	+14	17.25	15.1	19.3	—12	+12
	Total..	11.52%					5.37%					16.53%				

No. Cos.	Premium Range (in Millions)	Section D — Commission & Brokerage Ratios					Section E — Total Expense Ratios				
			Extreme Expense Ratios		Extreme Ratios to Mean			Extreme Expense Ratios		Extreme Ratios to Mean	
		Avg.*	Lowest	Highest	Lowest	Highest	Avg.*	Lowest	Highest	Lowest	Highest
6	⅛-¼	26.08%	23.9%	28.4%	—8%	+9%	42.10%	36.1%	51.7%	—14%	+23%
11	¼-½	23.14	18.7	28.1	—19	+21	39.17	31.0	45.0	—21	+15
9	½-1	19.16	0.1	25.6	—100	+34	34.28	14.1	43.2	—59	+26
10	1-2	22.54	20.7	24.8	—8	+10	40.23	35.5	43.9	—12	+ 9
6	2-4	21.98	19.9	24.0	—9	+9	38.18	34.9	41.9	— 9	+10
2	4-8	20.15	16.8	23.5	—17	+17	33.60	27.6	39.6	—18	+18
4	8-16	19.78	18.0	20.9	—9	+6	36.48	33.4	38.9	— 8	+ 7
	Total..	20.75%					37.00%				

* Lowest and highest cos. in all groups have not been included in determination of averages except 4-8 range. In 4-8 range there are only two companies. Total average is average of all cos.

NOTE: Expenses are expressed as ratios to adjusted direct premiums earned except commissions and other acquisition expenses which are expressed as ratios to written.

CALENDAR YEAR 1960 EXPENSE RATIOS
All Lines of Business

No. Cos.	Premium Range (in Millions)	Section A — General Expense Ratios					Section B — Other Acquisition Ratios					Section C — General Expense & Other Acquisition Ratios				
			Extreme Expense Ratios		Extreme Ratios to Mean			Extreme Expense Ratios		Extreme Ratios to Mean			Extreme Expense Ratios		Extreme Ratios to Mean	
		Avg.*	Lowest	Highest	Lowest	Highest	Avg.*	Lowest	Highest	Lowest	Highest	Avg.*	Lowest	Highest	Lowest	Highest
14	5-10	6.23%	0.8%	8.8%	—99%	+41%	3.21%	0.7%	6.6%	—98%	+106%	9.58%	1.1%	13.3%	—89%	+39%
12	10-20	5.63	3.2	7.9	—43	+40	4.64	1.0	10.1	—78	+118	10.81	6.9	15.8	—36	+46
22	20-40	6.72	4.1	9.5	—40	+40	4.09	1.6	5.6	—61	+ 37	10.77	5.9	15.3	—45	+42
18	40-80	7.39	5.1	10.0	—31	+35	5.23	2.9	7.3	—45	+ 40	12.63	10.6	17.1	—16	+35
8	80-160	8.33	6.9	9.0	—17	+ 8	4.46	2.7	6.3	—39	+ 41	13.05	11.1	14.3	—15	+10
9	160-320	7.43	4.7	8.9	—37	+20	5.20	4.2	6.9	—19	+ 33	12.63	10.2	14.5	—19	+15
3	320-640	6.77	5.5	8.1	—19	+20	5.37	3.6	6.7	—33	+ 25	11.77	8.0	13.9	—32	+18
	Total.	7.27%					4.98%					12.22%				

No. Cos.	Premium Range (in Millions)	Section D — Commission & Brokerage Ratios					Section E — Total Expense Ratios					Section F — Loss Adjustment Expense Ratios				
			Extreme Expense Ratios		Extreme Ratios to Mean			Extreme Expense Ratios		Extreme Ratios to Mean			Extreme Expense Ratios		Extreme Ratios to Mean	
		Avg.*	Lowest	Highest	Lowest	Highest	Avg.*	Lowest	Highest	Lowest	Highest	Avg.*	Lowest	Highest	Lowest	Highest
14	5-10	22.77%	16.0%	32.7%	—30%	+44%	32.32%	24.8%	39.0%	—23%	+21%	8.93%	5.8%	12.1%	—35%	+35%
12	10-20	26.25	19.0	30.9	—28	+18	37.19	30.3	43.4	—19	+17	8.08	5.7	11.5	—29	+42
22	20-40	24.18	—	28.0	—100	+16	34.99	9.1	40.7	—74	+16	8.34	5.8	10.9	—30	+31
18	40-80	22.33	12.7	26.0	—43	+16	35.05	24.7	41.3	—30	+18	9.08	6.9	13.1	—24	+44
8	80-160	21.40	19.8	24.0	— 7	+12	33.95	30.5	39.0	—10	+15	8.58	6.8	10.1	—21	+18
9	160-320	19.94	15.4	22.7	—23	+14	32.58	25.6	35.9	—21	+10	7.90	6.8	9.6	—14	+22
3	320-640	15.43	8.5	19.1	—45	+24	29.17	23.7	32.5	—19	+11	8.00	6.1	9.5	—24	+19
	Total...	20.20%					32.80%					8.29%				

* Lowest and highest cos. in all groups have not been included in determination of averages. Total average is average of all cos.

NOTE: Loss adjustment expenses are expressed as ratios to net premiums earned. Other expenses are expressed as ratios to adjusted direct premiums earned except commissions and other acquisition expenses which are expressed as ratios to written.

EXHIBIT 8

CALENDAR YEAR 1960 AVERAGE EXPENSE RATIOS

By Lines of Business

Auto Liability	*B.I. Total*	*P.D. Total*
General Expense Ratio	6.0%	6.3%
Other Acquisition Ratio	5.0	5.3
Commission & Brokerage Ratio	16.2	16.8
General & Other Acquisition Ratio	11.0	11.7
Total Expense Ratio	27.2	28.4

Auto Physical Damage	*Fire, Theft & Comp. Total*	*Collision Total*
General Expense Ratio	6.5%	6.0%
Other Acquisition Ratio	5.7	5.7
Commission & Brokerage Ratio	19.9	19.5
General & Other Acquisition Ratio	12.3	11.8
Total Expense Ratio	32.1	31.3

Liability Other Than Auto	*B.I. Total*	*P.D. Total*
General Expense Ratio	10.7%	11.5%
Other Acquisition Ratio	4.7	5.4
Commission & Brokerage Ratio	20.6	20.8
General & Other Acquisition Ratio	15.6	16.5
Total Expense Ratio	36.2	37.0

EXHIBIT 9

CALENDAR YEAR 1960 AVERAGE EXPENSE RATIOS
All Lines of Business

All Lines of Business	*Total*
Loss Adjustment Expense Ratio	8.3%
General Expense Ratio	7.3
Other Acquisition Ratio	5.0
Commission & Brokerage Ratio	20.2
General & Other Acquisition Ratio	12.2
*Total Expense Ratio	32.8

* Not including loss adjustment expense ratio.

PATTERNS OF SERIOUS ILLNESS INSURANCE

BY

MARK KORMES

1. *Introduction*

Several years ago I presented to the Society a paper describing the coverage and the methods of rate calculation for Prolonged Illness Insurance[1] developed by the Massachusetts Hospital Service, Inc. and the Massachusetts Medical Service.

About two years later there was introduced by these organizations a plan of coverage designated as Master Medical coverage. This plan in its current form is a single contract issued by both organizations which provides an unlimited period of hospital coverage with a specified room and board allowance and the entire amount of the hospital's maximum charges for included services in other than private accommodations in a licensed general, maternity or acute contagious disease hospital, and sixty days in a licensed mental hospital. Services of a private duty nurse are covered when ordered by attending physicians at 80% of customary charges with a limit of $1,000 for conditions other than serious illnesses. Following discharge from the hospital, benefits for specific prolonged illness conditions are covered in full except for transportation, services of a registered nurse and purchase of appliances where 80% of the charges is paid. For other than prolonged illness, benefits are provided on an out-patient basis except that for certain services there is a $25 deductible in each calendar quarter. Coverage for room and board in a licensed nursing home is limited to $8 per diem. Regular obstetrical delivery is limited to $100 for hospital benefits. Caesarian section or serious complications of delivery are treated as any other illness. Medical services are covered in accordance with Schedule B of fees ($500) and no further liability for service accrues to individual members with an annual income of $5,000 or less, two persons with income up to $6,000 and three or more persons with an income of $7,500 during the twelve months preceding the services rendered. For those members whose annual income exceeds the above limits, either the Fee Schedule, or 80% of charges customarily made by physicians and dentists in the community to patients of similar income status, whichever is greater, is allowed. Oral surgical benefits are provided for the excision of impacted teeth or extraction of seven or more teeth. Diagnostic X-Rays in a physician's office are covered to the extent of 50% (minimum member's responsibility is $15) either of the Fee Schedule or, for over-limit income members, of customary charges in the community. The rates for Master Medical coverage were set approximately 50% higher than those for Prolonged Illness insurance.

It may be readily seen from the above description that the Master Medical coverage is similar to many Major Medical plans written by insurance companies.

The purpose of this paper is to present the experience over a period of years under these coverages and several analyses of the cost elements which would be of general interest to the profession.

[1] CAS XLI, p. 102.

In the Transactions of the Society of Actuaries there appeared a paper by Charles A. Siegfried[2] which presents various analyses of claim distributions for a major medical plan with the first $25 deductible, the next $225 in full and 85% of excess. A comparison of the results will show that there are substantial differences which arise from the fact that the subject matter of this paper relates to the "excess" coverages.

I wish to express my sincere appreciation to the management of the Massachusetts Hospital Service, Inc. and the Massachusetts Medical Service for their kind permission to use the information and to the staff of both organizations for the preparation of the many tabulations of data which were required for this paper.

2. *Over-All Experience*

In Table I there is shown the total experience for each of the coverages since inception up to and including policy year 1960.

It may be seen from Table I that the experience under the Prolonged Illness coverage is very favorable. This is due in part to the change in the basic coverage where the extension of days of coverage from 60 full and 60 partial in-hospital days to 120 full days was made effective July 1, 1957. The complete review of the experience was made for the first time in 1960 and as a result the rates have been reduced by 15% and a slightly restricted coverage was offered to direct (non-group) subscribers on a health statement (warranty) basis.

Because of the upward trend in the Master Medical experience a revision of rates did not appear warranted at that time.

The well-known fact that a considerable period of time is required for the development of losses to their ultimate cost may be seen from the fact that even the earliest years still have loss reserves. The development of losses paid shown in Table II further illustrate this fact:

TABLE II

PAID LOSSES AS PERCENTAGE OF THE ULTIMATE ESTIMATED INCURRED COST

Cal. Year	*Paid at 3/31*	*Prolonged Illness*	*Master Medical*
1956	1957	38.5%	—
	1958	70.2	—
	1959	80.6	—
	1960	85.1	—
	1961	89.3	—
1957	1958	43.4	33.2%
	1959	65.2	68.6
	1960	75.6	82.1
	1961	83.1	92.3
1958	1959	47.0%	39.4%
	1960	69.8	67.7
	1961	79.7	84.3
1959	1960	39.8	42.0
	1961	61.5	66.7
1960	1961	28.3	34.9

[2] Some Considerations Involved in the Analysis of Major Medical Insurance Experience", Transactions, Vol. X, 1958, p. 505.

Table II indicates that the paid losses develop in a more or less similar pattern. The low percentages for the year 1960 are the result of a rather conservative method of setting up of reserves at the early stages of the experience. The pattern of loss development was utilized in the determination of the incurred and unreported liabilities.

The data in Table I indicate that the losses paid constitute the following percentages of the estimated ultimate incurred cost:

Year	*Prolonged Illness*	*Master Medical*
1955	91.0%	—
1956	89.2	100.0%
1957	83.1	92.3
1958	79.7	84.3
1959	61.5	66.7
1960	28.3	34.9

The higher ratio of paid claims to ultimate cost for Master Medical can be explained by the larger percentage of small claims (where payments occur at early stages of the illness) which do not arise under Prolonged Illness coverage.

In some of the following sections the analyses presented are based on the paid experience for the years 1956 to 1960 for Prolonged Illness and 1957 to 1960 for Master Medical. The inclusion of policy year 1960 was made solely for comparative purposes of certain elements where the trend is of significance.

Because of the fact that some confusion existed in the count of claims, the analyses presented are based on the distribution of paid cost rather than the number of claims. Since many elements of cost reflect a rising trend of charges for services the pure trend of incidence is obscured, but from the distribution it is still possible to discern just what elements are on the rise in relative importance.

3. *Cost of Medical Services*

The ratio of the cost of services of physicians and surgeons to the total cost is of interest. In Table III there is shown the proportion of the cost of medical services to the total cost based on paid claims plus reserves for known outstanding claims.

TABLE III

RATIO OF MEDICAL COST TO TOTAL COST

	Prolonged Illness			*Master Medical*		
Cal. Year	*Individual Contracts*	*Family Contracts*	*All Contracts*	*Individual Contracts*	*Family Contracts*	*All Contracts*
1956	.277	.352	.332	*	*	*
1957	.264	.310	.299	.333	.248	.256
1958	.242	.285	.275	.331	.291	.297
1959	.248	.284	.277	.257	.289	.285
1960	.281	.301	.296	.264	.272	.271

* Volume insignificant.

The rate structure is based on an assumption that the medical cost is approximately 26% of the total cost and this assumption is well borne out by the above experience indications.

4. *Analysis by Location of Service*

Table IV gives the distribution of losses paid by the location where the service is rendered. The distributions for Prolonged Illness and Master Medical differ as would be expected. Prolonged Illness is superimposed on contracts with various allowances for room and board and additional benefits accrue only for specific illnesses in the hospital, doctor's office and at home. It is for these reasons that relatively larger percentages are shown for these elements under Master Medical coverage. It should be borne in mind in this connection that the payments for costs incurred at doctor's office or patient's home are made towards the end of the disease and that, therefore, in the ultimate cost distribution the percentages for these elements will be relatively higher for the years 1958, 1959 and 1960.

Both distributions show a substantial upward trend in costs incurred in Mental Hospitals. This is due in part to the limitation of 30 days in the basic contract, in part to the successful application of electric or insulin shock treatments to cases which would otherwise be confined to an institution, and possibly to a rise in actual incidence as a result of increasing tensions stemming from the pressures and tempo of modern life.

5. *Analysis by Type of Service*

The difference between the Prolonged Illness and Master Medical coverages is also very marked when we analyze them by Type of Service as shown in Table V. Because of a rather large number of detail codes only two years have been summarized. Since the results are very similar for each kind of coverage by itself, the comparison as between coverages is sufficiently indicative.

It is seen from Table V that between 64.7% and 75.0% of the total cost of Master Medical is due to charges for surgeons, nurses and drugs or medicines, while for Prolonged Illness these services account for only 31.7% to 44.4% of the total cost.

6. *Analysis by Diagnosis*

This analysis is predicated on known incurred cost as of March 31, 1961 and is shown for the years 1958 and 1959 in Table VI.

Here again we see that the so-called dread diseases account for only between 53.6% and 61.5% of total Master Medical cost, the balance representing additional benefits for ordinary illnesses.

7. *Distribution by Size of Claim*

In order to arrive at a satisfactory size of loss distribution the following procedure was adopted: All paid and known outstanding claim punched cards were sorted by claim number and summary punched cards showing

total cost were obtained. These summary punched cards were then sorted on the "amount of loss" field to obtain the various loss sizes. This was done for the experience of 1958 and 1959 incurred as of March 31, 1960. The results are shown in Table VII in intervals of $25 up to $100, $50 up to $300, $100 up to $600 etc.

From Table VII it is quite apparent that the size distributions do not follow any regular pattern and that there are significant bunchings of claims in size groups $250.01 to $300.00 and $800.01 to $1,500.00, both for Prolonged Illness and Master Medical coverages. This is most probably due to certain types of more frequent serious illnesses for which the costs fall into the above ranges.

The total incurred costs as of March 31, 1960 are somewhat higher than those as of March 31, 1961 which is due to a conservative method of setting up reserves.

It should be noted that the Prolonged Illness coverage has a maximum limit of $5,000 (with the exception of one risk). While the Master Medical coverage has a limit of $15,000, there were no claims in excess of $10,000. Whether this is significant only time and more years of experience will give a satisfactory answer.

The data in Table VII permit the calculation of savings for certain deductible provisions or corridors. It may be found readily that a 15% reduction of cost may be realized on Master Medical with a $75 deductible but for Prolonged Illness $100 deductible is required for a similar saving. This is in line with the higher average claim cost for Prolonged Illness coverage.

8. *Claim Incidence*

As stated before, the analysis of the experience as respects the number of claims was not possible in most instances. The only reliable claim count was established in the course of preparation of the data for Table VII. These claims permit the calculation of the claim incidence for the years 1958 and 1959 for each of the coverages which give the following results:

Claim Incidence Per 1000 Contract Months

Policy Year	*Prolonged Illness*		*Master Medical*	
	Individual	*Family*	*Individual*	*Family*
1958	.695	1.443	3.665	10.649
1959	.669	1.482	3.494	8.695

Since the data are as of March 31, 1960, the number of incurred but unreported claims for the year 1959 is greater than that for the year 1958 so that the ultimate incidence for 1959 will be most probably equal or even higher than that for 1958.

The much higher incidence on Master Medical is primarily due to small claims. We find from Table VII that claims under $100.01 account for

43.4% to 64.8% of all claims for Master Medical while for Prolonged Illness they account for only 20.2% to 38.1% of total claims.

9. *Concluding Remarks*

The material presented in this paper not only brings out the difference between two types of excess plans but also as between individual and family contracts. The author hopes that further results will be presented in the future based on fully developed experience and several additional years to permit of a better evaluation of the cost of these coverages.

In general, the results of this paper appear to justify the social value of the Prolonged Illness coverage designed to mitigate the impact of serious and costly diseases. The Master Medical coverage introduced more or less for competitive reasons appears to add benefits primarily for services of physicians and nurses, and for drugs or medicines. Further study should be made whether these additional services are of sufficient impact on the budget of the average purchaser of this coverage or whether they benefit only a small segment of the insured population.

The claim incidence and the average cost indications for individual and family contracts produce pure premiums which are in line with the rate relativity for these classes of contracts.

TABLE I

EXPERIENCE FOR POLICY YEARS 1954—1960

As of March 31, 1961

Policy Year	*Earned Premiums*	*Losses Paid*	*Losses Outstanding*	*Losses Incurred But Unreported*	*Total Losses Incurred*	*Loss Ratio*
			Prolonged Illness			
1955*	$ 927,219	$ 163,412	$ 16,140	$ —	$ 179,552	19.4%
1956	2,230,425	391,593	47,275	—	438,868	19.7
1957	3,067,953	682,347	139,235	—	821,582	26.8
1958	3,708,339	994,568	253,099	—	1,247,667	33.6
1959	4,323,834	1,174,183	702,030	33,459	1,909,675	44.2
1960	4,816,329	1,021,054	2,109,337	474,295	3,604,686	74.2
			Master Medical			
1956	$ 732	$ 1,063	$ —	$ —	$ 1,063	145.2%
1957	71,630	38,509	3,223	—	41,732	58.3
1958	309,848	206,919	38,629	—	245,548	79.2
1959	927,633	525,713	184,533	78,243	788,489	85.0
1960	1,559,415	484,359	769,190	133,205	1,386,754	88.9

* Includes October to December of 1954.

TABLE IV
DISTRIBUTION OF PAID AMOUNTS BY LOCATION

Location of Service	Individual Contracts					Family Contracts				
	1956	1957	1958	1959	1960	1956	1957	1958	1959	1960
Prolonged Illness										
General Hospital										
In-Patient	36.8%	34.0%	25.9%	31.4%	26.0%	41.0%	37.2%	29.6%	27.5%	34.4%
Out-Patient	1.4	1.8	1.2	1.2	1.6	3.4	2.4	2.8	2.1	2.0
Mental Hospital										
In-Patient	13.3	18.1	28.5	32.4	40.7	11.7	14.5	23.7	25.9	28.0
Out-Patient	2.1	1.7	3.5	3.8	5.7	2.5	3.2	4.3	6.7	5.1
Nursing Home	22.9	11.6	16.0	13.2	8.5	5.1	3.8	2.5	6.0	3.3
Chronic Disease Hospital	.7	10.3	4.7	3.6	3.5	2.8	4.7	6.0	7.4	5.8
Doctor's Office	8.5	6.7	8.5	6.4	6.4	10.6	12.5	11.3	10.4	9.9
Patient's Home	14.3	15.8	11.7	8.0	7.6	22.9	21.7	19.8	14.0	11.5
	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Master Medical										
General Hospital										
In-Patient		14.0%	34.4%	45.7%	43.2%		41.9%	44.3%	48.9%	51.0%
Out-Patient		—	1.3	1.3	.9		1.6	2.2	1.7	1.8
Mental Hospital										
In-Patient		1.5	6.8	13.7	17.4		5.4	12.1	11.8	14.1
Out-Patient		—	.1	.9	2.3		.3	2.6	1.7	1.9
Nursing Home		1.4	9.7	.6	7.7		—	.2	2.0	.8
Chronic Disease Hospital		—	2.9	3.7	4.0		.2	.1	3.0	1.4
Doctor's Office		36.1	13.0	15.3	14.0		15.4	15.6	14.1	14.3
Patient's Home		47.0	31.8	18.8	10.5		35.2	22.9	16.8	14.7
		100.0%	100.0%	100.0%	100.0%		100.0%	100.0%	100.0%	100.0%

TABLE V
ANALYSIS OF PAID CLAIMS BY TYPE OF SERVICE

	Prolonged Illness				*Master Medical*			
	1958		*1959*		*1958*		*1959*	
Type of Service	*Individual*	*Family*	*Individual*	*Family*	*Individual*	*Family*	*Individual*	*Family*
Physician—								
Medical	5.8%	3.0%	3.7%	2.6%	2.5%	2.0%	2.1%	1.5%
Surgical	8.1	11.6	6.9	8.7	26.3	20.9	19.5	22.4
Shock Treatment	8.8	9.1	11.0	12.0	1.8	4.1	1.9	2.7
Miscellaneous	.7	2.0	.7	1.1	1.7	1.5	.9	1.4
Room and Board	34.0	22.3	33.5	27.3	12.1	12.6	21.3	11.5
Reg. or Vis. Nurse	18.4	23.6	23.8	24.0	29.3	32.6	37.5	42.3
Physiotherapy	2.8	3.1	2.5	2.2	2.7	1.1	.9	1.0
X-Rays	.5	.8	.6	.7	1.2	.9	.7	.5
Drugs	5.2	9.2	4.2	7.7	17.1	17.2	7.7	10.3
Ancillaries	14.2	12.9	11.4	11.4	4.1	5.6	5.4	4.9
Prosthetics & Appliances	1.3	1.9	.7	1.5	.3	.3	.3	.5
Other	.2	.5	1.0	.8	.9	1.2	1.8	1.0
Totals	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

TABLE VI
ANALYSIS BY DIAGNOSIS OF DISEASE
(Paid Claims Plus Reserves For Known Outstanding)

	Prolonged Illness				*Master Medical*			
	1958		*1959*		*1958*		*1959*	
	Individual	*Family*	*Individual*	*Family*	*Individual*	*Family*	*Individual*	*Family*
Polio	—%	.5%	.7%	1.7%	—%	.1%	—%	—%
Cancer	18.8	14.4	16.8	11.8	31.1	13.0	7.6	10.3
Cerebral Hemorrhage, Embolism or Thrombosis	8.8	8.9	12.8	7.7	1.6	5.7	7.9	4.7
Coronary Emb. or Throm.	8.0	18.0	10.6	17.4	9.2	8.1	9.7	9.1
Rheumatic Fever or Chorea	1.4	3.8	—	7.8	—	—	—	4.9
Congestive Heart Failure	4.3	3.6	3.7	1.6	3.0	1.0	2.4	4.6
Active Pulmonary TB	2.2	2.8	1.5	2.6	1.0	—	.1	.7
Ulcerative Colitis & Regional Enteritis	.4	.9	—	.8	—	4.6	—	.7
Cirrhosis of Liver & Chronic Nephritis	1.8	1.9	.1	3.3	—	.3	4.0	.1
Fractures	7.0	5.9	6.7	4.5	10.2	4.6	11.8	5.7
Amputations	6.6	.5	.2	1.2	—	1.0	—	.7
Mental & Nervous	30.9	23.8	31.7	23.9	5.4	15.2	12.1	12.9
All Other	9.8	15.0	15.2	15.7	38.5	46.4	44.4	45.6
	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

TABLE VII

Part 1.

DISTRIBUTION BY SIZE OF CLAIM
(Incurred as of March 31, 1960)

Prolonged Illness

Size of Claim	1958				1959			
	Individual		*Family*		*Individual*		*Family*	
	No.	*Amount*	*No.*	*Amount*	*No.*	*Amount*	*No.*	*Amount*
Up to - $ 25.00	72	$ 964	345	$ 4,642	44	$ 589	214	$ 2,960
$ 25.01- 50.00	48	1,905	200	7,723	33	1,276	159	5,994
50.01- 75.00	52	3,401	163	10,347	27	1,797	104	6,767
75.01- 100.00	46	4,173	119	10,508	28	2,462	95	8,340
100.01- 150.00	43	5,278	199	24,843	39	5,020	174	21,944
150.01- 200.00	47	8,063	109	18,789	23	4,031	93	16,061
200.01- 250.00	32	7,245	107	23,955	28	6,419	91	20,154
250.01- 300.00	53	15,358	199	57,887	103	30,146	336	98,526
300.01- 400.00	19	6,784	94	33,141	10	3,341	43	14,831
400.01- 500.00	26	11,677	67	30,371	37	18,344	141	69,622
500.01- 600.00	11	6,082	39	21,677	9	5,227	28	15,374
600.01- 800.00	20	14,074	68	48,291	10	7,081	42	29,915
800.01- 1,000.00	41	38,876	116	111,206	156	154,892	529	525,375
1,000.01- 1,500.00	41	52,769	221	282,834	78	100,638	378	486,857
1,500.01- 2,000.00	10	17,280	35	63,307	9	15,527	41	70,256
2,000.01- 3,000.00	11	26,679	39	97,681	15	35,920	77	193,879
3,000.01- 5,000.00	12	50,887	39	158,700	5	18,250	66	273,450
5,000.01- 7,500.00	1	7,050	7	41,800	—	—	—	—
7,500.01- 10,000.00	1	7,800	2	16,047	—	—	—	—
Totals	586	$286,345	2,168	$1,063,749	654	$410,960	2,611	$1,860,305

TABLE VII

Part 2.

DISTRIBUTION BY SIZE OF CLAIM
(Incurred as of March 31, 1960)

Master Medical

Size of Claim	1958				1959			
	Individual		*Family*		*Individual*		*Family*	
	No.	*Amount*	*No.*	*Amount*	*No.*	*Amount*	*No.*	*Amount*
Up to - $ 25.00	27	$ 385	230	$ 3,189	74	$ 943	428	$ 5,503
$ 25.01- 50.00	27	1,007	157	5,956	44	1,533	217	7,834
50.01- 75.00	8	473	78	4,811	13	785	101	6,167
75.01- 100.00	8	703	31	2,723	12	1,016	79	6,883
100.01- 150.00	12	1,412	54	6,361	12	1,457	87	10,560
150.01- 200.00	3	489	24	4,100	2	352	45	7,813
200.01- 250.00	3	665	19	4,207	6	1,279	28	6,289
250.01- 300.00	13	3,790	56	16,222	86	25,790	536	159,226
300.01- 400.00	1	384	17	5,942	7	2,315	29	10,131
400.01- 500.00	1	444	14	6,560	9	4,428	52	24,843
500.01- 600.00	—	—	7	3,907	3	1,617	15	8,222
600.01- 800.00	3	2,119	15	10,869	2	1,500	18	13,057
800.01- 1,000.00	7	6,701	20	18,640	14	13,447	121	118,849
1,000.01- 1,500.00	6	7,243	26	33,820	17	20,859	83	106,475
1,500.01- 2,000.00	1	1,745	5	9,150	2	3,700	29	51,261
2,000.01- 3,000.00	1	2,500	7	17,125	3	7,350	14	34,535
3,000.01- 5,000.00	1	3,900	4	16,322	2	6,750	16	63,800
5,000.01- 7,500.00	2	14,850	1	5,078	1	5,842	4	23,500
7,500.01- 10,000.00	—	—	1	9,900	—	—	1	8,500
Totals	124	$48,810	766	$184,882	309	$100,963	1,903	$675,448

MATHEMATICAL LIMITS TO THE JUDGMENT FACTOR IN FIRE SCHEDULE RATING

BY

KENNETH L. MCINTOSH

INTRODUCTION

E. G. Richards has stated: "* * * if *experience* is to measure fire insurance costs, it will show that the rate upon a specific risk should be the same as the average rate of its class * * *"[1]. Mr. Richards continues to the effect: "By the [schedule rating] method the charge or credit for each separate part or use of a risk is of necessity theoretical, its cost being purely an estimate unsubstantiated by actual experience, because no way has yet been discovered for subdividing the underwriter's outgo into separate parts corresponding to the separate structural parts or uses of the risk as provided for in existing rating schedules."[2] More recently, Longley-Cook has summarized the schedule rating process thusly: "* * * a schedule rating plan with numerous credits and debits for favorable and unfavorable features may be established * * *. Rate level adjustments, based on loss ratio developments will be made to insure the overall adequacy of the rates, but the individual debits and credits continue to be based on judgment *alone*."[3] (Emphasis added.) These authors, writing independently some 45 years apart, have expressed a concept echoed by others and long accepted as an axiom of the fire schedule rating process, that no mathematical basis whatever exists for the individual charge or credit of the rating schedule, hence that the specific rate of the individual schedule-rated risk must rest solely upon judgment.

Any suggestion that the charges and credits of any fire rating schedule are or can be rigorously computed from actuarial data would be absurd under present circumstances. However, anyone who has ever been faced with the problem of actually assigning values to the specific charges and credits of a specific schedule for actual application in the field has sooner or later (usually sooner) faced the choice either of modifying his "judgment" or of disregarding completely the "overall adequacy of the rates", if the term "rates" is understood to mean the average rates respectively indicated for the several classes to which a schedule may apply.

The earliest recorded instance of mathematical bounds to the schedule-maker's judgment is, to the author's best knowledge, to be found in the writings of A. F. Dean, perhaps the most vociferous advocate of judgment ever known to the fire insurance industry. Following detailed explanation and defense of the analytical basis for the occupancy charges of the Dean Schedule, we find this confession:

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[1] E. G. Richards, *The Experience Grading and Rating Schedule.* The National Board of Fire Underwriters. New York. (1915). P. 14.

[2] *Ibid.* P. 16.

[3] Laurence H. Longley-Cook, *Notes on Some Actuarial Problems of Property Insurance.* Reprinted in *Fire Insurance Rate Making and Kindred Problems.* C.A.S. (1960). P. 89 ff.

"The same basic occupancy charges for D buildings as for B buildings *would materially disturb the relations* established by usage in the rates [of certain categories of risks].

*"In lieu of the classification of combustibility the exigencies of the case have been met by selecting a basic occupancy charge and apportioning same * * * in such a manner as to produce a charge in cents * * * approximately equal to that which has been sanctioned by years of usage."*[4]

(Emphasis added.)

The point to be emphasized here is that certain rate *relationships* had to be met, and it was possible to meet them only by selecting and apportioning certain charges in a certain manner. The fact that the target rates to which Dean referred were themselves "sanctioned by years of usage", hence were based upon judgment, is in present context both irrelevant and immaterial. The simple fact is that the target rates forced a modification of judgment in selection and apportionment of individual charges. Had there been actuarial justification for the target rates, there would have been actuarial support for the schedule charges thereby indicated.

More modern examples of the interlock between target class rate levels and the charges of the applicable schedule may be taken from the operation (still in progress) of revising the *Uniform Grading Schedule,* or *"U.G.S.",* of the Middle Department Association of Fire Underwriters into the *Louisiana Uniform Grading Schedule,* or *"La. U.G.S."*

Detailed description of this schedule is not necessary, but certain of its characteristics should be explained. There is no "basis rate" as the term is commonly used; separate charges are provided for individual hazards. All charges are in "points" (to avoid decimals in the body of the rate calculation) and the final point total is multiplied by a so-called "rate conversion factor" to produce the rate.[5]

The exact values of charges are not important here, but certain ratios between charges are significant. In the original *U.G.S.,* the ratio of the frame wall charge divided by the joist floor-roof charge is 1.25. Also, the *U.G.S.* occupancy charges in frame construction are, on the average, about 1.4 times the corresponding occupancy charges in brick. In the *La. U.G.S.* the wall/floor-roof ratio is 0.8 and the frame/brick occupancy ratio is 1.2. The inversion of the one ratio from 1.25 to 0.8 and reduction of the other from 1.4 to 1.2 appear to reflect conflict of judgment as between Philadelphia and New Orleans. What these revisions actually reflect is *not* conflict of judgment but significant differences in the rate levels required in Pennsylvania and Louisiana respectively.

When the *La. U.G.S.* was originally filed (1953), classified experience of

[4] A. F. Dean, *The Philosophy of Fire Insurance,* edited by W. R. Townley. 3 Vol. Edward B. Hatch. Chicago. (1925). Vol. I. P. 281. (Original reference unknown to this author.)

[5] Arithmetically, the rate is the same as would be obtained if the rate conversion factor were taken as a "basis rate", and the point charges converted to appropriate percentages thereof.

more than minimal credibility indicated that pre-existing brick rate levels should be continued, but that pre-existing frame rate levels should be reduced by about 20%. Although the *overall* rate level could easily be adjusted by the rate conversion factor, the original *U.G.S.* could not be made to produce in Louisiana the *comparative* class rate levels required, until the indicated changes were accomplished.[6] Further revisions necessary to meet the class rate levels required in Louisiana included, among others, increasing the ratio between ordinary mercantile occupancy and office occupancy from 3.75/2.25 in the original to 3.75/1.60 in the *La. U.G.S.*, major adjustment of certain exposure charges, extension of a credit table by which structural charges are modified for internal exposure from occupancy and extremely drastic reduction in charges determining differentials between the rate on contents and the rate of the containing building.

It is obvious that once the point charges had been adjusted to meet comparative target rate levels, adjustment of the rate conversion factor to meet the required overall rate level then in effect automatically adjusted individual charges to absolute values which were definitely related to the class rate levels. The overall operation was by no means judgment-free, but the final result cannot be said to rest upon judgment *alone*.

It is not the purpose here to discuss methods of establishing the target class rate levels in the first place.[7] We here assume that a definite pattern of target levels has been pre-determined by appropriate methods, and consider only the problem of designing a schedule to produce this pre-determined rate pattern.

The existence of mathematically rigorous limits to the value of an individual charge can be demonstrated very easily, but these are not the final bounds to the fire ratemaker's judgment. It will be shown that certain complete combinations of charges are forbidden *as combinations* even though the individual charges may all be estimated within their respective individual limits. It is the existence of such forbidden combinations which constitutes the final and sometimes narrow restriction upon the exercise of judgment in preparing the schedule.

By analogy, a fire rating schedule may be likened to a house of cards. Incautious movement of one card can result in collapse of the entire interlocked pile. The rigorous consequences of incautious tampering with a single schedule charge may snowball into completely unacceptable distortions of the entire rate structure. This fact is not obvious, though the practicing ratemaker soon learns it by experience. We here propose to demonstrate that such is the case, and in so doing, will have displayed the limits within which judgment must be exercised if the overall pattern of rates is to exhibit both adequacy and consistency.

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[6] To have placed a lower rate conversion factor on frame than on brick would have led to serious complications with mixed construction.

[7] The interested reader is referred to the several excellent articles on this subject which appear in *Fire Insurance Rate Making and Kindred Problems.* C.A.S. New York. (1960).

FIRE SCHEDULE ALGEBRA

Statement of Theory

The author has noted previously that the class rate levels produced by a fire rating schedule may be expressed as a set of simultaneous equations in which the several charges of the schedule appear as variables, the co-efficients reflect actually existing field conditions and the class rate levels appear as the constant terms.[8] Assuming these equations to be consistent and not redundant, it is immediately apparent that if the number of equations were at least equal to the number of schedule charges, a unique solution would follow by elementary (though tedious) algebra, thereby eliminating all further exercise of judgment once the class rate levels had been pre-determined. In practice, however, the number of charges invariably exceeds the number of rating classes. Not only is unique solution impossible, the number of solutions will be infinite. A little reflection shows that the number of free choices permitted the ratemaker will be equal only to the difference between the number of charges and the number of equations, not to the full number of the charges themselves, but the equations impose no limits whatever upon the exercise of any or all of the choices permitted. So far, judgment is still unbounded for all practical purposes.

Any attempt to refine the classification plan to increase the number of classes to a figure equal to the number of schedule charges can only result in the loss of all statistical credibility in the classified loss experience. The number of equations, therefore, cannot be increased without impairing and perhaps destroying all ratemaking significance of the loss experience itself. We can, however, supplement the equations with inequalities. The system of m equations in n unknowns where $(n > m)$ is readily converted to a system of m' *significant* inequalities where $(m' \geqq n)$. Solution of the simultaneous inequalities does not yield a unique set of charges to produce the required rate levels (except possibly in special cases). It does, however, establish: (a) mathematically rigorous limits to the exercise of judgment; (b) practical limits somewhat elastic but considerably narrower than the rigorous limits. The solution also will display in mathematical expression the "house of cards" structure of the schedule as an entity.

Inequalities are derived from two sources, one mathematical and the other engineering. Mathematically, all probabilities must be non-negative. A rigorous implication is that in theory all charges of the schedule must be non-negative.[9] This fact serves to establish inequalities equal in number to the number of charges in the schedule. An additional series of inequalities is

[8] Kenneth L. McIntosh, *The Rationale of the Fire Schedule—Part I, Theory. The Annals of the Society of C.P.C.U.*, Vol. 13, P. 8 ff. (Summer, 1960).

[9] The negative "charges" (*i.e.* credits) in many schedules are empirical. A multiplicative credit can be and for certain manipulations must be converted to the positive equivalent by subtracting the credit from 100% (or from 1.00). An additive credit reflects the absence of a hazard elsewhere blanketed with other hazard(s) under a single compound charge. *E.g.*, where the basis rate of a brick building contemplates joist floors and roof, the schedule may contain additive credits for concrete floor and for incombustible roof. If the compound charge in such cases is broken down into its several specific components, these are all non-negative. The additive credit, or negative "charge", will be no longer necessary.

based upon axioms such as that "wood burns more readily than concrete", the denial of which seems less a matter of "judgment" than an excursion into absurdity. Inequalities from this source, which might be termed "engineering" inequalities, may in certain cases be superfluous, but in general they will not all be superfluous. Between the mathematical requirement that charges be non-negative and the engineering axioms as exemplified, we will normally wind up with the number of significant inequalities greater than the number of schedule charges.

Unfortunately, simultaneous inequalities are not so easily manipulated as simultaneous equations. To solve the problem, it is convenient to turn to matrix algebra. If we express the several charges of the schedule as components of a column vector, we will find bounds to the set of all such vectors whose components satisfy the rate level equations, the mathematical requirement that all charges be non-negative and the engineering axioms. The properties of and bounds to the set of vectors will be found to constitute the final limitations upon the exercise of the ratemaker's judgment in the evaluation of the charges of the schedule once the target class rate levels have been pre-set.

By geometric analogy, we may think of an empty box and may pick one corner of it as the origin of a coordinate system. We take a marble and place it anywhere we please with respect to the origin. Now let any three of the components of the vector be the coordinates of the position of the marble. The remaining components will be functions of the three coordinate-components, and thus there will be one combination of components, *i.e.* one specific vector, associated with any given position of the marble in all space. Any certain one of these vectors represents a combination of schedule charges which will produce the required rate levels, but we find that *if the marble is placed outside of the box at least one component of the associated vector will be negative. Therefore, to avoid violating the axiom that all schedule charges must be non-negative, we must keep the marble inside of the box at all times.*

This restriction obviously limits the values assumed by the three coordinate-components, which in turn limits the values which any of the remaining components may assume as functions of the coordinates. Thus there will be limits to the values assumed by each charge of the schedule.

Furthermore, it must be remembered that one specific vector will be uniquely associated with any given position of the marble, and the required rate levels will be produced *only* by a *combination* of charges displayed as the components of one of these vectors. The combinations displayed depend upon the functions which relate the balance of the components to the three coordinate-components; thus certain entire combinations are forbidden *as combinations* regardless of all other considerations.

The shape and size of the box within which the marble must be kept, *i.e.* the mathematical bounds of the vector set, are determined by the pattern of target class rate levels, by the actually existing distribution of fire hazards among the risks to be rated and by the amounts of insurance carried on individual risks. The ratemaker can control only the first of these, and by the introductory assumption of pre-determined class rate levels we have denied

him even that measure of freedom. We have placed him in a box and nailed the lid down. He may jump around inside, but he cannot get out.

The analogy may be extended to incorporate the engineering axioms ("wood burns more readily than concrete", etc.) if we now imagine the inside of the box to be subdivided into compartments by strips of sheet-rubber of varying degrees of elasticity. Although mathematically the marble may be anywhere inside the box, for consistency of the rate structure it must be kept within a certain compartment. As the divider strips are elastic to a degree, we may push the compartment walls somewhat out of shape, but if we go over into the next compartment we find that we must rate masonry higher than frame (other things equal), or perhaps rate an office higher than the carpentry shop in a similar building next door.

A geometric representation can be exact only when the number of schedule charges exceeds the number of the pre-determined rate levels by not more than three (otherwise more than three coordinates will be needed to express the position of the marble), but the analogy is mathematically valid regardless of how many charges and how few rate levels we assume. We cannot visualize an x-dimensional box where $x > 3$, but we still may manipulate in the abstract an n-component vector in the x-dimensional bounded set as easily as we manipulate the marble in a 3-dimensional box.

Though such an approach may depart from historically conventional approaches to the fire rating problem, it offers one tremendous advantage. By locking the schedule charges into a single vector and in turn locking that vector into a bounded set, complete mathematical expression in a single equation may be given to the entire pattern of class rate levels, the entire pattern of schedule charges, the actually existing field conditions, the mathematical axiom of non-negative charges and such engineering axioms as seem appropriate in a given case. It is only when all of the interlocking relationships existing within and between each and all of these several elements have been mathematically formulated in a single, readily-manipulated expression that significant mathematical bounds to judgment may be recognized. The simple scrutiny of individual schedule charges does not and cannot reveal their existence.

Basically, the whole problem would resolve itself into the extremely elementary problem of simultaneous equations if the inherent characteristics of fire risks would permit breakdown for statistical purposes into at least as many classes as there are charges in the schedule. We could then formulate a number of significant equations at least equal to the number of unknowns to be determined. Since we cannot change the inherent characteristics of the risks to be rated, we must turn to limiting inequalities for irremediable lack of determinative equations. We will find the inequalities to be perhaps more restrictive than is generally realized.

Mathematical Development

For simplicity of presentation, we make two restrictive assumptions:

1. All risks of all classes are equi-valued and carry the same percentage of insurance to value. As the effect upon the equations following of relaxing this restriction will be completely obvious, no further discussion seems necessary.

2. All charges of the schedule are additive.[10] The implications of this restriction are discussed in the Appendix. It can be relaxed in the interests of generality, but only at the cost of introducing mathematical complexities it is desired to avoid here. The historical examples given in the INTRODUCTION with specific reference to conversion of the Middle Department *U.G.S.* into its offspring, the *La. U.G.S.*, include application to multiplicative charges.

With these assumptions, we now write:

$$A_{11}P_1 + A_{12}P_2 + \cdots + A_{1j}P_j + \cdots + A_{1n}P_n = R_1 \qquad (1.1)$$

$$\cdots \qquad \cdots$$

$$A_{i1}P_1 + A_{i2}P_2 + \cdots + A_{ij}P_j + \cdots + A_{in}P_n = R_i \qquad (1.i)$$

$$\cdots \qquad \cdots$$

$$A_{m1}P_1 + A_{m2}P_2 + \cdots + A_{mj}P_j + \cdots + A_{mn}P_n = R_m \qquad (1.m)$$

and we have:

R_i = The pre-determined target rate level for the ith class.

P_j = The schedule charge reflecting contribution to loss expectation of a specific feature of hazard, "Hazard j".

A_{ij} = A factor reflecting the distribution of Hazard j as it exists in the ith class. *E.g.*, if Hazard j is combustible wall construction A_{ij} will be the average percentage of combustible wall construction found by inspection to exist in the several risks of Class i. It follows that all A_{ij} will be non-negative.

In final formulation, equations (1) will be neither inconsistent nor redundant.[11] By completely conventional techniques, therefore, they may be solved for any chosen group of charges numbering m, in terms of the remaining (n-m) charges which serve as parameters. As the several charges may be numbered in any way we please, there is no loss of generality in choosing the first (n-m) charges as parameters. There will be obtained a new system of equations of the form:

$$P_1w_{j1} + P_2w_{j2} + \cdots + P_{(n-m)}w_{j(n-m)} + w_{j0} = P_j \qquad (2)$$

where $(n\text{-}m) < j \leqq n$.

To facilitate the transition to vector notation, we also formulate (n-m) additional equations using the tautology that $P_j = P_j$ where $j \leqq (n\text{-}m)$. If for simplicity of notation we now let: $r = (n\text{-}m)$; $s = (n\text{-}m + 1)$; $t = (n\text{-}m + 2)$ . . . we have:

$$P_1(1) + P_2(0) + \cdots + P_r(0) + 0 = P_1 \qquad (2.1)$$

$$P_1(0) + P_2(1) + \cdots + P_r(0) + 0 = P_2 \qquad (2.2)$$

$$\cdots \qquad \cdots$$

$$P_1(0) + P_2(0) + \cdots + P_r(1) + 0 = P_r \qquad (2.r)$$

$$P_1(w_{s1}) + P_2(w_{s2}) + \cdots + P_r(w_{sr}) + w_{s0} = P_s \qquad (2.s)$$

$$P_1(w_{t1}) + P_2(w_{t2}) + \cdots + P_r(w_{tr}) + w_{t0} = P_t \qquad (2.t)$$

$$\cdots \qquad \cdots$$

$$P_1(w_{n1}) + P_2(w_{n2}) + \cdots + P_r(w_{nr}) + w_{n0} = P_n \qquad (2.n)$$

[10] If a basis rate of the *Analytic System* or similar schedule is multiplied separately by each of the individual percentage charges the result is a series of flat charges to be added into the final rate. These charges are thus in fact additive despite multiplicative appearance.

[11] See Appendix. Secs. 1 & 2.

Equations (2) may be immediately rewritten as:

$$P_1 \begin{matrix} W_1 \\ \begin{bmatrix} 1 \\ 0 \\ \cdots \\ 0 \\ w_{s1} \\ w_{t1} \\ \cdots \\ w_{n1} \end{bmatrix} \end{matrix} + P_2 \begin{matrix} W_2 \\ \begin{bmatrix} 0 \\ 1 \\ \cdots \\ 0 \\ w_{s2} \\ w_{t2} \\ \cdots \\ w_{n2} \end{bmatrix} \end{matrix} + \cdots + P_r \begin{matrix} W_r \\ \begin{bmatrix} 0 \\ 0 \\ \cdots \\ 1 \\ w_{sr} \\ w_{tr} \\ \cdots \\ w_{nr} \end{bmatrix} \end{matrix} + \begin{matrix} W_0 \\ \begin{bmatrix} 0 \\ 0 \\ \cdots \\ 0 \\ w_{s0} \\ w_{t0} \\ \cdots \\ w_{n0} \end{bmatrix} \end{matrix} = \begin{matrix} X \\ \begin{bmatrix} P_1 \\ P_2 \\ \cdots \\ P_r \\ P_s \\ P_t \\ \cdots \\ P_n \end{bmatrix} \end{matrix} \qquad (3)$$

New let:

$P_j = \alpha_j P_1$ where $(1 < j \leq r)$

and let:

$v_j = w_{j1} + \alpha_2 w_{j2} + \cdots + \alpha_r w_{jr}$ where $(r < j \leq n)$ (4)

Substituting for $P_2 \cdots P_r$ in the left member of equation (3), and substituting "$(P_j \geq 0)$" for "P_j" in the right member for all j, after certain manipulations and application of equation (4), we obtain:[12]

$$P_1 \begin{matrix} V_1 \\ \begin{bmatrix} 1 \\ \alpha_2 \\ \cdots \\ \alpha_r \\ v_s \\ v_t \\ \cdots \\ v_n \end{bmatrix} \end{matrix} + \begin{matrix} W_0 \\ \begin{bmatrix} 0 \\ 0 \\ \cdots \\ 0 \\ w_{s0} \\ w_{t0} \\ \cdots \\ w_{n0} \end{bmatrix} \end{matrix} = \begin{matrix} (X \geq \boldsymbol{0})^{(13)} \\ \begin{bmatrix} P_1 \geq 0 \\ P_2 \geq 0 \\ \cdots \\ P_r \geq 0 \\ P_s \geq 0 \\ P_t \geq 0 \\ \cdots \\ P_n \geq 0 \end{bmatrix} \end{matrix} \qquad (5)$$

Equation (5) is not an "equation" at all, properly speaking. It is a system of n inequalities which it is convenient to express in the form of an equa-

[12] See Appendix. Sec. 3.

[13] The symbol ***"0"*** should not be confused with the numeral "0". The italicized ***"0"*** designates the "null vector", *i.e.* the vector each of whose components is the number "0".

tion.[14] It should be noted that the right member displays the complete pattern of all schedule charges in order from P_1 to P_n, and incorporates the mathematical axiom ($P_j \geqq 0$) for all j. The left member incorporates the parameter P_1 and the $(r-1)$ ratios $\alpha_2 \cdots \alpha_r$,[15] thereby expressing the r choices permitted the ratemaker. As the constants v_j and w_{j0} are derived through equations (2), (3) and (4) from the rate levels R_i and coefficients A_{ij} of equations (1), the left member also reflects the pre-determined class rate levels and the conditions of hazard actually existing in the field. We have not yet recognized the engineering axioms such as that: "wood burns more readily than concrete", or "the expected loss to a protected risk is less than to a similar risk unprotected", etc., etc., but first let us examine the equation as it now stands.

Equation (5) defines a vector set of a particular type.[16] The set so defined may be designated "S". From the derivation of equation (5) it follows that a given combination of charges νP_j will satisfy equations (1) (*i.e.* will produce the rate levels R_i) and will also satisfy the axiom $P_j \geqq 0$ if and only if that same combination satisfies equation (5). As the several charges in order from νP_1 to νP_n are the components of a vector $X\nu$, it then follows that the combination of charges νP_j will produce the rate levels R_i and will satisfy $P_j \geqq 0$ *if* and *only if* $X\nu$ belongs to S as defined by equation (5).

It is easily shown that S is completely bounded;[17] hence the vector $X\nu$ will not belong to S for all ν. For any ν such that $X\nu$ does not belong to S, the entire combination of n charges νP_j will, by the foregoing argument, be forbidden.

It is extremely important to recognize that it is the combination of charges displayed by the vector $X\nu$ in such cases which is prohibited *as a combination* regardless of the fact that every individual charge νP_j may be valued within its own individual limits. It is in the existence of such forbidden combinations rather than in the limits to individual charges (though these latter exist) that the significant mathematical bounds to the fire ratemaker's judgment have their being. The purely mathematical bounds to judgment are equivalent to the mathematical bounds of the vector set S defined by equation (5).

Completely generalized treatment of the engineering axioms is difficult if not impossible. To illustrate, however, assume that on the *reductio ad absurdum* basis of "wood burns more readily than concrete", etc., it is established that, *e.g.*: $P_1 > P_2$ and $P_s > P_t$. Any combination of νP_j such that $\nu P_1 \leqq \nu P_2$ or $\nu P_s \leqq \nu P_t$ is immediately excluded regardless of all other considerations. There may, however, be further consequences.

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[14] As the parameters of equation (3) may be renumbered providing the vectors $W_1 \ldots W_r$ are correspondingly re-numbered, there is no loss of generality in selection of P_1 as the parameter of equation (5).

[15] Not only do $\alpha_2 \ldots \alpha_r$ appear directly in rows 2 to r, it should be remembered that v_j is a function of those same ratios by equation (4).

[16] See Appendix. Sec. 4.

[17] See Appendix. Sec. 5.

Given that $P_s > P_t$, then by rows s and t of equation (5):

$$P_1 v_s + w_{s0} > P_1 v_t + w_{t0}$$

from which:

$$P_1 > \frac{w_{t0} - w_{s0}}{v_s - v_t} \tag{6}$$

If the right member of inequality (6) is greater than zero, we have established a lower limit[18] for P_1 greater than given by $P_j \geqq 0$. The revised limit of the parameter will in turn affect the lower limits of all P_j as calculated by equation (5). This matter is pursued further in the Appendix, but the interlocking structure of the house of cards is already apparent, the more so when by application of equation (4) to v_s and v_t we may obtain from inequality (6):

$$P_1 > \frac{w_{t0} - w_{s0}}{(w_{s1} - w_{t1}) + \alpha_2 (w_{s2} - w_{t2}) + \cdots + \alpha_r (w_{sr} - w_{tr})} \tag{7}$$

Inequality (7) shows the limits of the parameter of equation (5) to be functions of the ratios $P_j/P_1 = \alpha_j$ where $(1 < j \leq r)$. *The ratemaker's "free" choices are not mathematically independent.*

Hypothetical Example.

To attempt illustration of the foregoing theory by the use of any actual example would introduce detail so complex that principle would certainly be obscured. For one thing, the necessary recognition of multiplicative charges and credits would, as noted, require the use of mathematical functions considerably more involved than have been developed. Further, it would be necessary to explain in full detail the structure of any particular schedule referred to; and, finally, the resulting equations might well be virtually impossible of manual solution. Admittedly what follows has been over-simplified and is unrealistic. It is intended as a demonstration of basic principle, not as an example of operational techniques.

Two parenthetical observations should be made here. First, slide-rule accuracy is the best to be expected in reproducing some of the calculations, despite the fact that for certain purposes additional decimals have been retained in results as shown. (Significant figures have been lost at certain intermediate stages of the calculation.) Secondly, specific equations below are identified with general equations previously developed by retention of the numbering with addition of a lower case letter suffix; *e.g.* equation (3a.) will be the result of entering a specific set of data into the general equation (3).

Assume a schedule of seven additive, non-negative charges, $P_1 \cdots P_7$. The schedule is applicable to three classes whose pre-determined rate levels are: $R_1 = 0.400$; $R_2 = 0.550$; $R_3 = 0.420$. The coefficients A_{ij} of equations (1) are assumed to reflect only the proportion of risks in Class i which exhibit

[18] Inequality (6) will sometimes be reversed to give an upper rather than a lower limit.

Hazard j, and thus may be determined by simple count of risks.[19] The values of A_{ij} are assumed as shown. By equation (1) we now have:[20]

$$1.000\,P_1 + 0.250\,P_2 + 0\,P_3 + 0\,P_4 + 0.200\,P_5 + 1.000\,P_6 + 0\,P_7 = 0.400 \qquad (1.1a)$$

$$0\,P_1 + 1.000\,P_2 + 0.500\,P_3 + 0.600\,P_4 + 0\,P_5 + 1.000\,P_6 + 0\,P_7 = 0.550 \qquad (1.2a)$$

$$0.400\,P_1 + 0\,P_2 + 1.000\,P_3 + 0.300\,P_4 + 0\,P_5 + 1.000\,P_6 + 0\,P_7 = 0.420 \qquad (1.3a)$$

It is immediately obvious that the P_7 terms should be dropped from all equations, as $A_{17} = A_{27} = A_{37} = 0$. This does not necessarily imply dropping the charge P_7 from the schedule unless the hazard reflected by P_7 is totally absent from all risks of all classes. It may and does happen, however, that a condition felt to be significantly hazardous will be found only in unusual risks too few in number to form a separate class. We may find that the values of A_{i7} are: $A_{17} = 0.00002$; $A_{27} = 0.00003$; $A_{37} = 0.00001$. For all practical purposes, these values become zero and the terms should be dropped, but the charge still may be retained for application to the vanishing percentage of atypical risks exhibiting the hazard.

After dropping the P_7 terms, equations (1.1a), (1.2a) and (1.3a) may be reduced to the following forms:

a. Choosing P_1, P_2 and P_3 as parameters:

$$P_1 \begin{bmatrix} 1 \\ 0 \\ 0 \\ -1.333 \\ -1.000 \\ -0.800 \end{bmatrix}_{aW_1} + P_2 \begin{bmatrix} 0 \\ 1 \\ 0 \\ -3.333 \\ -6.250 \\ 1.000 \end{bmatrix}_{aW_2} + P_3 \begin{bmatrix} 0 \\ 0 \\ 1 \\ 1.667 \\ 7.500 \\ -1.500 \end{bmatrix}_{aW_3} + \begin{bmatrix} 0 \\ 0 \\ 0 \\ 0.433 \\ 0.550 \\ 0.290 \end{bmatrix}_{aW_0} = \begin{bmatrix} P_1 \\ P_2 \\ P_3 \\ P_4 \\ P_5 \\ P_6 \end{bmatrix}_{X} \qquad (3a)$$

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[19] Such counts are often made in practice as a routine preliminary to schedule revision. A sample of risks may be used if the class is large.

[20] *cf.* McIntosh. *Op. Cit.* P. 12 and footnote 3, P. 13. With an obvious change of notation and the addition of the terms in P_7, equations (1.1a), (1.2a) and (1.3a) will be recognized as equations (6.1a), (6.2a) and (6.3a) of the reference.

$$P_1 \begin{bmatrix} {}_aV_1 \\ 1 \\ \alpha_2 \\ \alpha_3 \\ {}_aV_4 \\ {}_aV_5 \\ {}_aV_6 \end{bmatrix} + \begin{bmatrix} {}_aW_0 \\ 0 \\ 0 \\ 0 \\ 0.433 \\ 0.550 \\ 0.290 \end{bmatrix} = \begin{bmatrix} (X \geqq 0) \\ P_1 \geqq 0 \\ P_2 \geqq 0 \\ P_3 \geqq 0 \\ P_4 \geqq 0 \\ P_5 \geqq 0 \\ P_6 \geqq 0 \end{bmatrix} \qquad 5(a)$$

where:

$$\left.\begin{aligned} {}_aV_4 &= 1.333 - 3.333\alpha_2 + 1.667\alpha_3 \\ {}_aV_5 &= -1.000 - 6.250\alpha_2 + 7.500\alpha_3 \\ {}_aV_6 &= -0.800 + 1.000\alpha_2 - 1.500\alpha_3 \end{aligned}\right\} \qquad 4(a)$$

b. Choosing P_1, P_2 and P_4 as parameters:

$$P_1 \begin{bmatrix} {}_bW_1 \\ 1 \\ 0 \\ -0.800 \\ 0 \\ -6.993 \\ 0.400 \end{bmatrix} + P_2 \begin{bmatrix} {}_bW_2 \\ 0 \\ 1 \\ 2.000 \\ 0 \\ 8.762 \\ -2.000 \end{bmatrix} + P_4 \begin{bmatrix} {}_bW_4 \\ 0 \\ 0 \\ 0.600 \\ 1 \\ 4.500 \\ -0.900 \end{bmatrix} + \begin{bmatrix} {}_bW_0 \\ 0 \\ 0 \\ -0.260 \\ 0 \\ -1.400 \\ 0.680 \end{bmatrix} = \begin{bmatrix} X \\ P_1 \\ P_2 \\ P_3 \\ P_4 \\ P_5 \\ P_6 \end{bmatrix} \qquad (3b)$$

$$P_1 \begin{bmatrix} {}_bV_1 \\ 1 \\ \alpha_2 \\ {}_bV_3 \\ \alpha_4 \\ {}_bV_5 \\ {}_bV_6 \end{bmatrix} + \begin{bmatrix} {}_bW_0 \\ 0 \\ 0 \\ -0.260 \\ 0 \\ -1.400 \\ 0.680 \end{bmatrix} = \begin{bmatrix} (X \geqq 0) \\ P_1 \geqq 0 \\ P_2 \geqq 0 \\ P_3 \geqq 0 \\ P_4 \geqq 0 \\ P_5 \geqq 0 \\ P_6 \geqq 0 \end{bmatrix} \qquad (5b)$$

where:

$$\left.\begin{aligned} {}_bV_3 &= -0.800 + 2.000\alpha_2 + 0.600\alpha_4 \\ {}_bV_5 &= -6.993 + 8.762\alpha_2 + 4.500\alpha_4 \\ {}_bV_6 &= 0.400 - 2.000\alpha_2 - 0.900\alpha_4 \end{aligned}\right\} \qquad (4b)$$

It is readily seen by inspection that upon setting all parameters of equations (3a) and (3b) equal to zero, the vectors ${}_aW_0$ and ${}_bW_0$ will be solutions to the respective equations. It is also seen that upon setting P_1 equal to zero,

${}_aW_0$ will be a solution to equation (5a), but the vector ${}_bW_0$ does *not* satisfy equation (5b). The 3rd and 5th components of ${}_bW_0$ are negative in violation of $P_j \geqq 0$ for all j.

Equations (5a) and (5b) define the same vector set, and we shall designate this set as S_{36}.[21]

The vector ${}_aW_0$ is a so-called "extreme point" of S_{36}.[22] The others may be found by reducing equations (1.1a), (1.2a) and (1.3a) to the form of equation (3) using in turn each of the 20 possible combinations of three parameter charges. Of the 20 vectors W_0 thereby resulting, twelve (including ${}_bW_0$), will be found to exhibit at least one negative component. The remaining eight (including ${}_aW_0$) exhibit only non-negative components and are the extreme points of S_{36}. The present importance is that each individual charge, P_j, will assume its absolute limiting values at one or more of these points.

Designating an extreme point as T_ν and letting ${}_aW_0 = T_1$, we have for the extreme points of S_{36}:

$$T_1 = \begin{bmatrix} 0 \\ 0 \\ 0 \\ 0.433 \\ 0.550 \\ 0.290 \end{bmatrix} \quad T_2 = \begin{bmatrix} 0 \\ 0 \\ 0.193 \\ 0.756 \\ 2.000 \\ 0 \end{bmatrix} \quad T_3 = \begin{bmatrix} 0 \\ 0.0880 \\ 0 \\ 0.140 \\ 0 \\ 0.378 \end{bmatrix} \quad T_4 = \begin{bmatrix} 0 \\ 0.160 \\ 0.060 \\ 0 \\ 0 \\ 0.360 \end{bmatrix}$$

$$T_5 = \begin{bmatrix} 0 \\ 0.340 \\ 0.420 \\ 0 \\ 1.575 \\ 0 \end{bmatrix} \quad T_6 = \begin{bmatrix} 0.363 \\ 0 \\ 0 \\ 0.917 \\ 0.188 \\ 0 \end{bmatrix} \quad T_7 = \begin{bmatrix} 0.394 \\ 0.0250 \\ 0 \\ 0.875 \\ 0 \\ 0 \end{bmatrix} \quad T_8 = \begin{bmatrix} 0.300 \\ 0.400 \\ 0.300 \\ 0 \\ 0 \\ 0 \end{bmatrix}$$

The absolute limits of the several charges P_j are thus seen to be (designating the point at which the upper limit is assumed):

$(0 \leqq P_1 \leqq 0.394)\,(T_7)$; $(0 \leqq P_2 \leqq 0.400)\,(T_8)$; $(0 \leqq P_3 \leqq 0.420)\,(T_5)$; $(0 \leqq P_4 \leqq 0.917)\,(T_6)$; $(0 \leqq P_5 \leqq 2.000)\,(T_2)$; $(0 \leqq P_6 \leqq 0.378)\,(T_3)$.

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[21] The set is a 3-dimensional set of 6-dimensional vectors, hence the subscript "36". This notation is non-standard.

[22] See Appendix. Sec. 6.

These limits are obviously too broad to serve any but the academic purpose of showing that such limits do exist, but the vectors T_V are extremely useful in certain other calculations[23] and the limits of P_j emerge.

Turning to equation (5b), however, we see that the ratemaker's judgment is not so unrestricted as the foregoing might indicate. In general terms, let it be estimated that the hazards reflected by P_1, P_2 and P_4, respectively, are about equally severe. We thus have: $P_1 \simeq P_2 \simeq P_4$; and $\alpha_2 = \alpha_4 = 1$. We assume no basis whatever for this estimate except pure judgment. Entering $\alpha_2 = \alpha_4 = 1$ into equations (4b):

$$\left.\begin{aligned} {}_bV_3 &= -0.800 + 2.000(1) + 0.600(1) = 1.800 \\ {}_bV_5 &= -6.993 + 8.672(1) + 4.500(1) = 6.269 \\ {}_bV_6 &= 0.400 - 2.000(1) - 0.900(1) = -2.500 \end{aligned}\right\} \qquad (4b.1)$$

whence we obtain:

$$P_1 \begin{bmatrix} {}_{b1}V_1 \\ 1 \\ 1 \\ 1.800 \\ 1 \\ 6.269 \\ -2.500 \end{bmatrix} + \begin{bmatrix} {}_bW_0 \\ 0 \\ 0 \\ -0.260 \\ 0 \\ -1.400 \\ 0.680 \end{bmatrix} = \begin{bmatrix} (X \geqq \boldsymbol{0}) \\ P_1 \geqq 0 \\ P_2 \geqq 0 \\ P_3 \geqq 0 \\ P_4 \geqq 0 \\ P_5 \geqq 0 \\ P_6 \geqq 0 \end{bmatrix} \qquad (5b.1)$$

From row 5 of equation (5b.1):

$6.269\ P_1 - 1.400 = (P_5 \geqq 0)$; whence: $P_1 \geqq 0.223$

and from row 6:

$-2.500\ P_1 + 0.680 = (P_6 \geqq 0)$; whence: $P_1 \leqq 0.272$

Entering these limits of the parameter into the equation, we find:

$$\lim_{P_1 \to 0.223} X = \begin{bmatrix} {}_bX_1 \\ 0.22 \\ 0.22 \\ 0.14 \\ 0.22 \\ 0 \\ 0.12 \end{bmatrix} \quad \textit{and:} \quad \lim_{P_1 \to 0.272} X = \begin{bmatrix} {}_bX_2 \\ 0.27 \\ 0.27 \\ 0.23 \\ 0.27 \\ 0.30 \\ 0 \end{bmatrix}$$

The respective components of ${}_bX_1$ and ${}_bX_2$ are revised limits of the several

[23] See Appendix. Sec. 6.

charges P_j arising from the estimate that $\alpha_2 = \alpha_4 = 1$, and are much narrower than the limits displayed above as components of the vectors T_V. We may shrink them further.

Define P_1 as reflecting the hazard of full frame construction; P_5 as reflecting the hazard of a 25% frame attachment to a masonry building. The contribution of frame construction to loss expectation is not necessarily a linear function of perimeter or area percentage, but it is reasonable to assume, say, that $(0.10\,P_1 \leq P_5 \leq 0.40\,P_1)$. We now have from row 5 of equation (5b.1):

$$6.27\,P_1 - 1.40 = (0.10\,P_1 \leq P_5 \leq 0.40\,P_1)$$
$$(1.40/6.17) \leq P_1 \leq (1.40/5.87)$$
$$0.277 \leq P_1 \leq 0.239$$

Entering these parameter limits into equation (5b.1):

$$\lim_{P_1 \to 0.227} X = \begin{bmatrix} {}_bX_3 \\ 0.23 \\ 0.23 \\ 0.15 \\ 0.23 \\ 0.02 \\ 0.11 \end{bmatrix} \quad \textit{and:} \quad \lim_{P_1 \to 0.239} X = \begin{bmatrix} {}_bX_4 \\ 0.24 \\ 0.24 \\ 0.17 \\ 0.24 \\ 0.10 \\ 0.08 \end{bmatrix}$$

The limits to the several P_j as displayed in the components of ${}_bX_3$ and ${}_bX_4$ are elastic, obviously, since dependent upon the judgment that $\alpha_2 = \alpha_4 = 1$, and that $(0.10\,P_1 \leq P_5 \leq 0.40\,P_1)$, but they are extremely narrow. They could be stretched and still remain binding.

However, we may go still further. Let us define P_3 as reflecting the hazard of pig iron stocks; P_6 as reflecting the hazard of baled cotton. Now return to the limits of P_3 and P_6 as displayed in ${}_bX_1$ and ${}_bX_2$, noting that P_6 varies inversely with P_3. From ${}_bX_1$ we obtain a limiting ratio:

$$\frac{P_3}{P_6} = \frac{0.14}{0.12} = 1.2$$

which ratio increases as the parameter P_1 increases above its lower limit. Therefore, even though the P_3/P_6 ratio displayed in ${}_bX_2$ is indeterminate, a rigorous consequence of the judgment setting $P_1 \simeq P_2 \simeq P_4$ is that we must now set the occupancy charge for pig iron stocks at not less than 120% of the occupancy charge for baled cotton. "Judgment" or no "judgment" it might be advisable to re-evaluate the P_1, P_2, P_4 ratios. If we still have no mathematical indication of what the ratios α_2 and α_4 properly should be, we have a pretty clear mathematical indication of what they should *not* be. They should *not* be such that the ratemaker must subsequently charge a

higher rate for pig iron than for baled cotton in order to break even in the overall.

Practical Application

Any direct practical application of the theory here proposed is presently impossible, but the author's own experience leads him to believe that conformity with the theory is implicit in the structure of any schedule producing pre-determined rate levels regardless of the operational techniques employed in schedule development. Some of the obstacles to direct application may be overcome in the future by electronic data processing. The first of these is obvious, the complexity of the calculations. Secondly, it will be recalled that the coefficients A_{ij} of equations (1) reflect the distribution of hazards actually exhibited by risks in the field. The raw data will be available on the rating inspection surveys, since inspections must be made regardless of whether the schedule itself is to be formulated by crystal gazing or by Mr. Einstein's Theory of Relativity. The transfer of such data from survey to punch card is, however, a manual process and, at present, a prohibitively expensive process.[24] If certain experiments now in progress with other goals in mind are ultimately successful, economically practicable solutions to the field data problem may emerge as by-products.

Data concerning values and amounts of insurance carried, obviously a major factor to be considered, also might someday become available through electronics.

The fact that as a general rule the number of schedule charges greatly exceeds the number of rating classes (particularly the number of classes even remotely credible) is not so formidable as it seems. The number of variables in the equations can be reduced by empirical means. To begin with, in any but the simplest schedules many of the charges reflect hazards found only in a very small proportion of risks. Though these charges must be retained in the schedule to rate the abnormal risk, they have no significant effect upon any class rate level because their coefficients approach zero. They should be dropped from the calculation and must be evaluated by comparative (not absolute) judgment. *E.g.*, the charge P_7 was dropped from equations (1.1a), (1.2a) and (1.3a) above. Having defined P_3 as pig iron and P_6 as baled cotton, if we now define P_7 as fireworks storage, we have in P_3 and P_6 a measure of sorts by which to judge P_7 and the value of P_6 will constitute a lower limit to P_7 unless someone cares to suggest that gunpowder is safer than cotton.

Furthermore, many of the remaining charges can be grouped at common values. This is illustrated by the numerous occupancy charges of the *Anayltic System* which are grouped into seven classes. This, of course, is judgment. It is precisely the type of judgment which must underly any rating method, namely the decision that thus-and-such a class shall be defined in exactly such-and-so a fashion.

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[24] At one stage of the *La. U.G.S.* operation, skeletonized data had to be transferred from 18,000 surveys to some 54,000 I.B.M. cards. The process might also be termed "endless", or so it seemed at the time.

Finally, the theory as presented is incomplete. Any direct practical operation will require extension to include multiplicative charges. Although a possible approach is suggested in the Appendix, there are problems involved for which no immediate solutions are offered. The author feels that a complete development might either parallel or ultimately converge upon Almer's theories of "factor analysis",[25] but this is pure conjecture.

CONCLUSION

There is no intent whatever to suggest that judgment has been, will be, can be or should be eliminated from fire schedule rating. Apart from all other considerations, it is completely obvious that no limits mathematically derived, as here, from a pattern of target class rate levels can be any more rigid than are those rate levels themselves, and the actuarial problems of fire loss credibility are far from solution.[26] But the fire ratemaker is permitted completely free exercise of judgment in constructing or revising his schedule only if he is willing to accept whatever class rate levels may result when the schedule is applied in the field. Where comparative class rate levels have been pre-set there are bounds beyond which the ratemaker's judgment must not carry him in thereafter evaluating the charges of the schedule. The *overall obsolute rate level* is easily adjusted by any of a number of simple techniques, but the ratemaker must make up his mind in advance whether to prejudge his *comparative class levels* or to pre-judge the values of his schedule charges. He cannot do both except by resorting to techniques which constitute the outright superposition of class rating methods upon the schedule rating process and which frequently lead to both theoretical absurdities and practical difficulties in field application.

It seems completely obvious that the class rate levels produced by application of any schedule under a given set of field conditions are mathematical functions of the several charges embodied in that schedule. This being so, the inverse relationships expressing the charges as functions of the class rate levels must exist, though we find these to be limiting upon rather than precisely determinative of the schedule charges. Equation (5) indicates the author's concept of the general shape of the relationships and equation (5) may be challenged, but the simple existence of such functions in some shape seems beyond question. If their existence in some shape is recognized, the proper role of judgment in fire schedule rating is seen in a perspective clearer than that sometimes employed in critical evaluation of the schedule rating process. The existence of mathematical limitations upon the exercise of judgment then becomes apparent and it becomes obvious that the more credible the classified fire loss experience, the more rigid such limitations will be.

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[25] B. Almer. *Risk Analysis in Theory and Practical Statistics.* T.XV I.C.A. Vol. 2. P. 314.

[26] *Cf.* Robert L. Hurley, *A Credibility Framework for Gauging Fire Classification Experience.* Reprinted in *Fire Insurance Ratemaking and Kindred Problems.* C.A.S. New York. (1960). P. 122.

APPENDIX

1. *Inconsistency of Equations (1)*

Equations (1) may be inconsistent for any or all of three reasons. First, the hazard analysis upon which the schedule structure is based may be in error. The ratemaker may have failed to reflect by separate charges significant differences between hazards mistakenly believed to be essentially identical in nature. The remedy is obviously to review the hazard analysis.

Secondly, random variation of classified loss experience less than fully credible may produce random variation in the pre-determined rate levels, R_i. In theory, the ratemaker would be justified in eliminating inconsistency from this source by arbitrary adjustment of R_i within the statistical confidence interval, though in present practice the confidence interval will not be known.[1]

Finally, the assumption unavoidable in schedule rating, that unanalyzable hazards (*e.g.* the morale hazard) will be uniformly distributed throughout all risks of all classes may have broken down in particular application.

In any case, consistency may be secured by empirical methods provided the methods used are appropriately reflected in the final form of the schedule. As a last resort, the offending equation(s) may be dropped and the class(es) involved be rated under separate schedule. This is an area where very definitely the judgment factor is paramount.

2. *Redundance of Equations (1)*

In practice, redundance of equations (1) will indicate serious error in hazard analysis. Either the ratemaker has failed to group two or more underwriting classes so similar that they should be consolidated for rating purposes even if remaining separate for underwriting, or he has failed to distinguish between classes of essentially dissimilar characteristics. Remembering that the coefficients A_{ij} reflect distribution of hazards in the field, anyone familiar with fire risks as they exist may estimate the likelihood that we will have $A_{ij} = cA_{ik}$, where c is any constant, for all i for any (j,k). The rest follows. As a practical matter, barring analytical error equations (1) will not be redundant, but the sceptic may bypass the question if he chooses. We have defined r by the equation: $r = (n-m)$. If we re-define r simply to be the number of parameters remaining in equations (2) and (3) after reduction of equations (1), we have $r \geq (n-m)$ and the question of redundance in equations (1) becomes academic. The rest of the development still follows as presented.

3. *Derivation of Equation (5) from Equation (3)*

Equation (3) may be written in abbreviated notation as:

$$P_1W_1 + P_2W_2 + \cdots + P_rW_r + W_0 = X \qquad (3A)$$

Letting $P_j = \alpha_j P_1$ where $1 < j \leq r$; substituting:

$$P_1W_1 + \alpha_2P_1W_2 + \cdots + \alpha_rP_1W_r + W_0 = X$$

$$P_1(W_1 + \alpha_2P_1W_2 + \cdots + \alpha_rW_r) + W_0 = X$$

In full notation the parenthesis becomes:

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[1] *Cf.* Hurley. *Op. Cit.*

$$
\begin{matrix} W_1 \\ \begin{bmatrix} 1 \\ 0 \\ \cdots \\ 0 \\ w_{s1} \\ w_{t1} \\ \cdots \\ w_{n1} \end{bmatrix} \end{matrix}
+ \alpha_2
\begin{matrix} \alpha_2 W_2 \\ \begin{bmatrix} 0 \\ 1 \\ \cdots \\ 0 \\ w_{s2} \\ w_{t2} \\ \cdots \\ w_{n2} \end{bmatrix} \end{matrix}
+ \cdots + \alpha_r
\begin{matrix} \alpha_r W_r \\ \begin{bmatrix} 0 \\ 0 \\ \cdots \\ 1 \\ w_{sr} \\ w_{tr} \\ \cdots \\ w_{nr} \end{bmatrix} \end{matrix}
=
\begin{matrix} V_1 \\ \begin{bmatrix} 1 \\ \alpha_2 \\ \cdots \\ \alpha_r \\ w_{s1} + \alpha_2 w_{s2} + \cdots + \alpha_r w_{sr} \\ w_{t1} + \alpha_2 w_{t2} + \cdots + \alpha_r w_r \\ \cdots \\ w_{n1} + \alpha_2 w_{n2} + \cdots + \alpha_r w_{nr} \end{bmatrix} \end{matrix}
=
\begin{matrix} V_1 \\ \begin{bmatrix} 1 \\ \alpha_2 \\ \cdots \\ \alpha_r \\ V_s \\ V_t \\ \cdots \\ V_n \end{bmatrix} \end{matrix}
$$

The extreme right hand member follows by definition of v_j by equation (4):

$$v_j = w_{j1} + \alpha_2 w_{j2} + \cdots + \alpha_r w_{jr} \quad (4)$$

Substitution for the parenthesis gives immediately:

$$P_1 V_1 + W_0 = X \quad (5X)$$

Substituting $(X \geqq \boldsymbol{0})$ for X in the right member of equation (5X):

$$P_1 V_1 + W_0 = (X \geqq \boldsymbol{0}) \quad (5A)$$

which in full notation becomes equation (5).

4. *The Vector Set, S*

Equation (5) is, as has been noted, a system of n inequalities, and, therefore, defines the intersection of n half-spaces. Such an intersection defines a so-called "polyhedral, convex set."[2] In three dimensions, such sets may be geometrically represented by polyhedra, hence the term "polyhedral." A set is "convex" by definition if: Given that any two points are members of the set, then all points on the line segment joining the given points will also belong to the set.

For a polyhedral, convex set to be bounded, it is sufficient that the set not contain a ray.[3]

5. *To Prove that S is Bounded*

Equations (5) and (5A) define S, but equation (5X) is the completely general equation of a line. Whether or not the line defined by equation (5X) will intersect S will depend for all practical purposes upon the vector V_1,[4] which vector is a function of the ratios $\alpha_2 \cdots \alpha_r$, and may be conceived as the "slope" of the line. Assume V_1 to be such that the line does intersect S.

Returning to equations (1), choose the ith equation such that $A_{i1} > 0$,[5] and let all charges P_j except P_1 assume the lower limit of zero. Then:

$$A_{i1} P_1 + A_{i2}(0) + \cdots + A_{in}(0) = R_i \quad (1.i)$$

whence:

$$P_1 = R_i / A_{i1}$$

Since $A_{ij} \geqq 0$ for all (i,j), and also $P_j \geqq 0$ for all j, it is now obvious that if equation (1.i) is to be satisfied, then:

$$P_1 \leqq R_i / A_{i1}$$

Therefore, the intersection of the line defined by equation (5X) *for any* V_1 will be not greater than is given by:

$$P_1 V_1 + W_0 = X; \text{ where } (0 \leqq P_1 \leqq R_i / A_{i1}) \quad (5XS)$$

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[2] Kemeny, Mirkil, Snell and Thompson, *Finite Mathematical Structures*. Prentice-Hall, Inc. (1959). P. 337 *ff*.

[3] *Ibid*. P. 346.

[4] We may ignore as trivial the one-point intersection regardless of V_1 when W_0 belongs to S. The vector W_0 will invariably exhibit r zero components corresponding to the r parameter charges of equations (2) and (3). One-point intersection at W_0 implies that the schedule is cluttered with r charges each equal to zero. No ratemaker is that clumsy.

[5] It has been noted that if for any j, $A_{ij} = 0$ for all i, the jth term will be dropped from all equations, hence we must have $A_{ij} > 0$ for at least one i. The charge P_j could not otherwise be retained as a parameter.

Having set limits to the parameter of equation (5X) we have now defined by equation (5XS) neither a line nor a ray, but only a completely general segment. Therefore, S cannot contain a ray, therefore S is bounded.

The fact that the actual segment of intersection may and in some cases will be shorter than given by equation (5XS)[6] is immaterial. The proof depends not upon the length of intersection, but upon the fact that the intersection is a segment and not a ray.

The proof as given appears valid only under the restrictive assumption of no multiplicative, charges, but see Section 7, following.

6. *The "Extreme Points" of S*

If despite the impossibility of visualizing a polyhedron of more than three dimensions we maintain the geometric analogy, the so-called "extreme points" of S may be conceived as the corners of the polyhedron.[7] As noted under *Hypothetical Example,* preceding, these points display the absolute limits of the several P_j as components of the vector X, and in some cases the upper limit so indicated will be significantly less than the least value of R_i/A_{ij} for any i.

As previously noted, the extreme points of S, which we designate as T_ν, may be found by reducing equations (1) to the form of equation (3) using in turn each of the $\binom{n}{r}$ possible combinations of r parameters among the n charges P_j. We will then obtain a set of $\binom{n}{r}$ vectors ${}_\nu W_0$. Discarding all ${}_\nu W_0$ in which any component P_j is negative, those vectors remaining will be the extreme points, T_ν, and since S is bounded, the points T_ν will number at least $(r+1)$, *i.e.* the number of extreme points will be at least one more than the number of parameters in equations (2) and (3).[8] There are other methods to find the extreme points which are less tedious in application but which are difficult to present in general terms.

Apart from the display of limits to the several charges P_j, which is academic, the extreme points T_ν have a peculiar utility. By equation (2) and (3) we have limited the ratemaker to r degrees of freedom, but we have left his judgment free in the exercise of any or all of them. Now, however, if S exhibits exactly $(r+1)$ extreme points, we may write:

$$a_1T_1 + a_2T_2 + \cdots + a_rT_r + a_{(r+1)}T_{(r+1)} = X \qquad (8)$$

where:

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[6] *Cf.* under *Hypothetical Example,* preceding, the line defined by equation (5b.1) and the segment of intersection determined by the limits to P_1 as the parameter of that equation.

[7] See Kemeny *et al., Op. Cit.* P. 345 for an exact definition.

[8] This is not immediately obvious. It arises from the fact that although we are manipulating an n-component vector in n-dimensional space, the set S is r-dimensional, and the number of extreme points must be at least one greater than the number of the dimension of the bounded set. By geometric analogy, the extreme points of a *one*-dimensional segment are the *two* end points; the extreme points of the simplest bounded 2-dimensional set are the *three* vertices of a triangle; the extreme points of the simplest bounded 3-dimensional set are the *four* corners of a tetrahedron.

$a_\nu \geqq 0$ for all ν; and $\sum_{(\nu=1)}^{(r+1)} a_\nu = 1$

We may rewrite equation (8) as:

$$a_1T_1 + a_2T_2 + \cdots + a_rT_r + (1 - \sum_{\nu=1}^{r} a_\nu)T_{(r+1)} = X; \text{ where } \sum_{\nu=1}^{r} a_\nu \leqq 1 \quad (9)$$

The r degrees of freedom are now expressed by the coefficients $a_1 \cdots a_r$ of equation (9). From the restrictions imposed above upon a_ν, it is now completely obvious that these r degrees of freedom are not independent. As each degree of freedom is progressively exhausted, the bounds within which each subsequent choice must be exercised become progressively narrower. In the extreme case, let $a_\nu = 1$ and we have $X = T_\nu$, with no further freedom of choice whatever.

If S exhibits more than $(r + 1)$ extreme points, we still will find particular combinations of exactly $(r + 1)$ vectors T_ν such that any vector X of the entire set may be calculated by equation (9) with the same restrictions upon the coefficients a_ν. The *same* combination will not serve to calculate *all* X, but *some* combination of $(r + 1)$ vectors T_ν will serve to calculate *any* X in the set. Equation (9) is completely general provided only that S is bounded.[9]

7. *Apportionment Function and Multiplicative Charges*

There are two sets of functions which have been ignored for simplicity in the previous development, but which must be recognized in the interest of generality. The first, which may be called the "apportionment functions," reflect variation of the contribution to expectation with the extent of a given hazard in a given risk. The contribution of, *e.g.*, combustible walls to the expectation of a risk of mixed frame and masonry construction will be a function of that percentage of total wall perimeter[10] which is of frame construction; the hazard of flammable liquid storage is a function of the quantity stored.

The second set of functions might be termed the "contagion of hazard functions."[11] These functions reflect the fact that the contribution to expectation of a given hazard is not inherent to that hazard alone but is also a function of the environment. Put a pot-belly stove in the middle of the California desert and the worst to happen will be the singeing of incautious jackrabbits. Build a shack around the stove, and the stove becomes more hazardous. Now, put the same stove in a fireworks factory and ——?

Both the apportionment functions and the contagion of hazard functions

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[9] The number of combinations suitable for this purpose will not necessarily in general equal the number of all possible combinations of $(r + 1)$ vectors T_ν. See Kemeny *et al. Op. cit.* Ch. 5. Sec. 3 for further discussion of the concept of equation (9).

[10] Where the risk is comprised of separate but communicating sections of different wall construction, section area ratios are sometimes used rather than wall perimeter ratios.

[11] McIntosh. *Op. cit.* P. 11 and P. 29 *ff.* The author would welcome another term to avoid the confusing similarity between "contagion of hazard" as used here and the statistical term "contagion," referring to the apparent after effects of sampling. (*Cf.* Wm. Feller, *An Introduction to Probability Theory and Its Applications.* Vol. I. 2nd Ed. (3rd Printing) John Wiley & Sons, Inc. (1959). P. 112.)

may (and usually will) be non-linear, and may or may not be continuous. In the actual schedule, however, the former will appear either as linear approximations or as step functions in the form of specific values tabulated at selected intervals. The latter will appear in the schedule as step functions the tabulated values of which constitute the multiplicative charges. Multiplicative charges are not, properly speaking, "charges" at all. They are factors for application to the additive charges to reflect variation in the environment of the specific hazard for which the additive charge is made.[12] The simple additive charge P_j itself assumes "normal" conditions, *i.e.* an arbitrary standard environment for Hazard j, though the assumption may not be stated explicitly.

In completely general form, the terms of equations (1) will be:

$$\cdots + A_{ij}F_{ij}G_{ij}P_j + A_{ik}F_{ik}G_{ik}P_k + \cdots \qquad (10)$$

where:

A_{ij} = The proportion of risks in Class i which exhibit Hazard j.

F_{ij} = The average apportionment of Hazard j among those risks of Class i which exhibit Hazard j. If the severity of Hazard j is considered to be substantially independent of extent, then $F_{ij} = 1.0$. If $F_{ij} = 0$, then also $A_{ij} = 0$. Also $(0 \leqq F_{ij} \leqq 1.0)$.

G_{ij} = The average of the multiplicative charges applied to the additive charge P_j among those risks of Class i which exhibit Hazard j. The word "charge" here includes also multiplicative "credits". Also $(G_{ij} \geqq 0)$. (See footnote (12), preceding.)

If we now let:

$$Q_{ij} = F_{ij}G_{ij}P_j$$

the terms of (10) become:

$$\cdots + A_{ij}Q_{ij} + A_{ik}Q_{ik} + \cdots$$

and the original form of equations (1) is restored. The proof of bounds given in Section 5, above, is extended thereby to complete generality, and with it the entire development is likewise extended.

For practical purposes, the number of variables Q_{ij} becomes fantastic, but the problems can be shrunk back to reasonable proportions. The factors F_{ij} reflect weighted average values of a function $f_j(e_j)$, where e_j is the extent of Hazard j in a specific risk. The function $f_j(e_j)$ may be constant and equal to unity for some j. It is, however, a never-decreasing function. Therefore, not only will the factors F_{ij} be correlated for all i such that $F_{ij} > 0$, these factors may be placed *a priori* in order of increasing (or decreasing) values when average values of e_j have been determined for each class by physical inspection of risks.

The factors G_{ij} will reflect appropriately weighted average values of the products:

$$\cdots [{}_jg_k({}_jb_k)]\cdot[{}_jg_l({}_jb_l)]\cdots$$

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[12] A percentage "credit" of, *e.g.*, 5% is obviously the exact equivalent of a factor of 0.95. The modified additive charge is not $(-0.05P_j)$ but is $(P_j - 0.05P_j)$.

where ${}_jb_k$ is the extent of Hazard k in the environment of Hazard j in a particular risk. If ${}_jb_k$ reflects the arbitrary standard environment of Hazard j, then ${}_jg_k({}_jb_k) = 1.0$. Otherwise, ${}_jg_k({}_jb_k) \geqq 0$. Only those Hazards k(l)(m) . . . are considered here which significantly affect Hazard j. *E.g.*, a stove does not affect the hazard of welding and *v.v.*, but either affects the hazard of spray painting and also *v.v.* The function ${}_jg_k({}_jb_k)$ may (if not constant) be a never-decreasing or a never-increasing function, but will be monotonic in either case. For some j (not all j), therefore, the factors G_{ij} may also be placed *a priori* in order of increasing (or decreasing) values when average values of ${}_jb_k$ have been determined.[13] In any case, the factors G_{ij} will be correlated for all i. Also the same Hazard k may affect several other hazards, so that for some j the factors G_{ij} will be correlated for several j.

Therefore, although recognition of apportionment factors and multiplicative charges increases the dimension of the vector set, S, and thereby introduces additional degrees of freedom, the ratemaker's choice is not unrestricted in exercising these additional degrees of freedom. The coefficients of any P_j are correlated for all i such that the coefficient is greater than zero, are for some j correlated with each other over several j and finally can in many cases be arranged *a priori* in order of values. The mathematical limits to judgment do not become so broad that all practical significance will be lost; else the preparation or major revision of a fire rating schedule to meet pre-determined class rate levels would not be so frustratingly tedious a task as it is proved to be by experience.

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[13] It should be noted that for any given risk which exhibits both Hazard j and Hazard k, we will have $e_k = {}_jb_k$, although if Hazard j is absent and Hazard k is present, then $e_k > 0$ while ${}_jb_k = 0$. This establishes for some j and some k a further correlation of the respective coefficients of P_j and P_k.

AN ACTUARIAL ANALYSIS OF A PROSPECTIVE EXPERIENCE RATING APPROACH FOR GROUP HOSPITAL-SURGICAL-MEDICAL COVERAGE

BY

GEORGE E. MCLEAN

INTRODUCTION

In view of the current widespread interest in the field of hospital, surgical, medical coverage and its attendant cost, it seems desirable that there be a free interchange of ideas between the insurance industry and Blue Cross-Blue Shield in order to facilitate expansion of coverage to as large a segment of the United States population as possible.

Because of their early entry into the field and their widespread coverage of the population in concentrated areas, the Blue Cross-Blue Shield Plans have much to offer in the way of statistics and experience in this particular phase of the insurance business. The insurance industry, on the other hand, now provides hospital, surgical, medical coverage for more of the population, nationally, and has the advantage of more familiarity with insurance principles generally. One area of mutual interest should be the proper underwriting and actuarial approach to experience rating of group hospital, surgical, medical business.

In all lines of insurance, historically, those carriers which have sought to maintain rigid rates, regardless of the inherent characteristics of the risk, have found themselves in the unfortunate position of being deserted by risks with better than average experience and being warmly embraced by risks with high losses. Inevitably, this situation has led to very violent readjustments in the fixed rates or an extreme financial loss to the carrier involved.

This presentation will touch on both prospective and retrospective rating, historically and in connection with underwriting regulations, but the principal emphasis of the work will be on prospective rating.

HISTORY OF EXPERIENCE RATING GROUP HOSPITAL, SURGICAL, MEDICAL COVERAGE

Insurance Companies

It is rather difficult to trace the history of experience rating group hospital, surgical, medical coverage, as practiced by the insurance companies, because there seems to be no great uniformity of approach among the various carriers.

The only general pattern which seems to emerge from the industry as a whole is one of making retrospective adjustments with the larger group accounts as an overture to a complete experience rating approach.

Some companies which write a large volume of this group business today have been in the field for twenty to thirty years or more. Others have entered the field within the past ten years although they may write a substantial share

of the business currently. The most rapid growth in this coverage has occurred in the last ten years and, since there is so much diversity of operation among those who wrote this class of business prior to that time, this historical analysis will be confined to the more recent period.

Early in the last decade many companies introduced retrospective or dividend schemes. These provided for return of premium to their group risks based upon the actual experience during a given policy year. The amount of return was modified by a variable retention for expenses and assumption of risk contingent upon the size of the group as determined by premium volume. In some instances companies not only refunded to the larger risks if experience warranted, but, through agreement with the insured, assessed the account for losses in excess of a stipulated amount.

Another method of instituting recovery where excess losses have occurred is to withhold, from indicated refunds in any policy year, amounts sufficient to offset adverse experience in prior years. Of the two approaches this is probably the most common.

In general, prospective rating was introduced into the group hospital, surgical, medical field by an increasingly large number of carriers in the mid-fifties. Again, there seems to be a lack of uniformity in approach although certain similarities exist among most companies in this field. Usually, rating is based upon calendar or policy year experience with some consideration given to the ever-increasing cost of providing services.

A standard assumption is that hospital costs increase at the rate of 5% a year although there is no single figure which can be considered universal in its usage.

The credibility of the group is normally determined by the premium volume with maximum and minimum limits predetermined and ranges established within these limits by use of the formula $\frac{P}{P+K}$. In general, a permissible loss ratio is established for the particular size of risk based on a sliding scale of expense ratios. The actual loss ratio is then compared with the permissible and, depending upon the credibility of the group and the degree to which the particular carrier recognizes the advancing cost of care, a departure from the base rate is determined.

In smaller risks there is usually no attempt to rate the account closely and adjustments in 5% or 10% steps seem to be the order. In the case of groups of one hundred lives or less, rate adjustments are often made where the experience is extremely poor but very little in the way of reduction is normally offered even if the experience has been exceptionally good.

In the final analysis, much individual consideration is employed in determining the renewal rate of any group and no set formula is necessarily applied. Very often, in fact, in lieu of increasing renewal rates efforts are made to analyze the cause of the poor experience and corrective action is suggested.

Blue Cross-Blue Shield

Nationally, Blue Cross-Blue Shield Plans are over one hundred separate entities with a variety of different attitudes and approaches toward experience

rating for their own local accounts. On large national accounts, which have employees in a number of states, the Blue Cross Association and Blue Shield Commission, acting as coordinating agencies and in a sense as national rating bureaus, have evolved an experience rating plan which is applied uniformly in all areas. In tracing the history of experience rating by Blue Cross-Blue Shield, however, an analysis of one large Plan which was among the first to adopt this type of operation seems appropriate, since, to a degree, it represents the situation within the whole Blue Cross movement.

This Blue Cross Plan first departed from pure community rating in 1951 with the introduction of a program of retrospective refunds to groups with low losses. This step was considered necessary at that time to maintain a competitive position in the field of hospital coverage.

Although this mechanism succeeded for a time, it appeared that the community of risks as a whole was being penalized by making refunds to groups with good experience and failing to make some adjustment in the rate for those accounts which were contributing more heavily than others to the utilization of the services provided by Blue Cross contracts. For this reason, on July 1, 1954, the Plan embarked on a program of prospective rating for the larger groups whose experience was somewhat worse than the average.

Briefly, the experience of all accounts representing an average of approximately one hundred (100) or more contracts in force over a two year period was examined and, if their loss ratios were excessive when measured by approved standards, a 10%, 20% or 30% surcharge was imposed.

For a period of three years the combination of this surcharge program, based upon broad 10% groupings and the retrospective refund program, sufficed as a device to insure continued favorable participation in an increasingly competitive market yet, at the same time, avoid any serious effect on the great majority of risks. In 1957, however, as a result of a general rate increase, the Plan was faced with the possibility of losing many large accounts with better than average experience because the refund agreement, of itself, was insufficient inducement to retain these good risks.

The present program is designed so that groups with better than average experience might receive some reflections of this in their rate prospectively rather than waiting until after the close of their policy year. It therefore involves prospective discounts as well as surcharges and retrospective refunds.

GENERAL GROUP UNDERWRITING REGULATIONS

Before presenting an analysis of an actuarial approach to experience rating, it might be well to draw a brief comparison of group underwriting regulations as promulgated by the insurance industry and the service plans.

There are considerable areas of agreement between the insurance industry and Blue Cross-Blue Shield in the matter of general underwriting regulations on hospital, surgical, medical coverage. A detailed analysis of underwriting considerations is not within the scope of this paper but a brief analysis of the essential elements might serve to illustrate that, in spite of similarities, there are some fundamental differences between the industry and Blue Cross-Blue Shield.

In the matter of company contribution, for example, insurance companies generally require it, while Blue Cross-Blue Shield will write "employee contribution only" groups.

The industry generally requires 75% enrollment, while Blue Cross-Blue Shield does not although, normally, they will not grant a retrospective refund to a group which does not meet this requirement.

Both types of carrier will generally write group coverage for five (5) persons not associated solely for the purpose of obtaining insurance.

The Blue Cross-Blue Shield will ordinarily allow more than one level of benefit in the group so long as 75% of those covered have the higher level contract. Insurance companies, for the most part, are reluctant to allow more than one level of benefits in the group.

DETERMINATION OF ELIGIBILITY FOR PROSPECTIVE RATING

Participation Mandatory or Elective

In the case of insurance companies and most Blue Cross-Blue Shield Plans, participation in the prospective rating program is mandatory. In a few Blue Cross-Blue Shield Plans, groups may elect to come within the rating schedule if credible but this approach is obviously fraught with peril and is clearly disappearing as a method of operation.

Credibility Criteria

In Blue Cross-Blue Shield, as in the insurance industry, participation in the prospective group experience rating plan is contingent upon credibility. The subject of credibility criteria in the field of hospital, surgical, medical insurance is sufficiently complex and controversial that it might well be considered the subject for a separate paper. This presentation, however, will be limited to the explanation of a few of the possible bases and derivation and revision of the credibility tables used by a large Blue Cross-Blue Shield Plan.

The first possible base that comes to mind is volume of losses. This has a logical appeal since we are trying to predict future losses and attendant cost for the group. This serves as a very good base in such coverages as automobile where the occurrence of a loss is dependent on accidents which, though controllable to a degree, are basically subject to pure laws of chance and therefore more likely to fall into a normal distribution pattern. In hospital, surgical, medical coverage, however, the occurrence of a loss is dependent on a number of factors, not the least of which is medical practice in the area. Even within a single state, two groups of equal size, both with a high degree of year to year consistency and predictability in their loss patterns may have a significant difference from one another in the actual number of losses reported. This may be due to the fact that more hospital facilities are available in one area than the other or there may be ethnic characteristics of the population that hold down hospital admissions in a given locale. There are a number of other possible explanations but the fact remains that it would be discriminatory to assign more weight to the experience of the high loss group than to that of the low loss group, particularly if their average case cost is about the same so that the deviation in experience results exclusively from incidence.

Premium volume is another possible measure of credibility. It has the advantage of being readily available; of reflecting the losses incurred to a degree; and also the number of risks covered. It has several fundamental defects, however. First, most carriers provide different levels of benefits. To a degree, more liberal benefits encourage greater utilization but a fundamental difference in rate, and consequently in premium level, is due to higher average claim cost and has nothing whatever to do with the number of claims or number of insureds at risk and, hence, the predictability of experience.

Also, if a company introduces infirmary services, or in some manner manages to reduce its losses, it will receive a reduction in rate under the experience rating plan. This will reduce its credibility and give less credence to its own experience in future ratings so that continued better experience will not be fully credited to the group as it should be.

The average number of contracts in force is a fairly good barometer of the persistency of experience and yet it too has shortcomings. One of the primary objections to this yardstick is that it does not accurately measure the exposure to risk. Two groups having the same average number of contracts in force over a given period of time may be quite different in number of persons covered. One may be composed of 40% individual employee contracts and 60% family contracts. The other may have only 20% individual contracts and 80% family contracts. Since there are, on the average, something over three persons covered on every family contract the second group has many more persons exposed to risk.

One way of circumventing this difficulty is to assign a weight greater than one to the family contract. This weight in turn can be derived in at least two different ways. One very obvious solution is to determine, either from records available or from a sample study, the average number of persons covered per family contract and use this as a factor.

Another approach is to assign a weight to the family contracts based on the relationship of claim incidence on family to claim incidence on individual contracts. This can be accurately measured and modifies the number of contracts in force criterion by reintroducing the concept of volume of losses. It is my opinion that this is the best of the four bases discussed.

As previously mentioned, the basis of credibility used by most insurance companies is based on premium volume graded by the formula $\frac{P}{P+K}$. In the particular Blue Cross Plan chosen for analysis the original credibility criterion was premium volume and the formula for graduation was presented in a paper submitted by Mark Kormes which appears on page 98 of the 1952 Proceedings under "Statistical Notes". In time, management and technicians associated with this Plan came to feel that weighted contracts as previously described would provide a more satisfactory basis of establishing credibility than premium volume.

Family contracts were assigned a weight of 2.5 corresponding roughly to the ratio of Family to Individual pure premium. This ratio represents approximately the relationship of Family to Individual claim incidence and credibility ultimately should reflect frequency of utilization.

At the time of the conversion to weighted contracts from annual income, the most widely held coverage was the $7 Standard Room and Board indemnity contract for which the Family rate was approximately 2.50 times the Individual rate. Because this happened to coincide with the weight assigned to Family contracts, the annual income limits for the credibility ratings were divided by the Individual $7 contract rate to obtain the number of weighted contract months at risk required to produce the various credibility ratings.

The conversion from an income to a contract base occurred in 1952.

With the passage of time the incidence per contract month had increased considerably so that by 1959 a risk with the same number of weighted contracts as in 1952 developed a substantially higher number of claims.

Since it was desired to measure the extent of the change in claim incidence rather than claim cost, the overall in-patient and the overall out-patient incidence was first determined for the fiscal period ended June 30, 1951. By utilizing the experience for the four fiscal periods ended June 30, 1955, 1956, 1957 and 1958, a projection was obtained by the method of least squares to the anticipated average for the fiscal periods ending June 30, 1960 and June 30, 1961. The in-patient incidence was assigned a weight of unity (1.0) and the out-patient incidence a weight of one-half (.5). The comparison of the results produced an incidence increase factor of 1.55 and by dividing the weighted number of contracts in the present table by this factor a new table was derived which was intended to produce the desired results for the next two years. The details of the calculations and the revised table will be seen in Exhibits I to V.

RECORDING AND ACCUMULATING EXPERIENCE DATA

Statistical Plan

Each company and each service plan will evolve a statistical plan for recording premium and loss data which fits the unique requirements of the particular carrier. Most insurance companies, for example, will record not only hospital, surgical and medical premium and loss information on the detail card but, also, basic statistics for other allied lines. Generally, they will require information on the premium card with respect to the branch office or agency which has written the business and the commission to be paid.

Blue Cross Plans on the other hand, since they are monoline insurers operating through salaried sales representatives, will need far less data of the sort already outlined. Because of their contractual arrangements with particular hospitals and physicians, they may need a wealth of detail respecting the breakdown of charges and payments. In order to give this analysis direction, no attempt will be made to describe the great variety of statistical plans in use. Instead, the operation of the one large Blue Cross Plan used as a pilot throughout this study will be analyzed. Exhibit VI contains a sample of the detail cards currently in use together with a brief explanation of the coding employed.

Premium Reporting

A monthly premium card (see Exhibit VI) is cut for each subscriber and

these cards summarized by coverage code, within group, for Blue Cross, Blue Shield or Major Medical. This is the so-called "billed premium". Subsequently, when reports are received from the groups themselves, the original billing figures are corrected for adds, drops and changes of coverage. Cards are cut for each item and these constitute the adjustment to group billed premium. The "adjusted billed premiums", on a monthly basis, are then summarized quarterly by billed or incurred quarter and integrated to produce the total for each of the fiscal years of the experience study separately. Upon receipt of this information, the Actuarial Department applies the proper monthly, quarterly, semi-annual or annual factors to determine the actual earned premium for the study period. Adjustments to billings for three months after the close of the two fiscal years are reflected. In the summaries of premium employed by the Actuarial Department, the total Blue Cross or Blue Shield premium for a given group is reported. Another summary is made, however, which reflects the proper totals by coverage code. This latter tabulation is used to produce exposure figures.

Claim Reporting

Detail I.B.M. cards are initiated upon receipt of the admission report and contain, among other information, date liability incurred and group number. Detail cards are also initiated at the time of payment containing, among other information, date liability incurred, amount of payment and group number. These are summarized by group, quarterly, for each incurred quarter. In the interest of brevity, only the card for Blue Cross is shown in Exhibit VI because this is the more complex operation.

Summary claim cards are accumulated by incurred quarter to reflect paid development six months beyond the end of the policy year preceding the rating. For example; for an experience rating to be effective July 1, 1961, each of the incurred quarters, from the third of 1958 through the second of 1960, representing two fiscal years ending June 30, 1960, would be developed on a paid basis through December 31, 1960.

Payment cards are always matched against admission cards so that at the end of the period of paid development the unmatched admission cards for each incurred month, separately, represent the known or incurred and reported outstanding claims. The report of monthly outstanding claims is then integrated by incurred quarters. The incurred and reported count for a group is determined by addition of quarterly accumulated paid plus outstanding as described above.

The estimated ultimate experience of all business combined for the incurred quarter in question, paid through a specific date, is analyzed to produce claim count and average outstanding claim cost development factors. The estimated ultimate claim count, related to claims reported, produces a development factor. This, applied to reportings for the group in question, less the number of paid claims, produces the outstanding count.

For all business combined, the average outstanding claim cost related to paid claim cost, produces the average outstanding claim cost factor. This factor, applied to the average paid claim cost for the group in question, develops the average outstanding claim cost. The product of the outstanding

claim count and average outstanding claim cost is the estimated outstanding amount. This, added to the paid amount, yields the estimated ultimate amount for the particular quarter.

Eight quarters, representing the two policy years of the study, are normally accumulated as the next step with sub-totals for each of the two policy years. This produces the entire claim experience over the incurred period of examination. If, within the two fiscal years, a full eight quarters are not available, the maximum number obtainable is used.

DETERMINATION OF RATING ELEMENTS

Permissible Loss Ratio Criteria

The permissible loss ratio used to establish manual rates is based upon the carrier's needs to provide income for the following items:

1. Claim expenses
2. Acquisition expenses other than commissions
3. Commissions
4. General expenses
5. Taxes, licenses and fees
6. Special contingent reserves
7. Profit

Usually, the ratio of these items to premiums collected for some recent period or periods will establish the normal expense, contingency and profit percentage.

Subtracting this ratio from unity will produce a base permissible loss ratio for experience rating. Some of the above items vary in direct proportion to the premium; others are related to losses or depend on company policy. To the extent that the latter items remain fixed as income increases, advance discounts on new business and higher permissible loss ratios on renewal rating may be used for the larger groups. This approach establishes ranges of permissible loss ratios depending upon size of risk.

To attempt to establish a universal scale of permissible loss ratios in this analysis would be out of the question. There are too many variables, particularly when one considers the basic differences in the manner of operation of stock or mutual companies and non-profit service plans. As a specific example, however, I have set up the following scale of permissible loss ratios for one Blue Cross Plan:

Credibility Range	*Permissible Loss Ratio*
.05- .64	.88
.65- .79	.89
.80- .90	.90
.90- .94	.91
.95-1.00	.92

You will notice that this is a very abbreviated scale in comparison with that used by many insurance carriers but it should be borne in mind, here,

that the non-profit nature of service plans necessarily limits the expense factor and consequently abbreviates the range. The relatively high retention on the largest groups is in large part due to the statutory reserve requirements imposed on the particular Plan by the Insurance Department of the state in which it operates.

Adjustment of Experience to Contract Year Level

Premium Adjustment In determining departure of a group's experience from that established as normal, based on total group business, in addition to establishing a permissible loss ratio, the manual rate to be used as a measure must be decided upon. There are several approaches. One is to use the standard manual rates in effect during the experience period. This avoids the necessity of converting losses to the present or anticipated level in determining the departure from normal or permissible. The allowable loss ratio for the period of the study must be determined, however, from the experience of all groups combined. Furthermore, once the departure is established, trends must be analyzed and projections made to place the results on a current basis.

Another approach contemplates adjusting losses from the period studied to reflect increases in incidence and cost and, as accurately as possible, to place them on the level of the group's next policy year. The rate, then, underlying the premium which should be used to measure the departure from normal should be that which would be charged for exactly the same coverage provided during the period studied at the present manual level.

Whichever system is used, it is necessary to determine the contract exposure by classification (employee or individual, two person, family) and by type of coverage or contract held. Group business can be written on an annual, semi-annual, quarterly or monthly premium basis. The most common, however, is monthly business. For this reason, from this point on in this analysis, contract exposure will be taken to mean the number of contract months exposed.

Extension of the total number of contract months exposed in each of the years studied at current manual rates for the coverage provided, by classification and type of contract held, will produce premium on present rate level. This is to be the standard by which I have proposed that the rating will be determined for the Blue Cross Plan under consideration.

Loss Adjustment There are many difficulties in attempting to determine a proper trend factor to be applied to incurred loss amounts of a particular group in order to raise the loss experience to the cost level of the contract year for which we are trying to set the rate.

Most carriers, including the service plans, write both hospital and surgical-medical coverage for their group insureds. Whether the carrier is an insurance company or a service plan, however, it is general practice to segregate hospital from surgical and medical losses and there is a vast difference in projecting these claim costs to the contract year level. Hospital benefits, though often fixed as to room and board allowance, usually provide liberal if not full coverage of extra services and, therefore, are subject to cost variations beyond the control of the carrier. Surgical-medical benefits are usually fixed by a schedule of fees which may have to be raised from time to time, but which is at least

under the carrier's control. For the reasons cited, separate factors should be developed for hospital and for surgical-medical coverage.

The factor to adjust surgical-medical losses to the anticipated level of payment, in the absence of any contemplated change in the schedule of fees, can be based exclusively upon an analysis of year to year increases in incidence. In the particular Blue Cross-Blue Shield Plan which I am using as an example, the increase in in-patient surgical-medical cases has not been significant. The increase in out-patient surgery and diagnostic x-ray has been rather sharp but, since this constitutes a small portion of the overall cost, I have not recommended the application of any loss adjustment factor for this area of coverage. If and when a new schedule of fees is promulgated, then an analysis will have to be made of the impact upon cost and a proper factor applied to place the experience on current cost levels.

In the case of the year to year increase in Blue Cross loss cost, however, the compounding of a modest increase in incidence and accompanying annual increase in hospital cost produces a significant trend so that I have recommended an annual increase factor of 9% based upon a continuing analysis of the overall group experience as shown in Exhibits VII and VIII.

In these computations the reason for segregating the experience on room and board charges is basic to the determination of a proper trend factor. Most groups today are under constant pressure to up-grade their coverage and, unless some recognition is taken of this situation in the calculations, the year to year trends will be distorted by reflecting not pure utilization and charge increases but changes to the contracts with less coinsurance. This difficulty may be overcome by calculating a room and board charge per diem for the previous year and extending the number of in-patient days in the current year at that rate.

Special Maternity "A" in Exhibits VII and VIII is a subdivision of in-patient admissions concerned exclusively with miscarriage or natural abortions. Special Maternity "B" is a subdivision of the in-patient admissions covered on a regular basis regardless of the maternity allowance because of complications at time of delivery.

By determining adjustments to the pure premiums as indicated in the exhibits, to remove the effect of up-grading room and board indemnity coverage, it is then possible to make a direct comparison between the pure premiums in adjacent years to determine the overall increase in loss cost per contract month. Further, by using a three year weighted average increase you will note that, for the two years presented, very stable results are obtained. Exhibit VII produces an indicated annual increase factor of 1.093 and Exhibit VIII, a factor of 1.091.

Having arrived at an annual loss adjustment factor, it remains to apply this to the actual experience of the particular group being rated in order to obtain estimated losses on the future policy year level. To accomplish this, I have recommended that the Blue Cross Plan in question apply to the actual loss experience, for any period studied, a factor of $(1.09)^n$ where n is the number of years in decimal fractions which have elapsed from the midpoint of the period studied to the midpoint of the policy year for which the renewal rate is being calculated.

Mechanics of Computing Rating

The key to the whole problem of experience rating is the development of proper trend and cost adjustment factors to be applied to the group losses reported to project them to the forthcoming contract year level. Their application to the experience and the subsequent rating computations are relatively simple.

At the outset, although we may have used four years of experience in established trends, it is not usually practical to use more than the most recent two years of the group's experience in establishing renewal rates. This practice is actuarially defensible in the case of large groups. In fact, in the case of very large risks, sometimes only the most recent year of experience need be used as a base. For smaller accounts, it would be desirable to accumulate more experience as a rating base but, here, we run into a practical public relations problem. If the experience is good in the early years and poor in more recent periods, the group will gladly accept the inclusion of several prior years. If the reverse situation is true, however, all manner of arguments (some valid) will be advanced both by the sales department and the account itself against the inclusion of the earlier experience.

Although a certain amount of abuse from sales, management and the public at large is the natural lot of actuaries, only the heroic type will maintain a purist attitude when confronted with an irate public which has some basis, in fact, for its position. To cite one example, there are certainly underwriting characteristics of groups which may change over a span of years and have a decided bearing on their experience trends.

In view of the foregoing, I have proposed that renewal rating for this Blue Cross Plan be based on only the most recent two years of the group's experience.

Exhibit IX illustrates the method of computing the annual renewal rate for a sample group based upon the credibility criteria, the scale of permissible loss ratios and the adjustment factors previously outlined.

CONCLUSION

It might be well, before closing this presentation, to consider briefly the social implications of experience rating group hospital, surgical, medical coverage.

In Workmen's Compensation the company purchasing coverage on behalf of its employees has direct control over the experience to the extent that proper training and safety devices have an effect on the risk. In non-occupational hospital, surgical, medical coverage, however, we are dealing with a hazard which is not under the direct control of the company purchasing the coverage.

One might suppose that employees, particularly those who are organized, might object to any form of experience rating, since it would seem natural for the employer to use any means at its disposal to discourage the employees from availing themselves of benefits provided by the contract in order to produce a more favorable experience pattern. Precisely because of the fact that most

enterprises today operate either with union contracts or under the threat of union organization, they are in no position to intimidate their employees. As a matter of fact, it has been my observation that in many instances unions or employee organizations have been among the most vocal groups seeking recognition of experience in determining renewal rates.

In the case of the Blue Cross Plan for which I have recommended the procedure outlined in this paper, one of the requirements of the total experience rating operation—both prospective and retrospective—is that there should be a balance within the program itself. This is necessitated because of the fact that Blue Cross cannot indulge in any form of experience rating in which the overall community of risks is asked in any way to subsidize the rated groups. Proof of the validity of this approach is demonstrated in Exhibit X-Section A which tests the operation of the experience rating program for the fiscal year ending June 30, 1958.

A further, very important, consideration respecting the operation of the prospective rating plan itself is that the final results produce loss ratios within tolerable limits of the anticipated ratios. Exhibit X-Section B indicates that we have come reasonably close, in this particular Plan, to meeting this requirement and it also illustrates the violent off-balance which might have occurred in the experience rating program if no cognizance had been taken of the advancing cost of providing hospital coverage.

In conclusion, I would point out that it is highly unlikely that any formula or tabular approach to prospective rating can be implemented 100%. In the case of jumbo risks, or risks with some peculiar underwriting characteristics, it will always be necessary to modify the formulae, particularly as regards the use of trend factors. For the vast majority of risks, however, the uniform application of a well defined method of experience rating has proved eminently satisfactory both to the Blue Cross Plan involved and to their group accounts.

This presentation is not intended to serve as an answer to all of the problems which confront the insurance industry in experience rating hospital, surgical and medical business. It is my hope, however, that some of the concepts which have proved so successful for the specific carrier analyzed may be of some use to the industry or may provoke further experimentation in this field.

EXHIBIT I

Annual Incidence Per 1000 Contracts
Individual & Family Combined—All Group Business
Year Ending June 30, 1951

	Item	*In-Patient*	*Out-Patient*	*Source*
1.	Total Claim Count 1950	163,800	33,075	1950 Annual Statement Group Business Only
2.	Group Contracts in Force @ 12/31/49	575,527	575,527	Same as Item 1.
3.	Group Contracts in Force @ 12/31/50	627,242	627,242	Same as Item 1.
4.	Av. No. Group Contracts in Force Year End 12/31/50	601,385	601,385	[Item 2 + Item 3] ÷ 2
5.	1950 Annual Claim Incidence per 1000 Contracts	272	55	[Item 1 ÷ Item 4] × 1000
6.	Total Claim Count 1951	178,469	42,661	1951 Annual Statement Group Business Only
7.	Group Contracts in Force @ 12/31/50	627,242	627,242	Same as Item 6
8.	Group Contracts in Force @ 12/31/51	660,761	660,761	Same as Item 6
9.	Av. No. Group Contracts in Force Year End 12/31/51	644,002	644,002	[Item 7 + Item 8] ÷ 2
10.	1951 Annual Claim Incidence per 1000 Contracts	277	66	[Item 6 ÷ Item 9] × 1000
11.	Estimated Av. Annual Claim Incidence per 1000 Contracts Year End 6/30/51	275	61	[Item 5 + Item 10] ÷ 2

EXHIBIT II-A

Total Group Business
Annual Incidence Per 1000 Contracts — In-Patient Only
Diagnostic In-Patient Excluded
Projected to June 30, 1961

INDIVIDUAL

Rate Study Year End 6/30	X	Y	XY	X^2
1955	0	105	0	0
1956	1	106	106	1
1957	2	109	218	4
1958	3	111	333	9
Σ	6	431	657	14

$$4a + 6b = 431$$
$$6a + 14b = 657$$
$$24a + 36b = 2586$$
$$24a + 56b = 2628$$
$$20b = 42$$
$$b = 2.1$$
$$a = 104.6$$

Notation:
Ye = Year End 6/30

$$Ye = a + b\ (\times)$$
$$1959\ Ye = 104.6 + 2.1(4)$$
$$1959\ Ye = 113.0$$
$$1960\ Ye = 115.1$$
$$1961\ Ye = 117.2$$
$$\text{Average } 1960\text{-}1961 = 116.2$$

FAMILY

1955	0	416	0	0
1956	1	433	433	1
1957	2	438	876	4
1958	3	442	1326	9
Σ	6	1729	2635	14

$$4a + 6b = 1{,}729$$
$$6a + 14b = 2{,}635$$
$$24a + 36b = 10{,}374$$
$$24a + 56b = 10{,}540$$
$$20b = 166$$
$$b = 8.3$$
$$a = 419.8$$

Notation:
Ye = Year End 6/30

$$Ye = a + b\,(X)$$
$$1959\ Ye = 419.8 + 8.3(4)$$
$$1959\ Ye = 453$$
$$1960\ Ye = 461.3$$
$$1961\ Ye = 469.6$$
$$\text{Average } 1960\text{-}61 = 465.5$$

Average 1960-1961 Composite Annual Incidence per 1000 Contracts (Excluding Diagnostic) Based on Estimated Group Contracts in Force @ 6/30/60
(See Exhibit III for example of method) 345.8

EXHIBIT II-B

Total Group Business
Annual Incidence Per 1000 Contracts — Out-Patient Only
Diagnostic Out-Patient Excluded
Projected to June 30, 1961

INDIVIDUAL

Rate Study Year End 6/30	X	Y	XY	X^2
1955	0	29	0	0
1956	1	32	32	1
1957	2	34	68	4
1958	3	47	141	9
Σ	6	142	241	14

$4a + 6b = 142$
$6a + 14b = 241$
$24a + 36b = 852$
$24a + 56b = 964$
$20b = 112$
$b = 5.6$
$a = 27.1$

Notation:
Ye = Year End 6/30

Ye = a + b (×)
1959 Ye = 27.1 + 5.6(4)
1959 Ye = 49.5
1960 Ye = 55.1
1961 Ye = 60.7
Average 1960-1961 = 57.9

FAMILY

1955	0	152	0	0
1956	1	168	168	1
1957	2	187	374	4
1958	3	228	684	9
Σ	6	735	1226	14

$$4a + 6b = 735$$
$$6a + 14b = 1226$$
$$24a + 36b = 4410$$
$$24a + 56b = 4904$$
$$20b = 494$$
$$b = 24.7$$
$$a = 146.7$$

Notation:
Ye = Year End 6/30

$$Ye = a + b\ (\times)$$
$$1959\ Ye = 146.7 + 24.7(4)$$
$$1959\ Ye = 245.5$$
$$1960\ Ye = 270.2$$
$$1961\ Ye = 294.9$$
$$\text{Average } 1960\text{-}61 = 282.6$$

Average 1960-1961 Composite Annual Incidence per 1000 Contracts (Excluding Diagnostic) Based on Estimated Group Contracts in Force @ 6/30/60 (See Exhibit III for example of method) 205.6

EXHIBIT III

Total Group Business
Incidence Per 1000 Contracts — In-Patient and Out-Patient
Diagnostic Only
Projected to 1960-1961

Item	*Annual Incidence Per 1000 Contracts* Individual	Family	Source
1. Total Excluding Diagnostic Year End 6/30/58	158.0	670.0	Exhibits II-A and II-B In- and Out-Patient Combined
2. Total Excluding Diagnostic average 1960-61	174.1	748.1	Exhibits II-A and II-B In- and Out-Patient Combined
3. Ratio — Average 1960-61 to Year End 6/30/58	1.102	1.117	Item 2 ÷ Item 1
4. Total Diagnostic Year End 6/30/58	14	42	Blue Cross Rate Analysis Year End 6/30/58
5. Estimated Diagnostic Incidence 1960-1961	15.4	46.9	Item 3 × Item 4*
6. Composite Diagnostic Indence	36.1		**

*Prior to the year ending June 30, 1958, no diagnostic coverage was provided; therefore, it was necessary to apply a projection factor to this incidence based on trends for other services. Since diagnostic coverage was provided on both an in-patient and out-patient basis it was considered reasonable to use total in-patient and out-patient incidence combined for all other services as a base for the factor.

**Since 265,500 Individual and 509,000 Family contracts, estimated to be in force at June 30, 1960, represent the situation at midpoint of the period July 1, 1959 through June 30, 1961, Item 5 was composited as follows:

$$\frac{265{,}500 \times 15.4 + 509{,}000 \times 46.9}{265{,}500 + 509{,}000} = 36.1$$

EXHIBIT IV

Comparison of Annual Incidence Per 1000 Contracts
All Group Business
Fiscal Years Ending 6/30/61 and 1951

Item	*Amount*	*Weight*	*Source*
1. Composite Annual Claim Incidence per 1000 Contracts Average 7/1/59-6/30/61			
A—In-Patient	346	1.00	Amount—Exhibit II-A Weight—See Note
B—Out-Patient	206	.50	Amount—Exhibit II-B Weight—See Note
C—Diagnostic	36	.50	Amount—Exhibit III Weight—See Note
D—Weighted Total	467	—	Weighted Totals of Items 1A, 1B and 1C
2. Composite Annual Claim Incidence per 1000 Contracts Year End 6/30/51			
A—In-Patient	275	1.00	Amount—Exhibit I Weight—See Note
B—Out-Patient	61	.50	Amount—Exhibit I Weight—See Note
C—Weighted Total	306	—	Weighted Totals of Items 2A and 2B
3. Increased Incidence Factor	1.526		Item 1D ÷ 2C
4. Proposed Credibility Adjustment Factor	1.55		Item 3 Rounded

Note — In view of the sharp increase in out-patient incidence and its attendant effect on the credibility adjustment factor, and, considering the relatively low average case value for this type of claim, it would seem desirable to limit the effect of the increase in utilization of out-patient services. A weight of 50%, based on judgement, was considered reasonable.

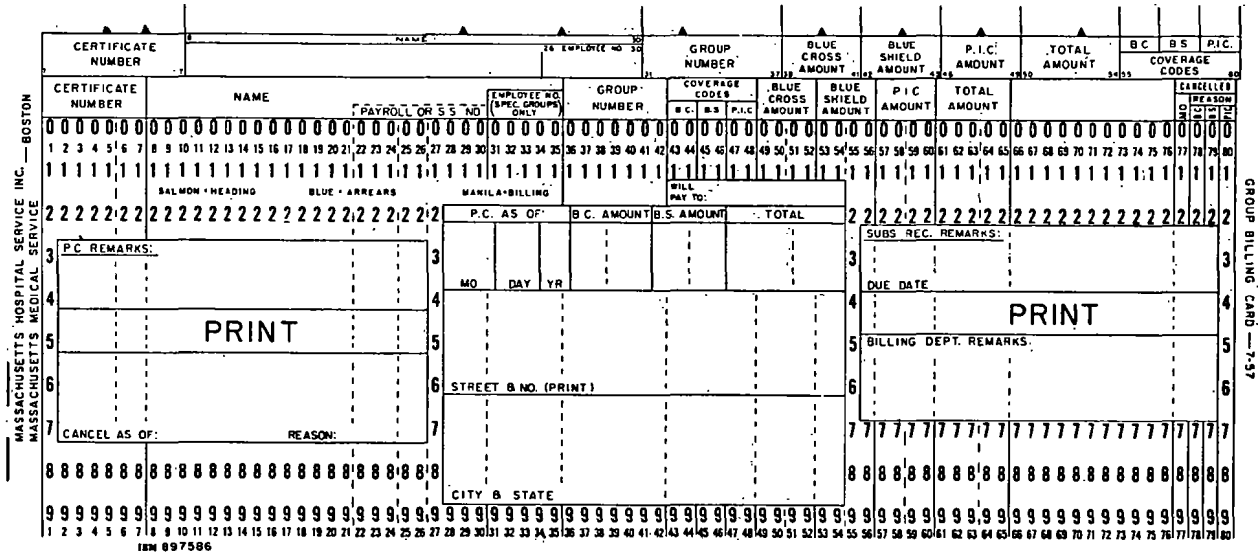
EXHIBIT V

1959 Revision of Basic Credibility Table Effective 7/1/59-6/30/61

(1)	(2)	(3)*	(4)**	(1)	(2)	(3)*	(4)**
	No. of Weighted Contract Months				No. of Weighted Contract Months		
Cred.	Pres. Table Lower Limit	1959-1961 Level Lower Limit	Proposed Table Upper Limit	Cred.	Pres. Table Lower Limit	1959-1961 Level Lower Limit	Proposed Table Upper Limit
.05	1,728	1,115	1,393	.53	24,516	15,817	16,025
.06	2,160	1,394	1,664	.54	24,840	16,026	16,218
.07	2,580	1,665	1,942	.55	25,140	16,219	16,412
.08	3,012	1,943	2,221	.56	25,440	16,413	16,605
.09	3,444	2,222	2,507	.57	25,740	16,606	16,799
.10	3,888	2,508	2,802	.58	26,040	16,800	16,993
.11	4,344	2,803	3,104	.59	26,340	16,994	17,178
.12	4,812	3,105	3,413	.60	26,628	17,179	17,364
.13	5,292	3,414	3,723	.61	26,916	17,365	17,550
.14	5,772	3,724	4,040	.62	27,204	17,551	17,728
.15	6,264	4,041	4,365	.63	27,480	17,729	17,906
.16	6,768	4,366	4,691	.64	27,756	17,907	18,084
.17	7,272	4,692	5,024	.65	28,032	18,085	18,262
.18	7,788	5,025	5,364	.66	28,308	18,263	18,440
.19	8,316	5,365	5,705	.67	28,584	18,441	18,618
.20	8,844	5,706	6,053	.68	28,860	18,619	18,796
.21	9,384	6,054	6,409	.69	29,136	18,797	18,974
.22	9,936	6,410	6,765	.70	29,412	18,975	19,153
.23	10,488	6,766	7,122	.71	29,688	19,154	19,323
.24	11,040	7,123	7,485	.72	29,952	19,324	19,501
.25	11,604	7,486	7,849	.73	30,228	19,502	19,687
.26	12,168	7,850	8,213	.74	30,516	19,688	19,873
.27	12,732	8,214	8,585	.75	30,804	19,874	20,058
.28	13,308	8,586	8,949	.76	31,092	20,059	20,252
.29	13,872	8,950	9,313	.77	31,392	20,253	20,445
.30	14,436	9,314	9,669	.78	31,692	20,446	20,647
.31	14,988	9,670	10,025	.79	32,004	20,648	20,848
.32	15,540	10,026	10,373	.80	32,316	20,849	21,049
.33	16,080	10,374	10,722	.81	32,628	21,050	21,266
.34	16,620	10,723	11,062	.82	32,964	21,267	21,491
.35	17,148	11,063	11,387	.83	33,312	21,492	21,723
.36	17,652	11,388	11,713	.84	33,672	21,724	21,963
.37	18,156	11,714	12,022	.85	34,044	21,964	22,203
.38	18,636	12,023	12,332	.86	34,416	22,204	22,458
.39	19,116	12,333	12,634	.87	34,812	22,459	22,722
.40	19,584	12,635	12,920	.88	35,220	22,723	23,016
.41	20,028	12,921	13,199	.89	35,676	23,017	23,318
.42	20,460	13,200	13,470	.90	36,144	23,319	23,643
.43	20,880	13,471	13,733	.91	36,648	23,644	24,014
.44	21,288	13,734	13,989	.92	37,224	24,015	24,433
.45	21,684	13,990	14,244	.93	37,872	24,434	24,905
.46	22,080	14,245	14,484	.94	38,604	24,906	25,416
.47	22,452	14,485	14,716	.95	39,396	25,417	26,213
.48	22,812	14,717	14,949	.96	40,632	26,214	27,537
.49	23,172	14,950	15,173	.97	42,684	27,538	29,380
.50	23,520	15,174	15,390	.98	45,540	29,381	31,741
.51	23,856	15,391	15,607	.99	49,200	31,742	34,621
.52	24,192	15,608	15,816	1.00	53,664	34,622 & Over	

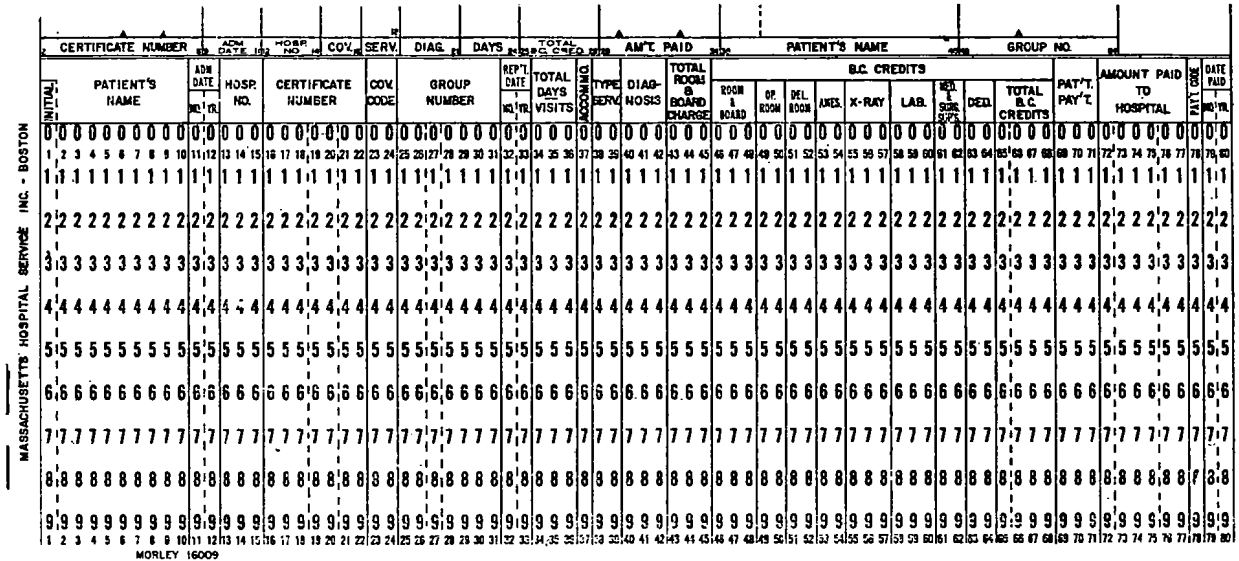
* Column 2 ÷ 1.55 (See Exhibit IV) — ** Next Higher Class Lower Limit — 1

HOSPITAL, SURGICAL, MEDICAL DETAIL PREMIUM CARD



Most of the fields in the above card require no detailed explanation with the possible exception of Columns 43 through 48 and Columns 78 through 80. This particular Blue Cross Plan has a great many difierent types of contracts in force with varying amounts of deductible or coinsurance. The coverage codes identify the particular type of contract and further distinguish between employee or individual and family coverage. The cancellation codes are set up to identify the specific reason for the individual cancellation as an aid in analyzing terminations for management and sales.

HOSPITAL CLAIMS PAYMENT AND STATISTICAL CARD



Column 37 refers to the particular type of accommodation occupied. That is, private room, semi-private room, ward or out-patient department. Columns 38 and 39 identify the type of service such as medical, mental, surgical, maternity, out-patient surgery, etc. Columns 40 through 42 identify specific diagnoses based on the International Classification of Diseases. Columns 63 through 64 will show the exact amount of deductible paid by the patient on limited contracts.

Calculation of Annual Increase in Loss Cost
For Use in Adjusting Group Experience
Source: Fiscal Year Rate Analyses—All Group Business Combined

Item	Year Ending 6/30 1955	1956	1957	1958
1—Total Individual and Family Contract Month Exposure	8,382,191	8,724,964	8,915,956	8,584,151
2—Non-Maternity In-Patient Room and Board Amount	$14,810,432.00	$16,943,902.63	$17,891,475.01	$19,766,956.34
3—Non-Maternity In-Patient Room and Board Days	1,446,729	1,562,881	1,551,334	1,540,987
4—Non-Maternity In-Patient Room and Board Per Diem [(2)÷(3)]	$10.24	$10.84	$11.53	
5—Non-Maternity In-Patient Room and Board Per Diem Previous Year		$10.24	$10.84	$11.53
6—Non-Maternity In-Patient Room and Board Adjusted Amount [(3)×(5)]		$16,003,901.44	$16,816,460.56	$17,767,580.11
7—Non-Maternity In-Patient Adjustment to Pure Premium [(6)÷(1)—(2)÷(1)]		—$.108	—$.121	—$.233
8—Special Maternity 'A' Room and Board Amount	$280,338.26	$300,101.01	$329,872.78	$330,913.42
9—Special Maternity 'A' Room and Board Days	26,605	26,903	27,906	25,290
10—Special Maternity 'A' Room and Board Per Diem [(8)÷(9)]	$10.54	$11.15	$11.82	
11—Special Maternity 'A' Room and Board Per Diem Previous Year		$10.54	$11.15	$11.82
12—Special Maternity 'A' Room and Board Adjusted Amount [(9)×(11)]		$283,557.62	$311,151.90	$298,927.80
13—Special Maternity 'A' Adjustment to Pure Premium [(12)÷(1)—(8)÷(1)]		—$.002	—$.002	—$.004
14—Special Maternity 'B' Room and Board Amount	$279,099.76	$320,780.66	$335,891.19	$342,932.00
15—Special Maternity 'B' Room and Board Days	26,366	28,229	28,195	26,085
16—Special Maternity 'B' Room and Board Per Diem [(14)÷(15)]	$10.59	$11.36	$11.91	
17—Special Maternity 'B' Room and Board Per Diem Previous Year		$10.59	$11.36	$11.91
18—Special Maternity 'B' Room and Board Adjusted Amount [(15)×(17)]		$298,945.11	$320,295.20	$310,672.35
19—Special Maternity 'B' Adjustment to Pure Premium [(18)÷(1)—(14)÷(1)]		—$.003	—$.002	—$.004
20—Total Adjustment to Pure Premium [(7)+(13)+(19)]		—$.113	—$.125	—$.241
21—Grand Total Claim Amount Incurred	$27,586,722.61	$32,492,184.74	$34,048,009.64	$40,067,314.49
22—Total Unadjusted Composite Pure Premium [(21)÷(1)]	$3.291	$3.724	$3.819	$4.668
23—Total Adjusted Composite Pure Premium [(22)—(20)]		$3.611	$3.694	$4.427
24—% Annual Increase in Blue Cross Cost (ratio present year adjusted pure premium to previous year unadj. pure premium — 1.00)		9.7%	—.8%	15.9%
25—3 Year Weighted % Annual Increase in Blue Cross Cost (weights; 1958 — 3; 1957 — 2; 1956 — 1)	9.3%			

EXHIBIT VIII

Calculation of Annual Increase in Loss Cost
For Use in Adjusting Group Experience
Source: Fiscal Year Rate Analyses—All Group Business Combined

Item	Year Ending 6/30 1956	1957	1958	1959
1—Total Individual and Family Contract Month Exposure	8,724,964	8,915,956	8,584,151	8,629,886
2—Non-Maternity In-Patient Room and Board Amount	$16,943,902.63	$17,891,475.01	$19,766,956.34	$22,604,071.98
3—Non-Maternity In-Patient Room and Board Days	1,562,881	1,551,334	1,540,987	1,614,760
4—Non-Maternity In-Patient Room and Board Per Diem [(2)÷(3)]	$10.84	$11.53	$12.83	
5—Non-Maternity In-Patient Room and Board Per Diem Previous Year		$10.84	$11.53	$12.83
6—Non-Maternity In-Patient Room and Board Adjusted Amount [(3)×(5)]		$16,816,460.56	$17,767,580.11	$20,717,370.80
7—Non-Maternity In-Patient Adjustment to Pure Premium [(6)÷(1)—(2)÷(1)]		—$.121	—$.233	—$.218
8—Special Maternity 'A' Room and Board Amount	$300,101.01	$329,872.78	$330,913.42	$352,918.74
9—Special Maternity 'A' Room and Board Days	26,903	27,906	25,290	24,930
10—Special Maternity 'A' Room and Board Per Diem [(8)÷(9)]	$11.82	$11.82	$13.08	
11—Special Maternity 'A' Room and Board Per Diem Previous Year		$11.15	$11.82	$13.08
12—Special Maternity 'A' Room and Board Adjusted Amount [(9)×(11)]		$311,151.90	$298,927.80	$326,084.40
13—Special Maternity 'A' Adjustment to Pure Premium [(12)÷(1)—(8)÷(1)]		—$.002	—$.004	—$.003
14—Special Maternity 'B' Room and Board Amount	$320,780.66	$335,891.19	$342,932.00	$375,148.32
15—Special Maternity 'B' Room and Board Days	28,229	28,195	26,085	26,547
16—Special Maternity 'B' Room and Board Per Diem [(14)÷(15)]	$11.36	$11.91	$13.15	
17—Special Maternity 'B' Room and Board Per Diem Previous Year		$11.36	$11.91	$13.15
18—Special Maternity 'B' Room and Board Adjusted Amount [(15)×(17)]		$320,295.20	$310,672.35	$349,093.05
19—Special Maternity 'B' Adjustment to Pure Premium [(18)÷(1)—(14)÷(1)]		—$.002	—$.004	—$.003
20—Total Adjustment to Pure Premium [(7)+(13)+(19)]		—$.125	—$.241	—$.224
21—Grand Total Claim Amount Incurred	$32,492,184.74	$34,048,009.64	$40,067,314.49	$45,365,247.38
22—Total Unadjusted Composite Pure Premium [(21)÷(1)]	$3.724	$3.819	$4.668	$5.257
23—Total Adjusted Composite Pure Premium [(22)—(20)]		$3.694	$4.427	$5.033
24—% Annual Increase in Blue Cross Cost (ratio present year adjusted pure premium to previous year unadj. pure premium — 1.00)		—.8%	15.9%	7.8%
25—3 Year Weighted Average % Annual Increase in Blue Cross Cost (weights; 1959 — 3; 1958 — 2; 1957 — 1)	9.1%			

EXHIBIT IX

Sample Computation of Renewal Rating to be Effective 10/1/60 Based on Incurred Period 10/1/57-9/30/59, Paid through 3/31/60

First Incurred Year — October 1, 1957-September 30, 1958

Item	— Loss Experience — No. of Claims	Amount	Premium	Loss Ratio
1—Actual Paid Basis	296	$25,183.19	$28,449.00	.89
2—Estimated Outstanding	—	—	—	—
3—Estimated Ult. Incurred	296	25,183.19	28,449.00	.89
4—Adj. to Anticipated Level		32,486.32(A)	31,854.00(B)	1.02
Second Incurred Year — October 1, 1958-September 30, 1959				
5—Actual Paid Basis	321	$29,423.06	$33,682.80	.87
6—Estimated Outstanding	5	750.00(C)	—	—
7—Estimated Ult. Incurred	326	30,173.06	33,682.80	.90
8—Adj. to Anticipated Level		35,905.94(D)	32,064.00(E)	1.12
Two Years Combined				
9—Item 4 + Item 8	622	$68,392.26	$63,918.00	1.07

Rating Procedure

$$\left[\frac{(\text{Loss Ratio} - \text{Permissible Loss Ratio})}{(\quad \text{Permissible Loss Ratio} \quad)} \times \text{Credibility}\right] \text{Rounded to nearest 5\%} = \text{Rating}$$

Loss Ratio = 1.07
Credibility = .80*
Permissible Loss Ratio = .90

$$\left[\frac{(1.07 - .90)}{(\quad .90 \quad)} \times .80 = +.151\right] \text{Rounded to nearest 5\%} = +15\%$$

* Credibility—Contract Months Exposed: Individual 2400; Family 7440
Computation: 2400 + (2.5) 7440 = 21,000
Based on revised credibility table 21,000 weighted contract months = .80 Cred.

NOTES: (A)—The estimated annual increase in cost is 9% based on statewide Blue Cross experience for the four most recent fiscal years. This increase is attributed to two factors; higher hospital costs and increased utilization. In order to reflect anticipated costs during the forthcoming policy year a factor of $(1.09)^n$ is applied to the actual incurred loss amount. The exponent "n" is the number of years in decimal fractions which will have elapsed from the midpoint of the experience period to the midpoint of the forthcoming policy year. In this case, the respective midpoints are 3/31/58 and 3/31/61 for a difference of 3.0 years which, when translated into the formula as an exponent, develops an adjustment factor of $(1.09)^{3.0}$ or 1.29. The computation, therefore, is: $1.29 \times \$25,183.19 = \$32,486.32$.

(B)—At 4/1/58 a new manual rate went into effect for the coverage held during the policy year of this study. These same standard rates are in effect today. A premium credit was obtained for the group based on the number of Individual and Family contracts in force during the experience period multiplied by this standard manual rate. Thus we can

measure the anticipated loss experience against the standard premium which would be charged currently for the coverage provided and thereby determine what, if any, deviation from the manual rate is indicated in this case.

(C)—Through 6/30/60 we had already paid out $525.00 against the $750.00 which was set up as an outstanding liability so this figure appears altogether reasonable.

(D)—See (A) for general explanation. In this case respective dates are 3/31/59 and 3/31/61, a difference of 2.0 years. The adjustment factor is, therefore, $(1.09)^{2.0}$ or 1.19. Following is the computation: $1.19 \times \$30,173.06 = \$35,905.94$.

(E)—During this experience period (10/1/58-9/30/59) the present standard rates plus 5% were charged as a result of the rate adjustment effective 10/1/58. Since a premium was collected which was higher than the standard level, a downward adjustment was necessary to reduce the premium to the anticipated standard collectible level. This accounts for the slight reduction in premium from the actual level for this experience period.

EXHIBIT X

SECTION A

Analysis of Group Experience-Fiscal Year Ending June 30, 1958

	*Net Earned Premium**	*Incurred Loss*	*Loss Ratio*
All Group Business Rated & Non-Rated	$46,079,519	$40,067,314	87.0
Sample of Experience Rated Gp. Business	13,711,425	11,886,444	86.7

* Gross earned premium less retrospective refunds.

SECTION B

Analysis of Group Experience
Sample of 100 Rated Groups-Fiscal Year Ending June 30, 1959

	Gross Earned Premium(A)	*Incurred Loss*	*Loss Ratio*
Actual Experience	$2,872,111	$2,512,917	87.5
Indicated Experience(B)	2,443,180	2,512,917	102.9

NOTES: (A)—Gross earned premiums are used in this section of Exhibit X because it is desired to illustrate how closely the prospective rating program comes to producing the desired or mean permissible loss ratio of 90.0 without the adjusting effect of retrospective refunds.

(B)—The gross earned premium for each account was reconstituted by extension of the total contract months exposed during the year ending 6/30/59 at rates which would have been charged had no loss projection factor been used in determining the experience rating at 7/1/58. The reason for this maneuver is to demonstrate the need for a factor to reflect the rising cost of hospital care.

DISCUSSIONS OF PAPERS READ AT THE NOVEMBER 1960 MEETING

AUTOMOBILE MERIT RATING AND INVERSE PROBABILITIES

BY

LESTER B. DROPKIN

Volume XLVII, Page 37

DISCUSSION BY D. C. WEBER

Mr. Dropkin's paper is a natural extension of his previous paper, "Some Considerations on Automobile Rating Systems Utilizing Individual Driving Records",[1] in which he introduced the negative binomial distribution as a proper model for the distribution of risks by number of accidents. Since that introduction, several papers dealing directly or indirectly with this frequency function have appeared in C.A.S. literature. Briefly, let us examine this theoretical function to determine how it fits in the area of accident distribution.

If p is the probability of success on a single trial (called a Bernoulli trial), p remaining constant from trial to trial, and q is the probability of failure on that trial such that $p + q = 1$, then the probability of x successes in n trials is given by the binomial probability function. Although a theoretical distribution in its own right, the Poisson distribution is generally thought of as the approximation to the binomial distribution when n is large, p is small and np remains constant in the limit. The variance of the Poisson distribution is equal to its mean so that the ratio of its variance to its mean is 1. Now if we assume that a given population is homogeneous with respect to inherent accident potential, that is, there is no difference in individual risks, then the distribution of the number of accidents is due to chance and the Poisson is applicable.

The probability that the rth success will occur at the Bernoulli trial number $x + r$ is given by

$$(1) \qquad N(x;r,p) = \binom{r+x-1}{x} p^r q^x, \quad x = 0,1,2, \ldots$$

The distribution defined by (1) is called the negative binomial distribution and its moment generating function is

$$M(\theta) = p^r(1 - qe^{\theta})^{-r}$$

Obtaining the proper moments by use of $M(\theta)$, we find that the mean of the negative binomial is rq/p and the variance is rq/p^2. Thus the ratio of its variance to its mean is $1/p$ or greater than 1 for $0 < p < 1$. Now the negative binomial remains meaningful if r is not an integer provided that $r \geqq 0$. If we let $q = 1/(1 + a)$ so that $p = a/(1 + a)$, then (1) takes on the form employed by Mr. Dropkin in his papers.

Empirical accident statistics frequently exhibit a variance greater than the mean which would lead one to suspect the validity of the assumption used

[1] CAS XLVI, p. 165.

in applying the Poisson frequency function. It is the variance greater than the mean property of the negative binomial that lends support to the use of this function in accident distributions. In using the negative binomial distribution we assume that the accident potential of the population is not homogeneous, that is, differences in individual risks exist. For each sub-group of the population, the inherent hazard is constant, but a variable accident potential exists between groups. Such an assumption is fundamental to any merit rating plan, automobile or otherwise.

A function which gives the probability that an individual will have x accidents in the next t years given that he has had c accidents in the past s years is truly an exciting notion. I believe Mr. Dropkin's paper is a remarkable contribution to the idea of merit rating. I have checked through the formulas in this rather mathematical work and have found them to be accurate. In the development, however, the author is a little sketchy on the application of inverse probability. Bayes' Rule is an extension of conditional probability and it is the latter concept that Mr. Dropkin has used in deriving the expression for $T(m|c,s)$. Assuming that clarification will not detract from the paper, the reasoning is as follows.

The probability for the occurrence of event A given that event B has occurred is given by the relationship

$$(2) \qquad P(A|B) = \frac{P(A \text{ and } B)}{P(B)} \qquad , P(B) > 0$$

Let us make the following notation definitions for clarity.

$P(m)$: Probability that an individual has accident potential, m.

$P(c,s)$: Probability that an individual has c accidents in time s.

$P(c,s|m)$: Probability that an individual has c accidents in time s given that he has accident potential, m.

$P(m|c,s)$: Probability that an individual has accident potential m given c accidents in time s.

By multiplication in formula (2) we see that

$$P(c,s \text{ and } m) = P(m) \cdot P(c,s|m)$$

But

$$P(m|c,s) = \frac{P(c,s \text{ and } m)}{P(c,s)}$$

$$= \frac{P(m) \cdot P(c,s|m)}{P(c,s)}$$

Replacing the probability expressions above by Mr. Dropkin's symbols gives us his formula (8), the crux of the entire derivation.

Someone working in the automobile merit area is more qualified to comment on the applications of the development by Mr. Dropkin, but in the interest of completeness I shall make a few observations. In his paper the writer pointed out that the general expression for risk distribution, $N(x;t|c;s)$, is of interest to rating systems which determine credits and debits on the basis

of fixed experience periods. The average future claim frequency by each sub-group is given by the mean of $N(x;t|c;s)$; namely, $t(r + c)/(a + s)$. Hence it is possible to compare the expected claim frequency for risks having had 1 accident in the last 2 years, say, with risks having had 2 accidents in the last 4 years. In these cases, the claim frequencies are $(r + 1)/(a + 2)$ and $(r + 2)/(a + 4)$, respectively. Also, by comparing the expected claim frequency for a certain sub-group with the average annual claim frequency for all risks, r/a, one is able to determine debits and credits as previously noted. This procedure was demonstrated by Mr. R. A. Bailey[2] in his discussion of Mr. Dropkin's previous paper.

An important result of the paper being reviewed is the realization that any merit rating plan which recognizes only the length of time since the most recent accident is not using all of the data available. At the same time it must be remembered that the developed formulas assume that each risk does not change from one time interval to the next, which obviously is not correct for long periods of time. Hence one may conclude that the most recent accident is more significant than any prior accident, but still the prior accidents are of some value.

The change in each risk that we know occurs and referred to in the previous paragraph brings to mind another application of the formulas. By comparing the actual with the theoretical we may be able to estimate the change in individual risks which occurs with passage of time. Also from a theoretical point of view, the formulas should be helpful in estimating the effectiveness of proposed changes in merit rating plans before any experience is obtained.

A NEW APPROACH TO INFANT AND JUVENILE MORTALITY

BY

CHARLES C. HEWITT, JR.

Volume XLVII, Page 41

Author's Review of Discussion by

A. L. MAYERSON IN VOLUME XLVII

This is the first time that the writer of the article under discussion has ever had occasion to respond to a review. Frankly, I find the problem of responding more difficult than the original writing of the article itself.

The standard textbook of the Society of Actuaries on this subject is "Life Contingencies" by Professor Jordan of Williams College. In that text[1] the force of mortality is graphed from the beginning to the end of the mortality table and looks something like:

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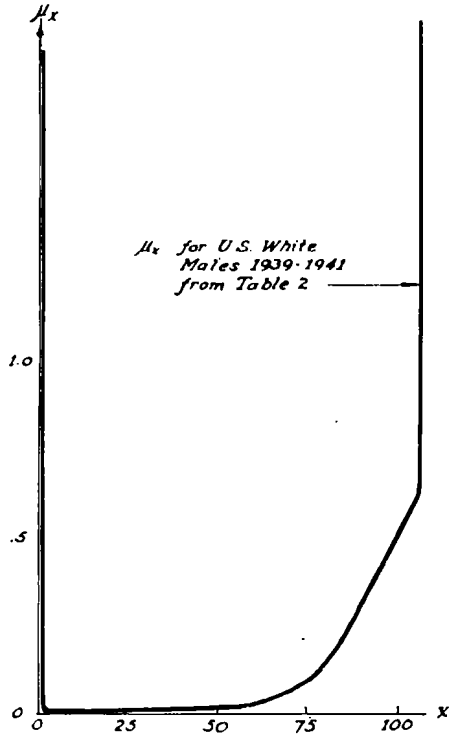
[1] "Life Contingencies", Jordan, C. W. (1952). The Society of Actuaries, p. 16.
[2] CAS XLVII, p.p. 152-154 (Bailey's discussion).



Previous attempts to express this complete curve by analytical means have generally been unsatisfactory, and actuaries have been content with the statement that either the Gompertz or Makeham function produced a good approximation from age 15 to near the end of the mortality table. The existence of the unanalyzed portion of the mortality curve has represented a challenge to actuaries for many years. Admittedly, as stated in my paper, this omission has not caused any great practical inconvenience since life insurers are primarily concerned with the mortality rates of mature individuals.

The advent of a more serious approach to the general subject of probabilities including developments in the theory of stochastic processes supplies what I believe is the missing link in the problem of a complete analytical expression for the *average* force of mortality. The solution of this problem was the primary purpose for the writing of the paper under discussion.

With these thoughts in mind, I now take up Professor Mayerson's review of my paper. Professor Mayerson is kind enough to recognize the originality of the approach and to appreciate the rationale underlying the paper. Because Professor Mayerson has been sympathetic in his review, I find it hard to bring myself to pointing out certain misconceptions on his part. Nevertheless in the interest of a more complete understanding of what I have tried

to do, the following comments seem necessary:

(1) Professor Mayerson states that I have assumed that the individual force of mortality has a Pearson Type III distribution. Actually, what I did assume was that one of the three principal elements of the individual force of mortality had a Pearson Type III distribution.

(2) In describing the formula which I have derived for the group or average force of mortality, Professor Mayerson states that the term which I have referred to as the "force of selection" is intended to measure the individual's inherent capacity to survive. Actually, this term in the expression for the average force of mortality measures the effect of the elimination from the group of those individuals who have the least capacity to survive.

(3) Professor Mayerson indicates that he detects an error in the mathematics of my illustrative example. In making this statement Professor Mayerson ignores the context of the illustrative example in which it is assumed that both the individual forces of mortality and the individual rates of mortality for certain infants are constant for the first 4 years of life. Furthermore, although the paper maintains a scrupulous distinction between the individual force of mortality (μ_x) and the average force of mortality ($\bar{\mu}_x$), I am afraid that Professor Mayerson has confused the individual force of mortality with the average force of mortality. The fact is that one of the principal conclusions of the illustrative example is that the average force of mortality decreases throughout the four-year period even though the individual forces of mortality remain constant; the reason being, of course, that those lives least fit to survive are being eliminated by a process of selection.

Also on this same point, Professor Mayerson's statement "μ_0 decreases rapidly during the first year of life is self—contradictory since μ_0 is the value of the force of mortality at only one point, namely age 0. Professor Mayerson suggests that it would be interesting to see a comparison of the theoretical and actual mortality rates at individual ages between 0 and 5. This comparison shows the following:

	Mortality Rates	
Age (x)	*Actual* (q_x)	*Theoretical* (q_x)
1	.00487	.00320
2	.00264	.00205
3	.00189	.00158
4	.00154	.00136

Professor Mayerson correctly points out that the formula for joint life contingencies does not lend itself readily to calculation because the "law of uniform seniority" may not apply. This factor did not bother the writer as much as the fact that in the calculation of joint life contingencies it is customary to assume that the force of mortality with respect to each contingent life is independent of the force of mortality with respect to each of the other con-

tingent lives. In dealing with benefits to survivors under a Workmen's Compensation Law where the survivors normally are the widow and children of a deceased workman, the assumption of the independence of the force of mortality among the members of the same family is open to serious question. While I did not raise this question in the paper itself, I did mention it at the original presentation of the paper in Washington last November. I do think this question of independence or dependence must be resolved before any further practical use is made of the actuarial model created in my paper.

The author of the paper under discussion is unable to resist one further comment which is in the nature of speculation. I believe that we are on the threshold of a major revision in the theoretical approach to the general subject of life contingencies.

I would like to express my appreciation to Professor Mayerson for his time and effort in presenting his review, and I would like to express the hope, which is probably common to every author, that this paper will lead to further study in this field.

THE NEGATIVE BINOMIAL APPLIED TO THE CANADIAN MERIT RATING PLAN FOR INDIVIDUAL AUTOMOBILE RISKS

BY

CHARLES C. HEWITT, JR.

Volume XLVII, Page 55

DISCUSSION BY O. D. DICKERSON

Mr. Hewitt's interesting paper carries on the discussion of automobile rating plans which consider the accident, conviction, claim and/or fault, experience of the auto and its drivers. There is a lack of general agreement whether such plans properly should be classified as individual risk rating plans or as extensions of the classification system.[1] The Canadian plan, to which Mr. Hewitt refers specifically, is designated as a "Merit rating plan"; the European plans are referred to as "no loss bonus" plans; and the bureau plan in the United States bears the hopeful appellation "Safe Driver Insurance Plan". By whatever name called and however categorized, such plans have been the subject of much current discussion and many papers.[2]

Recently the negative binomial distribution has become popular as a model to describe the theoretical distribution of accidents (convictions, claims, or

[1] *See, e.g.:* Kulp, C. A., *Casualty Insurance*, 3rd ed., New York: The Ronald Press Co., 1956, pp. 513 & 515-516; Simon, LeRoy J., "Myths and Mysteries Concerning the Actuarial Soundness of Merit Rating", paper presented to the Casualty Actuaries of Philadelphia, Sept. 7, 1960.

[2] Mr. Hewitt's footnotes cite most of these; the footnotes to this discussion cite a number of others.

accidents involving fault) by number for a single exposure unit during a finite time period. Mr. Hewitt carries on this discussion, deriving formulae for forward claim frequencies for the various classifications of the Canadian plan, and compares his theoretical frequencies with the actual experience for policy years 1957 and 1958 (developed through June 30, 1959). He implies that the fit is reasonably good but does not perform any statistical tests of goodness of fit.

It is difficult to criticize Mr. Hewitt's paper for what it contains. The mathematics seem correct and the fit looks plausible. It is for his sins of omission rather than commission that Mr. H. should be castigated, if at all. The failure to make any statistical tests of the fit has been mentioned above. While not all of the theoretical requirements for a Chi-square test may be present, it still would seem worthwhile to make the test. Not enough data are available for the reader, even if sufficiently ambitious, to do this himself. Moreover, it is not clear how many parameters were fitted, so the number of independent dimensions (degrees of freedom) is difficult to determine. Some amplification of the example would make such an additional test possible and also would clarify Mr. Hewitt's comments on his last page relative to the coefficients of variation of the five classes. Since he does not give these, nor the grand mean for all five classes combined, it is impossible to verify his conclusion or to determine the magnitude of the "smaller relative dispersion" to which he refers.

Another area of criticism is the duplication of the early part of this paper with that by Lester B. Dropkin[3] which apparently was developed almost simultaneously, but to which Hewitt refers. Hewitt's first five pages seem to contain nothing that is not in Dropkin's paper except a bit of more detailed explication. One is inclined to wonder why the two did not collaborate on a jointly authored article under the circumstances.

Several minor points may be raised. Rigor would be added by appending to formula (1.5) the qualification "when P(x) and T(m) are defined as in (1.1) and (1.2)". Finally, this discussant questions whether the "process of creating groupings based upon driving record . . . is *completely* random" (Page 56, emphasis added). How a particular driver is classified in a particular year may be completely random, but it seems that the creation of the group is not.

In terms of statistical theory, readers with slightly different backgrounds might be helped if the author would point out that the negative binomial distribution is also known as the Pascal distribution and sometimes as the Polya-Eggenberger distribution. It might also help to point out that the Pearson Type III distribution is a special case of the Gamma distribution where the origin is set at zero, and that other origins produce somewhat different results. In other words, the negative binomial described is a special case of a whole family of related distributions.

This discussant's major concern with the paper applies also to almost all

[3] "Actuarial Note—Automobile Merit Rating and Inverse Probabilities", CAS XLVII, p. 37. (Hewitt's footnote 4.)

the recent American literature which he has had the opportunity to read. There is apparently a total lack of familiarity with European literature on the subject on the part of most Americans.[4] This lack of communication is most unfortunate since it results in much unnecessary duplication of effort—effort which might be devoted more fruitfully to pushing forward the frontiers of knowledge.

Several remedies suggest themselves immediately, First, as many members of this Society as possible should join the ASTIN Section of the Permanent Committee for International Actuarial Congresses, thus obtaining the ASTIN literature and the opportunity to participate. Second, it would be extremely valuable for this Society to establish a committee to abstract summaries of the more significant foreign actuarial literature and publish these summaries in the *Proceedings*. Perhaps it might be possible to have some of the best translated and distributed to the members in processed form. Similarly, the Society might invite occasional papers by foreign actuaries. Perhaps one noted foreign authority might be invited as a guest speaker to each meeting. It is probable that financial support for travel expenses could be obtained without undue difficulty.

Illustrative of this lack of communication is the fact that neither Mr. Hewitt nor any of the other writers on this subject has even mentioned the papers presented at the ASTIN Colloquium at La Baule, France, 11 and 12 June, 1959. The topic of the colloquium was "No claim discount in insurance, with particular reference to Motor business." Ten papers were presented and discussed. The discussion was well summarized by Ammeter[5] and in the *ASTIN Bulletin*[6]. Particularly appropriate to the subject of Hewitt's paper are the papers by Bischel[7], Delaporte[8], and Thyrion[9]. None of these articles is precisely parallel to Mr. Hewitt's but each develops the negative binomial as a suggested model for automobile insurance.

Unfortunately, there seems to be a startling paucity of data on both sides of the Atlantic. It is to be hoped that future experience will be tabulated and reported in such a way as to make possible further building and testing of models. Data on the distribution of losses by amount also would be valuable. It well may be that this would lead to a model involving a double

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[4] Admittedly, this discussant shared this unfamiliarity until rather recently.

[5] Ammeter, Hans, "Die Rückvergütung bei schadenfreiem Verlauf in der Motorfahrzeugversicherung", *Mitteilungen der Vereingung schweizerischer Versicherungsmathematiker*, Heft 2, 1959, p. 3.

[6] Vol. I, Part III, pp. 92-105.

[7] Bischel, F., Une Methode pour Calculer une Ristourne Adéquate pour Années sans Sinestres, *The ASTIN Bulletin, Vol. I, Part II* (pp. 106-122).

[8] Delaporte, Pierre, "Quelques Problémes de Stastique Mathématique posés par l'Assurance Automobile et le Bonus pour non Sinistre", *Bulletin Trimestriel de l'Instutut des Actuaires Francais*, No. 227, pp. 87-102 (Juin, 1959).

[9] Thyrion, P., "Contribution a l'Etude du Bonus pour non Sinistre en Assurance Automobile", *The ASTIN Bulletin*, Vol. I, Part II, pp. 142-162.

compound distribution. Perhaps the Poisson Pascal distribution might serve as a useful first approximation.

Despite these comments Mr. Hewitt's paper is interesting and informative. This discussant learned a good bit from it and it does seem to be the first paper to develop formulae for forward claim probabilities by classes. It is a worthy contribution to the growing body of literature on the subject.

AUTHOR'S REVIEW OF DISCUSSION

CHARLES C. HEWITT, JR.

The author would like to express his appreciation to Professor Dickerson for his kind treatment of the paper under discussion.

He is in complete agreement with most of the items which Professor Dickerson refers to as "sins of omission." Although pleading guilty on virtually all counts of the indictment, I do wish to indicate certain extenuating circumstances:

(1) As freely indicated, my paper is built on the foundation of earlier work in this field by Lester Dropkin. As Professor Dickerson correctly infers, Mr. Dropkin and I did arrive at our conclusions with respect to forward claim frequencies of stochastic groups independently, and I suspect almost simultaneously.
Therefore, there is some duplication of Dropkin's work in my paper. Professor Dickerson will be glad to know that Mr. Dropkin and the writer got together on the matter of symbols and when these two papers are printed in the Proceedings, there will be a general agreement.

(2) Professor Dickerson suggests that the creation of groups based upon driving record is not completely random. I think that our difference on this matter is a question of semantics (he is speaking of the shell into which the group is placed, and I was speaking of the aggregation of individuals that are placed in the shell).

The author is particularly grateful to Professor Dickerson for two items in his review:

(1) He recognizes that the subject matter of this and earlier papers consists basically of actuarial models for the rating of Automobile insurance. It is to be expected that no model will exactly fit the actual data.

(2) Professor Dickerson devoted considerable space (and rightly so) to the lack of communication between European and American actuaries. He says "There is apparently a total lack of familiarity with European literature on the subject on the part of most Americans." I would like to add my voice to that of Professor Dickerson in urging this

Society to make available to its members in English much more of the European literature in this area and in the more general area of collective risk theory. Professor Dickerson does not state outright, but does imply that European actuaries are substantially ahead of American actuaries in this field. In my mind, there is no question that this is true. However, we would be a lot further behind European actuaries in this field were it not for the recent papers by such individuals as Bailey, Dropkin and Simon. I hope we can look forward to many more papers of this general type in our *Proceedings* in the near future.

COVERAGE AND UNDERWRITING ASPECTS OF BURGLARY INSURANCE

BY

WALKER S. RICHARDSON AND RICHARD J. WOLFRUM

Volume XLVII, Page 87

DISCUSSION BY T. E. MURRIN

At a time when an increasing frequency of crimes has adversely affected underwriting results for Bulgary Insurance, Messrs. Wolfrum and Richardson are to be commended for their timely and valuable contribution to our *Proceedings*. That this is the first paper presented to the Society on the subject, "Burglary Insurance—Rates and Ratemaking," should, as the authors suggest, help raise the veil of mystery that has shrouded this form of insurance. Furthermore, the paper should serve as a useful reference to the students of the Society preparing for its examinations.

The authors have chosen to limit their discussion to non-banking commercial sublines, noting that the trend in providing coverage on banks and individuals is towards the indivisible package policies.

A substantial part of this paper deals with a description of the various commercial contracts, and based on my review it appears that the authors have covered the subject matter clearly and completely. The summary exhibit of the many burglary forms is unique for its clarity and simplicity and should be of great assistance to one not familiar with the various relationships of the different burglary policy forms. Some comments on our part at this point might be helpful.

The authors state that burglary underwriters have generally refused to offer insurance for the disappearance peril on merchandise outside the insured's premises. This is due to the fact that the nationwide definition of forms and coverages consider this inland marine coverage and thus is provided under appropriate inland marine policies.

The authors further point out that coverage for money in some cases includes coverage for other property, such as merchandise, but this coverage is incidental. Undoubtedly, there are many cases where there is a heavy mer-

chandise exposure, as a retail establishment which will have a heavy money exposure—hence the need for coverage on both merchandise and money. A good illustration is a supermarket. There are also instances where the insured is interested in insuring damage to his safe, in addition to its contents, since damage to the safe may in many cases be more costly than the loss of the contents.

In the second section of the paper, captioned "Rates and Rating," the authors recognize the problems that exist in determining rates for burglary insurance, principally because of the limit volume developed for these various policy forms. As an illustration of this point, for the safe burglary subline of insurance the premium volume developed, countrywide, for National and Mutual Bureau companies amounted to slightly more than $2,000,000. Splitting this premium by state, and sub-dividing it into approximately 150 territories, affords the ratemaker only extremely sparse experience having little credibility. The authors further observed that expected loss costs for areas within given statistical territories may vary, and suggest that further refinement to some statistical territories be considered. They then correctly note that in a low credibility line such as burglary insurance the cure could be worse than the disease.

In the commercial lines of burglary insurance, rates vary by use classification or the actual business of the insured. Mr. Wolfrum and Mr. Richardson discuss the basis of the use classification relativities and conclude that judgment has probably played a larger part than experience in determining the present rate differentials. Exhibits of available classification experience were utilized to support the adjustment of classification relativities when submitted to supervisory officials for consideration in 1955.

In that filing which became effective countrywide, use classification experience for the Mercantile Open Stock and Money and Securities Broad Form Loss Within Premises coverages was available through calendar year 1952, and for Mercantile Safe and Interior Robbery (now called Mercantile Robbery inside Premises) use classification experience was available through 1950. The first two coverages developed a volume of experience by use classification which forms a satisfactory basis for a review of relativities. For mercantile open stock, nine of the eleven groupings by use classifications that were considered had at least 5000 claims in the 5-year period reviewed, and in the case of broad form money and securities, ten of fourteen groups had at least 1000 claims. The mercantile safe and interior coverages developed somewhat less volume by use class, but since the coverage provided under these two forms and the money and securities policy are related, simultaneous study of three sets of class experience produced revised differentials based largely on the experience.

The authors note that effective January 1, 1961, the Bureau Statistical Plan was revised to provide for detailed reporting of data by class of business, by alarm systems, and by types of safes. It did not provide for the separate reporting by number of watchmen or for the less important types of protection, and this is felt to be a weakness in the current statistical plan. However, when the question of detailed coding was considered by the un-

derwriting specialists comprising the Burglary Rating Committee of the National Bureau, it was the judgment of this committee that more detailed statistical data should not be collected for these less important subdivisions.

To supplement the authors' paper, this reviewer feels an explanation of how rate level data for the burglary lines are developed from company reports would be informative and helpful not only to students who will be using the *Proceedings* as a reference, but also to some members of the Casualty Actuarial Society who may be unfamiliar with this procedure.

Burglary Insurance experience is reported to the National Bureau on a unit transaction basis. These reports are submitted monthly and contain the full detail required by the Burglary Insurance Statistical Plan. Thus, the punch cards show the codes for policy form, term, territory, etc., as well as the written premiums and incurred losses. From these data we calculate the portion of the written premiums that is earned in the current year, as well as the contribution to the earned premium of subsequent years, depending on the effective date and the term of each policy. To reflect changes in manual rates, the earned premium summary cards for policies written prior to the date of the revision are separated from those for policies written subsequent to the date of the change. The rate change factors are applied to the earned premium contributions from policies written prior to the effective date of the change, but no adjustment is needed for the earned premium arising from policies written subsequent to the date of the change because such premiums already reflect the revised level of rates.

In conclusion, may I again say that Mr. Wolfrum and Mr. Richardson are to be congratulated on their excellent and valuable addition to the *Proceedings* of the Casualty Actuarial Society.

DISCUSSIONS OF PAPERS READ AT THE MAY 1961 MEETING

RESERVES FOR REOPENED CLAIMS ON WORKMEN'S COMPENSATION

BY

RAFAL J. BALCAREK

Volume XLVIII, Page 1

DISCUSSION BY R. E. SALZMANN

Mr. Balcarek has presented a very interesting and thorough study on Reserves for Reopened Workmen's Compensation Claims. He is to be commended for contributing a paper to the *Proceedings* of the Society on loss reserves because very few papers have been presented on this subject in the past several years. Even though his paper pertains to only a small segment of the general subject, it is a welcome addition to the *Proceedings.*

The author sets forth a sound method of measuring the reopened claim

liability for his company. He develops a probability of reopenings in each of the eight calendar years after the year of closing. He also determines the relative cost of subsequently reopened claims as compared to the average cost of all claims closed in the applicable calendar year. With these two estimates of frequency and average cost, it is then a simple matter to calculate the reopened claim liability as of any year end.

The liability thus computed is an aggregate figure for all incurred years. Because of Schedule P requirements, this reserve needs to be subsequently allocated by policy year and incurred year. It therefore would be a desirable refinement if the same method could be applied in a manner which would produce reopened claim liabilities by incurred year (or policy year), thus leaving only a two-way split in the final computation. For Schedule P coverages it is always worthwhile to determine whether it is feasible to establish reserves by incurred year directly rather than as a portion of a total calculated figure. It would appear that Mr. Balcarek's method would lend itself to this treatment.

Mr. Balcarek's method satisfactorily answers the three questions which I believe should be asked of any loss reserve formula. These three questions are:

(1) Is it logical?
(2) Does it fit the applicable experience of the past?
(3) Will it respond properly to changes in operations or conditions whereby factors in the formula might be affected?

Answering the third question affirmatively is the most difficult test of any formula reserve method. Mr. Balcarek's method meets this test. Reopened claims have been thought to be sensitive to two particular items. One is unemployment and the other is the company's procedures for closing claims. The effects of *changes* in these items must be properly evaluated and provided for in the formula. The author accomplished this by first studying the correlation of reopenings with unemployment and found that there has been no significant correlation since the beginning of World War II. Assuming that extremely high unemployment rates are a thing of the past, the author was able to disregard this item in his formula. Mr. Balcarek provided for the second item by basing the probability of reopenings on the number of claims closed.

Because the reserve for reopened claims is a relatively minor part of the total loss reserve liability, it is important to emphasize simplicity. It is likely that a simpler method could be developed using dollars rather than frequency and average cost. To investigate this possibility, it would be necessary to make correlation studies of frequency and average cost. Due to the very low frequency involved, considerable fluctuation occurs in both the frequency and the average cost of reopened claims from year to year. Under these circumstances, it would be of particular interest to determine whether any significant correlation exists. If the correlation is negative, a simpler method, relating reopened loss volumes to losses paid on closed claims, should be studied and the results of the two methods compared.

The above comments pertain directly to the method described in the paper.

There are a few other items that were not fully covered in Mr. Balcarek's paper which I believe to be pertinent.

First, it was mentioned in the paper that "most companies make the reserve for reopened claims a part of the reserve for Incurred But Not Reported Claims." Although this may be a true statement, it implies that such a procedure is proper. Actually the liability for reopened claims should be included in column 1 of page 9 of the annual statement—"Adjusted or in Process of Adjustment." Column 4 on page 9 is limited to an estimate of claims not yet reported or known to the company. It is my belief that the assignment of reserves to column 1 or 4 is perhaps of no material consequence, because it is the accuracy of the total reserve in column 5 that really counts; nonetheless, it is well to point out that the reopened claim liability is not a segment of the INR liability—whether or not it is included in column 4—and thus its measurement should be quite independent of the measurement of INR liability.

Second, it should be noted that the method proposed in the paper could be adopted by other companies but not the specific formula or the relative cost values. These are only appropriate for the author's company. Reopened claim statistics vary from company to company depending upon claim closing practices.

The third item that should be pointed out is that the need for a separate reopened claim reserve exists only for those companies which use individual case estimates in compiling their aggregate loss reserves. Because individual case estimates provide for *reported and open* loss reserves, additional reserves for reopened claims—and another for additional payments—are necessary to make up the total liability for reported claims. For companies using a formula basis to measure their reported loss liability, the entire liability is provided for in the formula. The elimination of coding and recording reopened claim data is one of the several advantages of the formula reserve method.

In conclusion, Mr. Balcarek's paper will add to the somewhat meager reference material on the complex subject of loss reserves in our *Proceedings*. It is hoped that this paper will stimulate interest and encourage others to present papers on other facets of loss reserving techniques.

A STUDY OF THE SIZE OF AN ASSIGNED RISK PLAN

BY

FRANK HARWAYNE

Volume XLVIII, Page 9

DISCUSSION BY P. S. LISCORD

"What can be expected as the normal size of the New York Automobile Assigned Risk Plan?" Mr. Harwayne attempts to answer this question by reducing the acceptance or rejection by underwriters of automobile risks in the

State of New York to a consideration of the accident records over a three-year period. He further reduces this criteria to an examination of bodily injury claim frequency by classification, assuming 50% of such a figure as involving fault on the part of drivers. From this base, he then determines the percentage of drivers free of liability over the three-year period, and compares this with the percentage of business voluntarily written. The resultant ratio and its relation to unity indicates whether or not the number of assigned risks is greater or less than can be expected.

Mr. Harwayne's study shows, at least for the first half of 1959, that the size of the New York Assigned Risk Plan was about normal. Furthermore, it shows a disproportionate share Class 2 drivers in the Plan. Since the period measured is before the introduction of the new crediting procedure for writing Class 2 risks voluntarily, this is not surprising.

As Mr. Harwayne points out, the result is only a rough estimate and subject to criticism on various scores, particularly concerning some of his basic assumptions. However, there is only one point on which I would like to comment. This has to do with the relative lack of responsiveness of the final index. In this respect a relationship of the number of assigned risks to the number of accident-free drivers as derived from the number of claims might prove more responsive.

While the general introduction of safe-driver plans in the State of New York has all but reduced this particular approach to an academic exercise, the technique outlined is worthy of study particularly on the part of students and prospective actuaries and as such is a welcome addition to our *Proceedings.*

COSTS OF HOSPITAL BENEFITS FOR RETIRED EMPLOYEES

BY

MURRAY W. LATIMER

Volume XLVIII, Page 13

DISCUSSION BY A. D. PINNEY

Mr. Latimer has presented to us his detailed analysis of a specific request from a large company to give them an estimate of the cost of providing retired hospital benefits for their employees, and more specifically, to provide for the advance funding of these benefits similar to the approach used for their pension program. This is neither a theoretical study being offered by the author as the best solution to a major current problem, nor is it merely a statement for the record of something commonly being done in the industry since, to my knowledge, no company has used this particular approach.

It is, instead, a case study from which a great deal can be gained, particularly since it has been so thoroughly and painstakingly prepared. For example, one cannot read this paper without being aware of one of the major

problems in the Accident and Health field, that of not having enough refined statistics; especially on retired employees.

Mr. Latimer presents in great detail his study of inflation in hospital care costs and the increased utilization of hospitals for retired employees. This analysis was necessary because of the drastic effect these trends have on ultimate costs for the employer. The result of the 8% arithmetic annual increase for hospital costs and utilization used in his calculations increases the minimum cost per active employee nearly three times. But aside from this the basic trend information should be of real value to anyone interested in developing proper rates for retired employees irrespective of whether they use the prefunding approach as described in this paper or one of the more conventional aproaches. Many of us will find this data valuable to use as a comparison with the results of our own studies.

Actuaries not concerned with pensions will be impressed with the involved symbolism needed to handle the many variables such as interest, turnover, mortality, inflation in salaries, inflation in medical care costs, etc. Further complications arise from the funding method to be used. Mr. Latimer used the common "Entry Age Normal" approach in which a past service liability and a future service liability are recognized. Other funding approaches could have been used, but it suffices to say that they all aim at the same objective, namely, the availability of the funds when they are needed.

Mr. Latimer makes clear that determining future hospital costs is far more uncertain than determining future pension costs, and that, in all probability, revisions in the initial estimates will have to be made from time to time. This entire question of uncertainty as to future costs should be of much concern to a company trying to decide whether or not to provide hospital care for its retired employees, but once that decision is made, this uncertainty should have little influence in determining the approach to be used. This is because the size of future costs should be of just as much concern to a company whether they are using a funding method or the more common one year term coverage.

Now, it seems to me, one of the big advantages of the funding approach described by Mr. Latimer is that it does this automatically and the employer is made immediately aware of what the future costs of adding retired hospital coverage will be. This is not the case with one year term coverage since the employer only sees the costs year by year and, if he is to see what lies ahead for him, a separate study must be made. If this isn't done he could be greatly deceived, because even though a one year term plan for future retirees costs very little in the beginning, the costs mount steadily for years to come. And since a benefit of this type would be quite difficult to drop once it has been initiated, present management would, in effect, be saddling future management with the problem of meeting the costs of their decisions. Moreover, it is considered proper accounting to charge the costs of the re-

tired benefits over the active working lifetime of the employee. A prefunding approach does this.

Mr. Latimer also points out the greater administrative and actuarial complexities involved in a pension plan approach, particularly if any part of the plan is on a contributory basis. This is certainly true, but that in itself should not discourage us from giving his method serious consideration. If we are to successfully prevent the Government from assuming full responsibility for the medical care of retirees, then one of the things we must be able to do is to provide these employers with satisfactory methods of meeting retired costs. I believe Mr. Latimer has given us an assist in that direction with this timely and important paper.

DISCUSSION BY R. J. MYERS

Mr. Latimer is to be congratulated on his presentation of a very interesting case study in the field of hospitalization-benefit cost estimating. This paper serves the unique function of permitting one to peer inside the actuary's mind as he develops cost assumptions from limited data—both as to the specific plan itself and as to other programs providing similar benefits—before he applies these assumptions to more or less standard actuarial formulas for computation purposes. It will, of course, be recognized that the title of the paper implies a far broader scope than is actually the case, since it deals with a single specific plan and not an analysis of the situation for various programs that would provide hospital benefits for retired persons. Nonetheless, certain of the analysis made in regard to the underlying assumptions is of significance in considering the broad general subject.

I am particularly interested in this paper because of its relationships with, and implications for, the cost estimates that I have prepared for the Administration's health-benefits proposal, which incorporates only hospitalization and related benefits. This proposal is set forth in legislative form in bills introduced by Congressman King of California and Senator Anderson (H.R. 4222 and S. 909, respectively). The provisions of this proposal and the underlying cost estimates are contained in *Actuarial Study No. 52* issued by my office, except for the fact that Secretary Ribicoff in his testimony before the House Ways and Means Committee recommended that the earnings base for OASDI purposes, which is involved in part of the financing of the health-benefits program, be raised from the present $4,800 to $5,200, rather than only to $5,000 as in the introduced bills. This change would be necessary to finance the program sufficiently according to my estimates. For further details on this matter, see my paper "1961 Amendments to the Social Security Act" in the 1961 volume of the *Transactions of the Society of Actuaries*.

My cost estimates for the Administration proposal can be summarized by the statement that the level-cost is estimated at about ⅔% of taxable

payroll. Of perhaps prime interest to me in reading Mr. Latimer's paper was what cost (in terms of payroll) he would derive for the plan that he was studying. No doubt many other people are interested in this particular aspect because there is a considerable difference of opinion about the cost of the Administration proposal (some critics have stated that the cost will actually be at least twice as high as my estimates). Despite the fact that there are many differences in the underlying covered populations and in the provisions of the plans, nonetheless it is possible that some individuals may compare only the resulting final costs; so let us turn to this matter first and then subsequently analyze the reasons for the differences.

The conclusion of the paper is a recommendation that the proposed hospitalization-benefits of the particular plan should be financed by a contribution rate of 3.15%. This figure is almost 5 times as high as my estimate of the cost of the Administration proposal, which would certainly lead one to wonder about the reliability of the latter. Let us now see what causes this great difference.

In the first place, the 3.15% figure arises under the assumption that the past service liability resulting from the initial covered group (including pensioners), who did not have contributions made with respect to them during their entire working time, would be amortized over a 30-year period. If this is done, then following the 30-year period the contribution rate would be decreased to about 1.3% of payroll. To put it another way, if—as is quite proper in a social insurance system—the unfunded accrued liability is never funded, but rather only interest on it is payable, then the long-range level-cost comparable to 3.15% of payroll would be about 2.4% of payroll. However, this is still far in excess of ⅔% of payroll.

Another factor of importance is the difference between the provisions of the plan that Mr. Latimer studied (hereafter referred to as "the Latimer plan") and those of the Administration proposal. In some respects, the Latimer plan is more costly because it has a higher maximum duration (120 days vs. 90 days), because it has no deductible provision (in the Administration proposal, $10 per day for the first 9 days of hospitalization, with a $20 minimum), and because benefits are furnished to disability pensioners under age 65 and their wives. On the other hand, the Administration proposal is more costly because it applies to all insured persons aged 65 and over (not merely to those in this group who have retired), because it provides benefits for widow pensioners (not merely to wives of pensioners as long as the primary pensioner survives), and because it provides certain auxiliary benefits such as skilled-nursing-home care, hospital-outpatient-diagnostic services, and home-health services (certain of these benefits and others of a like nature are included in the Latimer plan but were not considered by him in the cost estimates). It is difficult to say, in balance, which of the plans is the more costly. I would guess that there is not too much difference in cost between the provisions of the two plans.

Another important element is the age composition of both the initial group of pensioners and the existing group of active employees on whose payroll the contributions are to be made. Initially, the cost burden would seem to

be somewhat less for the Latimer plan than for the Administration proposal since the ratio of eligibles to active employees is about 16%, as against a corresponding figure of about 23% for the Administration proposal. Of more importance, however, is the fact that the active employees covered under the Latimer plan have an unusually old age distribution—with peak coverage in the age group 40-44, as compared with a corresponding figure of 25-29 for the general labor force. In fact, as Mr. Latimer points out, the active employees under his plan are quite apt to decline in number in the future, whereas the covered group under OASDI is anticipated to increase significantly in the future in line with general population trends. In balance then, it would seem that a considerable portion of the difference in the cost estimates arises because of the unusual demographic structure under the Latimer plan.

We are now led to examine the basic underlying cost assumptions for further light on the differences in the cost estimates. Two basic elements are involved—hospital utilization rates and average daily hospital costs.

As Mr. Latimer points out, data on hospital utilization rates among aged persons are rather sparse and incomplete. His assumptions are based on experience under insurance plans and not that obtained from surveys. Admittedly, the latter sources of information have certain limitations, but it seems to me that much of value can be obtained from them when they are properly used and adjusted for such factors as (1) not all individuals surveyed having benefits as freely available as if they had insurance and (2) the significant extent of hospitalization used by decedent, who normally are not included in surveys. Moreover, surveys such as those that have been conducted by the U. S. Public Health Service are based on a far greater amount of data than some of the limited studies of insurance experience that Mr. Latimer mentions.

Mr. Latimer first derives an average duration of hospitalization (spread over all pensioners and not merely over those who are hospitalized) of 3 days for males and 2½ days for females, based on the maximum duration provision being 120 days. A 90-day maximum, as in the Administration proposal, would reduce these averages by about 1½% relatively. These average durations are comparable with the corresponding figures in the cost estimates for the Administration proposal—namely, for both sexes combined, an average of 2.5 to 3.0 days in the initial year of operation.

Mr. Latimer then goes on to adjust the average hospital utilization rate for males to allow for the fact that he is dealing only with retired persons; the experiences generally relate to working and retired persons combined (as does the Administration proposal). His adjustment for this factor is about 15%. This seems to be too great an adjustment based on (1) his assumption that hospital utilization by those employed is only 75% of that of those who have retired and (2) the fact that pensioners aged 65 and over represent 81% of the total of aged pensioners and active employed persons aged 65 and over (and this proportion will increase in the future). Under such circumstances, the adjustment should be 5%.

Mr. Latimer next increases his assumed average hospital utilization to al-

low for a higher assumed utilization by disability pensioners. No experience is available as to hospital utilization by disability pensioners. Mr. Latimer assumes that such utilization can be obtained by rating-up the pensioners involved in accordance with their higher mortality. As a result, most of his disability pensioners (including those beyond age 65, who continue to be so classified) have an assumed utilization rate of almost 8 days per capita (with very few having less than 6 days per capita). It cannot be stated for certain whether or not this is a reasonable assumption, but it should be noted that some people believe that disability pensioners will have hospital utilization of about the same order of magnitude as for all aged persons combined (see page 79 of report "Hospitalization Insurance for OASDI Beneficiaries," referred to by Mr. Latimer in his footnote 8).

As a result of the assumed higher utilization for disability pensioners, Mr. Latimer raises his average days of hospitalization for primary pensioners to 3.9 days per year, while retaining the figure of 2.5 days for wives. The latter figure tends to be relatively low because wives are covered for hospital benefits only while the basic pensioner is alive and, therefore, tend to be younger on the average than the total aged female population.

Mr. Latimer derives an average daily hospitalization cost of about $29 for 1960 and adds to this a 9% loading for administrative expenses, making a total of about $31.50. This is virtually the same as the first-year cost figure used for the estimates for the Administration proposal—namely, $32.

Next, Mr. Latimer examines possible future trends of utilization and costs. Admittedly, this is a very necessary procedure when making cost analyses for hospital-benefit proposals, but it should be recognized that it is fraught with dangers and uncertainties. Mr. Latimer perceives this and examines a wide variety of theoretical possible trends. Some of these, however, seem even more unlikely than the assumption that present utilization rates and costs will continue unchanged in the future, which he discards as being unjustifiable (but more on this later).

In considering future trends of utilization rates and costs, Mr. Latimer after examining past experience (primarily in regard to average daily costs) makes certain assumptions as to future increases, which he takes to be on a simple-increase basis rather than on a compound-increase basis. These range from an annual increase of 7% to 9% of the first year cost indefinitely into the future, after combining the two factors of daily cost (which accounts for most of the increase) and utilization. If these assumed flat increases are measured against each specific year's average daily hospital cost, the relative increases for the intermediate figure of 8% would, of course, begin at 8% and after 12 years would be down to 4.1%, and then after another 12 years would be down to 2.7%, et cetera.

Next, in order to offset the anomaly resulting under the foregoing basis of ever-increasing hospitalization costs, Mr. Latimer makes the assumption that there will be several alternatives involving decreases in the flat increases previously assumed. To a certain extent this is a reasonable procedure, but when carried out to extremes, as Mr. Latimer recognizes, this results in average daily hospital costs increasing for a number of years to a peak and then

decreasing until eventually not only becoming lower than present-day costs but also becoming negative. In the final results presented by Mr. Latimer, this theoretical hypothesis was not used.

Finally, Mr. Latimer recognized what he might well have done earlier—namely, that hospital costs in monetary terms is not the significant element, but rather hospital costs in relation to general wage trends. This is important because the contribution rate derived to finance the program is based on payroll. Recently, hospital costs have risen at a rate of about 7% annually; this fact should not be considered alone, but rather in conjunction with the 3% annual rise in the general wage level, so that the net cost effect is only 4%. As indicated in *Actuarial Study No. 52,* the cost estimates for the Administration proposal assumed that this gap would be gradually reduced in the next few years and that the total net effect, before there would be a "catching up" of hospital costs with the general wage level, would be a 14% cumulative increase. Mr. Latimer's final estimate is based on a simple increase of 8% annually for hospital costs and of about 4% for covered payroll, so that the net effect is about 4%. This increase is continued indefinitely into the future and is undoubtedly one of the major reasons why his costs are so much higher than those I made for the Administration proposal.

A vivid example of the effect of this element of assuming continuously increasing hospital costs and utilization is that Mr. Latimer estimates a cost of 1.24% of payroll under 30-year amortization of past service costs if there were to be no increase of utilization in the future and if the hospital costs were to rise no faster than general wage levels. This cost would be only about .9% of payroll if there were no amortization of past service costs. Mr.Latimer, however, states that he believes that such figures are unjustifiably low and inadequate.

In summary then, where does this leave us? Mr. Latimer has derived hospital-benefit costs that are almost 5 times as high as those underlying the Administration bill. A considerable part of this difference is properly explained by differences in the plans and in the compositions of the covered groups involved. Nonetheless, it must be recognized that there still remains a significant difference in the cost estimates that arises from the assumptions made as to future trends of hospital utilization and of hospital costs relative to general wage levels. I believe that my estimates underlying the Administration bill are based on reasonable assumptions, but quite obviously these are not the only reasonable assumptions possible. Certainly, one cannot say that such an eminent authority as Mr. Latimer, with his long experience in the social-insurance field, does not know whereof he speaks or that his assumptions are completely untenable. Perhaps—as I remember Mr. Latimer saying years ago—it will only be possible to know the experience under a new type of social insurance program after it has been enacted and after several years of experience are available. Finally, it would be of interest to hear from Mr. Latimer what his views are on the cost estimates for the Administration plan.

FITTING NEGATIVE BINOMIAL DISTRIBUTIONS BY THE METHOD OF MAXIMUM LIKELIHOOD

BY

LEROY J. SIMON

Volume XLVIII, Page 45

DISCUSSION BY M. BONDY

LeRoy Simon's paper deals with two statistical concepts which have lain just outside our door for many years but with which most of us Actuaries have not, until recently, been familiar.

The now popular Negative Binomial Distribution brought to us by Frank Harwayne and developed lucidly by Lester Dropkin has been lying around for how many years this reviewer does not know. We now wonder how we have gotten along without it.

LeRoy now brings us, for what I think is the first time in our literature, the method of maximum likelihood. This method was developed in two papers by R. A. Fisher in the early 1920's, and A. M. Mood says of it "Thus Fisher virtually solved the whole problem of point estimation in these two remarkable papers."

Now that this tool is before us it may well turn out to be one of the most useful we have. The author has suggested a use in determining parameters of truncated distributions; for example, those resulting from a study of individual company records of insureds having claims against them. This is applicable to the reviewer whose company maintains policy histories only on those insureds who are not claim free. This has been considered by my company to be the most efficient method of handling the policy history problem.

It may be that common use of this tool by actuaries as well as interchange of findings may take the underwriting function a bit further off the "seat of its pants" and onto a somewhat more scientific basis. Does not the refined classification scheme brought about by our recent Auto Merit Rating Plans work in this direction?

Who knows what other already discovered answers to our problems lie just beyond our rather short grasp? We have, as a professional Society, been, it seems, too preoccupied with the solution of problems within our own area by means familiar and comfortable to us. We have not been willing to venture into the neighborhood camps of Game Theory, Operations Research, or other possibly fruitful kindred fields. Perhaps a permanent "Fishing Expedition" or "Basic Research Committee"—or call it what you will—functioning under the aegis of the C. A. S. would help us collectively to discover what is before our eyes in less than forty years.

Incidentally, LeRoy Simon is to be commended for a thoughtful job which entailed not only the use of some rather advanced mathematical techniques (at least from this worm's-eye point of view) but also a good deal of dull, soporific arithmetical calculation which is the bane of every Actuary.

REPORTS OF THE SEMINARS HELD AT LAKE KIAMESHA, NEW YORK AT THE 1961 SPRING MEETING OF THE SOCIETY

CURRENT PROBLEMS IN COMPENSATION INSURANCE

(Summation by Russell P. Goddard, Actuary, New York Compensation Insurance Rating Board)

In order to provide some basis for discussion, a list of current "problems" had been prepared in advance, divided into two main categories, those which we, as actuaries, might be able to do something about, and those which might be interesting to talk about with no action expected.

The first session devoted its time to the first category, concentrating largely on means of handling risks under $500. These risks produce comparatively little premium, but create annoying statistical problems. In New York, for example, the risks under $500 constitute 85% of the total number of risks, but develop only 15% of the premium. A new law, effective in 1962, extending coverage to employers with one employee, is expected to add 50,000 new policies to the 400,000 already in existence. Although doubt was expressed as to the accuracy of this estimate, the problem of auditing and preparing unit reports on small policies still remains.

No explanation was offered as to why there has been so little mechanization of unit reporting, even by companies well-mechanized for other lines, but the suggestion was made that some companies which do not have punch-card equipment might make use of the computing typewriters, of which there are several on the market, to provide either the unit reports themselves, or paper tapes from which unit reports could be prepared. It was agreed, in any event, that we could not look forward to complete mechanization in the foreseeable future, and it would be necessary to allow the option of preparing reports either by hand or machine.

Some interest was expressed in the use of the Schedule "Z" method for reporting small risks, or, what amounts to practically the same thing, of the submission of a listing of payroll and loss items from which the rating organization could prepare its own Schedule "Z". It was pointed out that some of the refinements of the present rate structure, such as loss constants varying by industry group, would have to be sacrificed if bulk statistical methods were adopted.

There seemed to be considerable sentiment for a greater use of per capita policies on small risks, to avoid both statistical and auditing problems. It was suggested that a head-count be substituted for payroll up to three employees. However, the question of how to maintain equity in borderline cases was left unsolved.

Inevitably, the three-year fixed rate program for small risks came in for discussion. This program has apparently not achieved the popularity expected of it, either with the buying public or the insurance companies, and the opinion was expressed that it might do better if installment payments were permitted.

To sumarize this session, there appeared to be a general willingness to do something about the small risk problem, but the consulting actuaries were willing to go further than the company men.

In the second session, devoted to problems which we didn't expect to be able to do anything about, attention was turned to the "fragmentation of the Bureaus" which has affected other lines, and the Compensation actuaries asked "Can it happen to us?" They also asked "Do we want it to happen to us?" The general impression which was conveyed was that the Compensation men within the companies have no particular desire to copy present practices of the Automobile field, and that the Automobile men are too busy with their own problems to do any missionary work on Workmen's Compensation. The slightly less restrictive climate of Illinois and Rhode Island, particularly as respects experience rating, was discussed briefly, but there appeared to be no great desire among those present to extend this atmosphere to the rest of the country. One or two men felt that a "no prior approval" law might be helpful in obtaining rate increases, but shuddered at the disruption which might be caused by "subsequent disapproval."

One member expressed the opinion that the strict regulation of Workmen's Compensation had supported certain ratemaking "crudities" which a system of free and open competition would soon erase. At the word "crudities," ears were pricked up and eyebrows raised all over the room, but no tempers flared, because old-time Compensation men, who had long been hardened to accusations that their rating systems were too refined for their own good, could find an accusation of crudity amusing, but not annoying. The accuser was allowed to explain that one crudity, in his opinion, was the use of payroll beyond that required to produce the weekly benefit. The more orthodox members explained that this crudity was offset by other crudities, such as the experience rating plan and the retrospective rating plan, and that we had planned it that way.

Speaking generally, the members showed no particular fear of relaxation of regulation, or any especial desire for it.

RATE MAKING FOR PACKAGE POLICIES

(Summation by LeRoy J. Simon, Associate Actuary, Insurance Company of North America)

The seminar opened with the statement of an objective for the session: "To have an open discussion of how rates *should* be made for a package policy when it has reached the state of mature development with a large volume of information available."

After outlining our ground rules, we went directly into a discussion of the difference between the Homeowners package and the commercial package. The Homeowners is a large total volume of business with many, many relatively homogeneous units. This is not the case with commercial packages such as motels, apartments, stores and so forth. They won't be so nicely

homogeneous. The liability premium, for example, might be 10% of the total premium on one policy; and on another policy in the same type of package, the liability portion might represent 70% of the premium. This is definitely going to have an effect on the rate making.

There were three principal schools of thought on how information should be collected and, therefore, on how rates might be made. The first one was to send all the premiums and losses back to the lines and classes from which they originally came; and maybe also be able to identify the package figures by some special overall line code. The second system was to keep rate making information for packages in five broad categories. Category A would be property insurance for the mandatory coverages or the core of the package; or perhaps mandatory or core coverages, excluding some unusual hazards. Category B would be property insurance not included in Category A. Category C would be liability insurance again for the mandatory or core coverages for the package, again possibly excluding unusual hazards. Category D would be the rest of the liability insurance and E would be the comprehensive crime coverages. The third system for keeping track of the experience and hence guiding the rate making in the future would be to keep virtually no detailed rate making information except on an overall loss ratio basis for the package. This was referred to as analogous somewhat to the fire approach.

A statistical plan was outlined by one company which had been operating in the commercial package field for some time. The plan involved the following features:

(a) There was a major division of premiums between Property Insurance (fire, EC and V&MM) and Liability Insurance (BI, PD and Med Pay).

(b) The Property Insurance premium was broken down into buildings, contents and earnings.

(c) The Liability Insurance premium was broken down into the basic policy exposure with additional codes for restaurants, gift shops, swimming pools and so forth.

(d) A construction-protection code was used.

(e) A type code allowed the year-round, non-resort type of motel to be differentiated from the seasonal and primarily resort type.

(f) An exposure code grouped the motels into 0-10 units, 10-20 units and so on.

Another company also had a plan that was similar to this. A third company coded the information back to the original coverages which made up the package.

Referring to Homeowners rating history, it started as a sum of components and remained this way for some time. As component rates changed, so did the Homeowners rate change. In 1957 at least one company swung over to using the Homeowners experience to set the Howeowners rates. The natural question is, "Will commercial packages follow the same pattern, and what will be the deterrents to it doing so?" It was agreed that the experience under the package would be different from the non-package business. There was

considerable doubt if there would even be a large enough volume to really make rates for any given package. Also, there was the fact that the fire peril in these commercial packages, is on a schedule-rated rather than the simple class-rated basis we had in Homeowners. This certainly is going to create a difference that might be a deterrent to putting rate making in the package on its own basis. Two important features that couldn't be discussed too thoroughly were reinsurance problems and the catastrophe problem. This latter question arose in connection with rate making for all the property coverages as a single unit. The presence of a hurricane in two years would distort the figures, so would the absence of a hurricane in two years distort the figures. The same catastrophe problem arose in the experience rating area also. It appears that experience rating is applicable to the liability portion of the commercial package policy and the question arose as to what it is going to do to the total package.

We just touched on certain phases of the indivisible rating problem—such as state taxes and reinsurance. The area of completely divisible rating raised problems of excessive cost of handling, difficulty in expense allocation, the loss of vital information from mixing with non-package business. Cause-of-loss coding seemed essential as a minimum requirement, regardless of what type of a system anyone favored. Accident year records on the losses seemed to win the most approval, with calendar year a rather weak second. No one talked about a policy year approach. An interesting discussion centered around reporting premium and exposure data in sparse detail, and then using sampling techniques to get specific details. Losses would be recorded with care, in detail and by cause. This is untested as yet, and offers an interesting area for actuarial investigation. One company has found that sampling techniques in insurance are difficult to use statistically.

An important part of the seminar was the rules under which it operated. It was hoped that with these rules we would get a free and easy exchange of ideas and viewpoints. They were as follows:

1. The chairman has all the problems and no special privileges.
2. No lectures.
3. Do not speak to the chairman—speak to the person farthest away from you in the room.
4. We are not primarily going to discuss current practice or currently proposed procedures, but they may be referred to as starting points.
5. You may *not* be quoted by anyone—be candid, open, frank.

At the conclusion of the seminar, it was decided to rewrite the seminar rules in light of the experience gained. With due deference to George Orwell and the *Animal Farm,* the revised rules are as follows:

1. The chairman has only a few special privileges.
2. No lectures from the floor.
3. Do not speak to the chairman except to ask his advice.
4. We are not primarily going to discuss current practice of the chairman's company, but it may be referred to as a faultless system.

5. Be candid, open, frank, in telling the chairman your future plans.

To be serious for a moment in closing, package policies are new; they are unique; they're different from the sum of their components in both loss and expense elements. We must do our best as actuaries to recognize this and act on it. I think we have to ask ourselves, "Are marketing methods, statistical plans, and rate making procedures for package policies being formulated in such a manner that we will be doing our very best for the insured, or will we fall significantly short of this ideal?"

Question by Mr. Berkeley: I wonder if the seminars arrived at any conclution as to how rates might be made for motel policies? The Inter-Regional Actuarial Committee which has that problem right now would like to know if you did find a solution.

Response by Mr. Simon: Well, I think if we had to vote on some of the different cases that I've talked about here, that probably the majority of people would favor the system of recording statistics in the A through E categories that I enumerated. There would be good minorities in what I call the fire system camp of no detail; and I'm sure that there would be a good minority in the put-it-back-to-the-original-components camp, too. I think that the accident year system would be favored by most people. Again, the fire people would say that you do not need this for the fire part if you're going to make rates separately there. The liability experts have been accustomed to the accident year basis for rate making and hence voiced no objection to its use in motels.

ACCIDENT PRONENESS

(Summation by Ernest T. Berkeley, Actuary, Employers' Group)

As Bill Leslie has just pointed out, this is one of the two non-actuarial subjects that were taken up at the seminars yesterday afternoon. Judging by the interest shown by the seminar participants and the lively discussion that took place, I think the experiment was a complete success.

Since actuarial chairmen are not supposed to know anything about non-actuarial subjects—and I certainly fall in that category—I took the precaution of asking Dr. Leon Brody to come to the seminar to make some opening remarks and answer questions. Dr. Brody is the Director of Research at the Center for Safety Education at New York University. I am very grateful to him for the fine contribution he made and I am sure the seminar participants are too.

In view of the importance of the subject of accident proneness in the automobile field, it was decided to limit the discussion pretty much to that area, although industrial accidents were also touched upon to some extent.

In his initial statement Dr. Brody sketched the dimensions of the accident proneness problem and what might be done about it. The picture is a familiar one to everybody I know, with thousands of persons being killed every year in automobile accidents, millions of people injured and property and related

losses running into billions of dollars. Having in mind that some 90% to 95% of the vehicles involved in accidents are in good condition and also that 70% to 80% of the accidents occur in clear weather and on dry roads, it is apparent that the human element is the principal factor in automobile accident causation.

It has been estimated that there are some twenty-four million people in this country with a physical impairment of some kind and about seventeen million with a nervous or emotional problem where treatment has been sought. If we add to this total those people who have emotional and nervous troubles but do not seek treatment, we arrive at a very impressive total figure.

At this point it might be noted that the driving record of the handicapped person on the average has been found to be superior to the over-all average, due to the development of qualities in the handicapped person that tend to offset the disadvantage of the handicap.

It has been established that the number of chronic accident offenders, that is the repeaters, is relatively small and thus the major portion of the problem is centered in the larger group of drivers who fluctuate considerably in their accident proneness due to the temporary stress of emotion, or stress from various types of problems involving families, finances, etc.

In the teen-ager particularly, accidents may be traced very frequently to rebellion or resentment against authority. These thoughts lead to the conclusion that a personality test of some sort might be devised which would permit the identification of accident-prone drivers and, thereoretically at least, would enable action to be taken by the licensing authorities on the more serious types of cases. Dr. Brody told us, however, that although much effort has been applied along this line, there is no reliable test available today.

He also stated he has concluded that one of the most effective means of accident control is the point system, in effect in about half the states, that assigns demerits for violations and may lead eventually to license suspension or revocation.

In our discussion we explored in varying degrees the points that had been made by Dr. Brody. In addition to what had been brought out before, it was also suggested that tightening of the licensing requirements in certain states where they are now very loose or nonexistent might be helpful in curbing the accident-prone driver. Also, generally it was felt that great care should be exercised to insure the collection of accurate statistics in analyzing various aspects of the automobile accident problem so that proper conclusions might be drawn.

In summary, it seems impossible at this point of time to identify and restrict the accident-prone driver by means of personality tests. The best approach appears to be the point system for violations, supplemented by tighter licensing requirements in some of the states.

MARKETING RESEARCH

(Summation by Laurence H. Longley-Cook, Actuary,
Insurance Company of North America)

The seminar on Marketing Research owed its success to Mr. Seymour Smith, Vice President and Actuary of the Travelers Insurance Company, who had prepared a general review of the subject.

Marketing research may be considered to be the application of scientific methods and procedures in the study of marketing problems to provide management with factual information upon which to formulate executive decisions and policies. Clearly a company cannot usefully undertake such research until it has determined its overall aims which will vary according to its Surplus, Volume and Profit position. For some companies increased growth is desirable, for others, improved underwriting results. Again, in some cases, lower expenses must be achieved before growth is desirable. Without a strong surplus position, too fast a rate of growth is unwise. A stock company's major aim should be to serve its stockholders; and achievement in this field is measured not by growth but by dividends and future dividend prospects. The market measures the combination of these by the value placed on a company's stock. The value of a company with consistently good operating results will stand well above its break-up value while the reverse is true of a company with consistently bad results. Considerations in a mutual company are primarily good policyholder dividend service and growth must be subservient to maintaining a good profit and adequate surplus protection.

Having analysed the companies' Surplus, Volume and Profit position, top management may decide that it should embark on a program of growth, of improved underwriting results, or both. Marketing research is a valuable aid in planning such a program, but it is necessary to consider the potential of the company before starting detailed planning. Has the company the people and the know-how to undertake the development and launching of new products? Personnel who have been used to writing business in lines where there has been no rate competition are generally ill-suited to rate making and the selection of risks under changed circumstances. Companies, like leopards, cannot change their spots.

Marketing research can be applied to the development of new products, sales growth, and many other aspects of business development. For this reason nearly the whole of management is concerned in one way or another with various aspects of marketing research. Consequently, it is generally considered undesirable to establish a single market research department. The broad aims of the company must be established by top management and the various research aspects of each problem can best be studied in different sections of the company organization as is most appropriate.

New products research is an important field of study at the present time, and the usual method of study by questionnaires to a sample group of the public does not prove particularly satisfactory. The public is dismally disinterested in insurance and more often the problem is to determine what can

be sold rather than what the public wants. In commercial and industrial insurance it is difficult even to determine who in a company organization really determines what insurance coverages should be effected. The development of new products is often by a trial and error basis, modifications being introduced step by step as sales experience is gained. This leaves a trail of discarded forms and modified rating plans which is most uneconomic.

For distribution studies there is ample data available on production of competitors, population trends, income levels, etc., which are considered the normal basis for determining the areas of a country which have the most potential for future growth. It is important, however, to consider many other features of each area. In particular the political climate is most important since we are regulated on a state by state basis. Some states discourage the introduction of improved coverages and others may abuse their rate regulation laws.

The classification of business should be an important aid to marketing research, but our statistical plans seem to be invariably keyed to trying to prove that something we did some years ago was right, rather than to developing better rating systems for the future. The use of sampling techniques is coming increasingly into vogue because they can often provide valuable data more economically than is otherwise possible. Sampling involves a number of important technical considerations; and unless such studies are carried out properly, they will not give satisfactory results.

Marketing research is a management tool of outstanding importance at the present time. Such research, if conducted wisely, can contribute greatly to the advancement of a company.

REPORTS OF THE SEMINARS HELD IN CHICAGO, ILLINOIS AT THE 1961 ANNUAL MEETING OF THE SOCIETY

REINSURANCE

(Summation by the Chairman, Paul M. Otteson, Vice President and Actuary, Federated Mutual Implement and Hardware Insurance Company. Co-Chairmen: Ruth Salzmann and Matthew Rodermund)

Objectives and Scope

An appropriate over-all objective was considered to be an attempt to analyze the actuarial phases inherent in the reinsurance operation. (This necessitated a preliminary discussion of the barrier that has separated the actuary from reinsurance so effectively over the years.) The main discussion then started with an analysis of the components of the "total" reinsurance function. Components which relate to actuarial theory and techniques could then be isolated. The "total function" of reinsurance was reviewed briefly. Then the limitation of subject matter to the "actuarial realm" of chance fluctuations was prescribed and the discussion proceeded along the following lines:

a. Stabilization fundamentals and functions
b. Rating problems and tools
c. Basic concepts

Total Function of Reinsurance

An over-all statistical review suggests an inflated evaluation of the relative importance of reinsurance in the over-all insurance operating picture. According to Best's Fire and Casualty Aggregates and Averages (1961), reinsurance premiums compared with direct premiums for certain company categories are as follows:

1960 Premiums (Millions of Dollars)

		Reinsurance	
	Direct	*Ceded*	*(2) ÷ (1)*
Stock	*(1)*	*(2)*	*(3)*
Fire and Allied—100 Std. Rate	887	1,247	140.6%
Grand Total—767 Companies	10,813	5,400	49.9
Mutual			
Grand Total	3,747	562	15.0

Reinsurance volume in total is impressive; however, reinsurance transactions are effected for many reasons:

(a) Stabilization of loss experience is the major purpose of reinsurance.

(b) Much reinsurance represents "division of spoils". A single management group can use this device to allocate or distribute premium income or costs (through commissions) among a number of companies that are joined together by common ownership or other ties.

(c) There is an accounting peculiarity that commissions are considered as earned entirely at the *transaction date* while the *written* premium is considered earned on an amortized basis. This makes it possible for companies to influence temporarily their operating gain or loss through commission types of reinsurance. The commission charge or credit can be registered in a year *other* than the year in which the major portion of earned premium amortization affects the operating results.

(d) Technical services in underwriting or claims adjustment sometimes represent an ingredient of the total reinsurance service.

The last three functions were reviewed so that they could be identified. The balance of the sessions was spent in a discussion of what was considered to be the "actuarial realm"—the stabilization of loss experience.

Stabilization Fundamentals and Functions

The stabilization function of reinsurance was the prime consideration of these sessions. As a prelude, three axioms were considered as basic to a comparison of cost versus value of reinsurance protection:

1. There is no element in reinsurance transactions to change or improve the income versus outgo relationship between policyholder and the direct insurer. The 100¢ dollar paid by the policyholder is all there is or ever will be.
2. The division of the premium dollar must favor the accepting company in order to cover its expenses plus an expected profit.
3. Reinsurance contracts are cancelable both ways without penalty or retribution. Reinsurers ordinarily do not furnish long term level premium insurance protection such as is found in life insurance or non-cancelable accident and health primary coverage.

The loss stabilization objective should be to cause:

$$\frac{A}{E} \rightarrow 1.00$$

Such objectives and axioms may well be at variance with reinsurance contracts we are familiar with. This was intentional. These simple truths indicate that there is no basis for reinsurance contracts which in essence insure rate level adequacy or general underwriting capability.

When reinsurance is negotiated by line of business, there is no balancing of events which provides the opportunity of offsetting the unusually good of one line against the abnormally bad of another. Likewise, when reinsurance is negotiated by company where the individual companies are controlled through a single management group because of cross ownership or other reasons, there is no opportunity of offsetting good results in one company with abnormally bad in another.

Effective stabilization as a principle must involve a total concept of offset of unusually good against unusually bad.

Rating Problems and Tools

As the biggest actuarial challenge seemed to exist in excess of loss and excess loss ratio contracts, the discussion was limited to these two types of reinsurance contracts.

Two possible viewpoints on rates or price were introduced. The ceding company is interested in the price in relation to stabilization need, or the probable and possible variations from normal experience. The accepting company is interested in price or rate from the viewpoint of the mathematical loss expectation. The discussion was designed to relate to both viewpoints.

Actuaries are accustomed to think in terms of composite experience and manual rates. Private passenger auto class 1A composite experience may not be completely homogeneous because of variations in underwriting standards but it is sufficiently so as to make it valuable in predicting losses.

The reinsurance situation is different because in fire and allied lines particularly it is extremely difficult to find an exposure base that is homogeneous to any practical extent.

The actual rating of a reinsurance contract reduces itself to experience-rating the risk, but in a reverse pattern to the experience-rating procedure as we know it. It is not a measure of how far an insured's rate should vary from average, but how far an insured's rate should vary from its actual experience.

The rating of an excess of loss contract can be appreciated more by observing the true purpose it serves. The reinsured, or direct writing company, wants its balance sheet to absorb only the first X dollars of every loss or occurrence, thereby assigning 100% credibility to this portion of its losses. For excess losses, however, the company does not want 100% credibility each year and therefore effects reinsurance so that its excess losses will be "averaged" from year to year.

Premiums have been used extensively as an exposure base. This presents certain technical difficulties because of changes in the pure premium portion of the rate for a single company over a period of time, and variations among different companies for any prescribed period. Changes or variations in expense loadings or in practices concerning "policyholders' dividends vs. net rates" can produce these distortions.

The consideration of losses themselves either in total or else up to some truncated valuation figure was suggested as an improvement.

It is difficult to know if the primary experience of different carriers is homogeneous to a sufficient degree to permit combination. One suggested test was to compare the xth largest loss. Experimentation concerning this approach has not been made, but analyses in direct experience indicates that it may very well prove to be a worthwhile rating tool.

The use of the mean or standard deviation of loss ratios was also introduced as a potential tool for rating or testing homogeneity in excess loss ratio contracts.

The most useful measurement of exposure, however, for a single company or a comparison of companies is the analysis of total claim cost by size of claim. This analysis will permit the primary carrier to assess loss stabilization

needs and it will permit the reinsurer to evaluate mathematical expectation at various levels.

A Table M approach to a measurement of total variation between actual and expected losses may be useful under certain conditions. This approach involves developing a ratio of losses produced by excess of actual over normal loss ratios to an exposure measure such as total premiums.

A common practice, in reinsurance circles is to expect that future experience (to be stabilized) will approximate the average loss ratios for the past five years. This approach is erroneous because it fails to recognize trend. *When sufficient data are available,* the use of a least squares trend line to replace the straight five-year average will produce a more accurate prediction of expected losses.

When sufficient data is not available for a trend line, an extrapolation of five year moving averages may be the next best alternative.

The idea of a monetary value assigned to "degree of variability" as contrasted with "mathematical expectation" was introduced. Ceding companies at least will be willing to pay more as the degree of variability increases.

Basic Concepts

Reinsurance protection may relate to unfavorable events that have *never* happened, that have *seldom* happened, or that happen *often* but with some degree of variation. Concerning the last mentioned type of event, a fourth reinsurance axiom might be added:

> "A normal amount of abnormal losses is not an abnormal situation and therefore is not a reinsurable hazard."

The exposure of a company may be such that 100 claims of $25,000 amount, or $2,500,000 in total, is the normal, expected experience for claims of this size. This, then, is not a reinsurable hazard. Also, it is of no consequence as to whether these claims are from a single line of insurance or a composite of many lines.

The aggregate idea permits the balancing of unusually good as an offset to unusually bad, without getting involved in the problem of reinsuring rate adequacy or other non-reinsurable elements that affect total loss ratio.

Considerable discussion in one of the sessions involved the question of the extent to which the value of reinsurance is reduced through the rigid application of experience rating on a total loss ratio concept basis. If losses will eventually have to be paid by the primary carrier, the question of value of "spread" or delay is pertinent. These "buy now—pay later" plans were considered to have little actuarial significance.

Finally, the general idea of the monetary value of stability in itself is subject to question. In the company's journey from point A to point B, what is the value of "steady speed" as compared with "fast starts" and "abrupt stops"? Possibly the element of knowledge and the ability to separate "chance" from "cause" will have bearing on the answer to this final point. Also, this question might introduce broader phases of the loss experience stabilization through reinsurance problems such as:

(a) the taxable investment income, Federal tax, and loss ratio vulnerability triangle; and

(b) capital structure as a factor in shaping reinsurance policy and determining loss experience needs.

In general, the discussions suggested in a convincing manner that there are many areas in reinsurance to challenge the actuary's skill.

REPORTS FOR MANAGEMENT

(Summation by Clarence S. Coates, Actuary,
Lumbermens Mutual Casualty Company)

The broad title for this seminar was selected for the deliberate purpose of encouraging a presentation of the various kinds of reports that were being made for management and inviting questions and discussion concerning them.

It was pointed out that the Annual Statement itself and its related Insurance Expense Exhibit were reports for management as well as mandatory documents filed with Insurance Departments. Schedule P and Page 14 were touched on, and the desirability, even necessity, of developing a full Insurance Expense Exhibit on Direct, Reinsurance Accepted, and Reinsurance Ceded sections separately before combining into the filed "Net" basis, was emphasized.

Various types of production comparison reports were discussed, and the importance of bringing in the "Share of Market" aspect was highlighted. Mention was made of the desirability of measuring progress in "New" production separately from total production.

On experience reports the discussions and comments ranged over the entire gamut of lines of insurance and their differing characteristics. Policy year, accident year and calendar year approaches were touched upon, bringing out advantages and disadvantages and areas of most logical application. Considerable interest was shown in the discussions of how best to develop and present experience by producer. Development of trend in average loss cost per injury in such lines as compensation and bodily injury, and using these for a check on loss reserve levels as well as for experience was another interesting subject. The need for improving reports so that instead of being merely historical in nature they would enter into the projection into the future area was brought out.

Discussion throughout was frequent and lively, and would undoubtedly have continued longer had time permitted. Grateful acknowledgment to Messrs. Norman Bennett and Dunbar Uhthoff for their participation in the planning and carrying through of the seminar is sincerely made.

SCHEDULE RATING IN FIRE INSURANCE

(Summation by Robert L. Hurley, Actuary, Inter-Regional Insurance Conference)

The Program Committee certainly made the chairman's job easy by selecting for the panel two men, both with wide experience in the field, and each a recognized authority in his own right. Our colleague, LeRoy Simon, who writes technical papers and articles with equal facility on fire and casualty subjects, handled the statistical aspects of fire rating problems. As our other expert, the seminar was privileged to have Mr. John Hommes, Manager of the Western Actuarial Bureau and a professionally trained engineer with an outstanding record in the construction and application of schedule rating in the fire field. Mr. Hommes distributed to the group a typical rate survey form and explained the principles involved in schedule rating. The following major aspects of the fire rating problem were scheduled for possible discussion:

1. The Meaning and Scope of Schedule Rating.
2. The Basic Element of the Fire Insurance Risk.
3. Alternative Philosophies of Hazard Measurement.
4. Evaluation of the Contribution of Fire Schedule Rating.
5. The Major Elements in the Schedules for Rating Fire Insurance Risks.
6. Fire Insurance Statistics and their Relation to Rates.
7. Industry-wide Trends affecting Fire Schedule Rating.

Now, based on this seminar, what would one predict for fire rating methods as they will be conducted by the time of the United States bicentennial celebration, a brief 15 years from now? Will there be no essential changes? Or will all that has been previously accomplished be cast aside? And will electronic-thinking machines and men to match evolve a philosophy and technique still hidden from most of us? With no responsibility to take sides in the various proposals made during the seminar, the chairman imagined that he might well be in a good position to sense the direction of seminar's thinking along these lines.

As I followed the discussion, I detected no sign that the seminar thought that schedule rating had run its course and was about to be scrapped. There was, it seemed to me, a real appreciation of the contribution made by schedule rating. This was no hollow tribute for past services but a realization that hazard measurement for fire insurance called for techniques different from those employed in Life, Workmen's Compensation and Auto Liability. The seminar recognized the large number of variables which affect the fire hazard of the individual risk. Admittedly, these factors are so many and so varied as practically to defy customary statistical techniques. They are nonetheless real and pertinent to the risk evaluation of the fire hazard, which inherently requires a physical inspection of the property to be insured.

There was some mention of a few areas of the schedule rating system wherein further exploration might be conducted. In the periodic reviews

that are made of the schedules, consideration might be directed to the elimination of any minor items having only marginal influence on the final risk rate. Moreover, it was proposed that, particularly in view of the creation of package policies, investigations might be made to see if a closer alignment might be devised between the risk classification and protection (i.e. public and private) systems and the risk rates. However, it was my impression that the seminar looked for schedule rating (for the purpose of an individual risk evaluation of the fire hazard) to survive any "wave of the future."

At the same time, the seminar discussion suggested that the next two decades may witness some significant adjustments in present fire schedule rating techniques. Some of the emerging forces stem from the insurance business itself. Others impinge from outside. High in the list of the external forces are:

1. The application of such research techniques as statistical sampling of complete universes.
2. The potentialities of electronic data processing.

From within the industry, we shall have to reckon with:

1. The trend to multi-peril policies.
2. High deductibles, and excess covers.
3. The competitive picture, and the search for objective standards for rates which shall not be excessive, inadequate or unfairly discriminatory.

During the seminars, it was pointed out that Fire loss probabilities are significantly different from those of WC, A & H, and Auto Liability. It may well be that fire loss expectancy for other than trivial losses may be of such a low order of magnitude that a rate classification system based solely on loss statistics may prove not feasible within the normal tolerance for credibility standards.

And yet it is unthinkable that fire rates will be made with no advertence to loss experience. This is not done today. Fire Rating Bureaus have a Rate Level Adjustment formula which has received wide recognition, and is working reasonably well. While fire rates will probably never be made exclusively on a detailed classification of loss statistics, it is quite possible that the present Rate Level Adjustment procedures may be extended to additional areas. One might easily visualize the Rate Level Adjustment procedure being applied to a very limited number of broad groupings of fire risks—possibly not solely on a mere occupancy classification basis. Then the schedule rating evaluation will continue to be used to distribute the indicated average rate levels among the various individual risks within each hazard group.

With such a development, statistical sampling may become an important tool in determining average rate levels for hazard groups and possibly subgroups. At the same time electronic data processing may well assume an important role in the mechanical handling of the pieces of paper involved. It might well process the results from the application of the schedule rating, but will not likely ever replace the individual risk evaluation of the fire hazard. It will indeed be interesting to see what has happened to fire insurance schedule rating in the world of 1976.

THE PROBLEM OF SUBSTANDARD AUTOMOBILE RISKS

(Summation by Frank Harwayne, Chief Actuary, New York State Insurance Department)

I'd like to give a vote of thanks to Dutch Day, Tom Murrin and the audience that participated in this session. Both sessions of the seminar were well attended. The chairman brought out that both the young and the old have substandard risks which cannot find an insurance market other than in the assigned risk plan or a specialty company for substandard risks. Elden Day covered the substandard risk as he is known through assigned risk plans. In general, incurred losses on assigned risks have exceeded premiums for many years. In 1959, the assigned risk plan incurred loss ratio, countrywide excluding Massachusetts, was about 98%. A sample study of 500 assigned risks in New York State shows these risks are not attributable to any small group of specialized producers. These risks account for 800 applications approximately; the policies stay in force for approximately 11 months; 13% are in the plan for the full three year period; 50% of the new applications are renewed. Tom Murrin developed the thought that the substandard risks are inextricably wound into the assigned risk plan and that it may be necessary to establish a different classification and rating system for such risks, in contrast to that for voluntary risks. He pointed out that although classification rate differentials presently appear adequate, it may take considerable time for substantial segments of the young driver class to obtain voluntary insurance.

Much discussion centered about the definition of substandard risks. It was finally believed that an acceptable objective definition is difficult, if not impossible. Although an acceptable definition was not obtained, there was general agreement that adequate insurance coverage at a fair price is the basic problem. In view of the virtual necessity of the automobile to most Americans today, and in view of the legal and moral need for automobile insurance, to convince the substandard risk that it is proper to classify him differently from his neighbor, appears to be a major problem. This is particularly so if his neighbor has the same characteristics as he, yet is classified and rated on a preferred basis. The underwriter's basis for discriminating between risks cuts across classifications and may be youth, age, marriage, divorce, disability, occupation, residential area, driving experience, lack of credit standing, prior rejection for insurance coverage, and so on. Classifying a risk on the basis of acceptability to the underwriter may not appear equitable.

Some suggestions were put forth for consideration. One was the possibility of a longer term contract with specified differentials for age along the lines of the mortality table, but the rate would not be guaranteed. Another was further experimentation with the substandard subsidiary insurance company.

Both sessions ran overtime as a consequence of the members' lively participation. I might add that, possibly on account of the nature of the problem, we just were unable to find any solution and, as indicated here, we had substantial difficulty really in getting clear basic definitions.

ADDRESSES AND REPORTS

ACCREDITATION OF ACTUARIES

(Address by Reinhard A. Hohaus, Senior Vice President and Actuary of Metropolitan Life Insurance Company—May 3, 1961)

This meeting this morning, Mr. President, brings back many nostalgic thoughts and there is a bit of biography I would like to refer to. Thirty-five years ago, before many of you were born and before almost all of you became Fellows of this body, I had the great privilege of being a guest speaker at your Annual Meeting in 1926. The subject was the "Function and Future of Industrial Retirement Plans". The only one that I know in this room that can go back that far is Murray Latimer, and he knows as well as I that in those days, both retirement plans on an actuarial basis and my own professional career were in their infancy.

Your invitation prompted my secretary to remind me that I had written that paper 35 years ago and that I had better read it again. Well, I reread it and I am happy to say that the 1926 observation measures up reasonably well in the light of what happened. I might add that if it hadn't measured up reasonably well I would have made no reference to it. I don't know who my ghost writer was, but my style then was beautiful with short, pungent sentences.

Across my years as an actuary I have felt a very close kinship to your Society. It would be too long a list, it would be two score or more, to name members of your body to whom I am deeply indebted for advice, encouragement and friendship. I will just cite several of them and, to avoid making choices, they're all past presidents.

One of these was J. D. Craig. I think he was your second president; he was my early mentor. It so happened that the first job I had in the Metropolitan was in health insurance. J. D. had the great vision, as a pioneer in health insurance, to recognize that there were many problems in that field for which a casualty approach rather than a life insurance approach was more appropriate. So, my early training was in the casualty field as much as the life field. Others who guided and helped me were Joe Woodward and Ben Flynn of the Travelers. Then there was Win Greene, who I am delighted to see here today, who was your president in 1934 and 1935; I should also mention Francis Perryman and Ralph Blanchard.

Win Greene and I lived way out in Westport, Connecticut, for a period of years; it took us well over an hour to commute. We used to ride on the train together and Win taught me an awful lot about Workmen's Compensation Insurance. He would tell me about all the problems, and I learned from those lessons principles and practices which could be used for Group Insurance.

Ralph Blanchard had a very select organization to which I had the

privilege to belong. It was called the D & T'ers—it was the Drinkers and Thinkers Association—which had dinner meetings at which the members did not hesitate to discuss any problem in any line of insurance.

So much for the past. Both the subject assigned to me this morning and my remarks will be in two parts. One is the report which the Committee to Investigate Possible Certification and Licensing of Actuaries, appointed by the Society of Actuaries, made at the Society's Annual Meeting last year. That will be followed by comments on subsequent developments.

The Committee's report appears in the last issue of the Transactions[1] and was limited to the situation in the United States. There's a wide variety of government licensing, certification and accreditation methods in use for the various professions in the United States. About the only common denominator is that licensing or certification is done at the state level; although, in some cases, a federal agency will have supplemental requirements such as those for lawyers and accountants desiring to practice before the U. S. Treasury Department on tax matters.

I will spend a little time on accountancy, because after we checked through the different professions, we came to the conclusion that the problems of accountancy seemed to be the closest to our own problem of the actuary. All states now have accountancy laws which include provisions whereby a public accountant can be certified by a state agency and hold himself out to the public as a Certified Public Accountant, a CPA, if he meets the professional and personal requirements of the state.

These laws are of two types. One is a permissive type. The permissive type of law permits anyone to practice public accountancy but he cannot use the title of CPA and cannot hold himself out as a CPA unless he is so certified by the state.

The other type is what is known as "regulatory laws" which limit the practice of public accountancy to CPAs and a closed group of those who aren't CPAs, but who were in practice at the time the law became effective. Most of the states started with permissive laws and gradually shifted over to regulatory laws. The majority of them now have regulatory laws.

A permissive basis for the actuarial profession, which was the first approach we explored, would be intentionally designed for, and limited to, those situations in which there is a government requirement that there be an independent actuarial valuation or appraisal made by an actuary whom that government agency recognizes as qualified for that purpose.

This approach would recognize that there are many types of services which do not involve a sufficient degree of public interest for the state to exercise its police power constitutionally to require licensing or certification of those engaged in practice as consultants.

Reference is made to "constitutionality" because a licensing statute in this country is a restriction on a private right and it can't be done constitutionally unless it can be demonstrated that it is necessary in the public interest.

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[1] TSA XII, p. 747 ff.

Hence, it would appear that the main area in which there may be a requirement in the near future that actuarial statements be made by a recognized actuary, one recognized by the appropriate government agency, would be in the field of pension plans—a non-insured and deposit administration type plans—for which actuarial information must be filed with the Internal Revenue Service, and now with the Labor Department and some State Agencies under Disclosure Acts. The number of such plans may be about 10,000.

It seems reasonable to assume that the persons who prepare the actuarial reports for these plans are concentrated in a limited number of states, not throughout the whole fifty states. And also, it is reasonable to assume (and whatever checks you can make on it seem to confirm it) that many, if not most, of these consulting actuaries do not belong to any of the four national actuarial organizations.

In the case of the Society of Actuaries, probably less than 200 members of the Society are in full-time consulting work. On the other hand there are 60,000 CPAs located in all sections of the country; hence, they total many times the number of persons who do consulting actuarial work. And now, not even taking these factors into account, there are also many other uncertainties as to the possibilities of obtaining the necessary state legislation for certification of consulting actuaries.

I thought it would be quite easy to have legislation for certification of actuaries enacted in New York. I made some inquiries of Charlie DuBuar of the State Insurance Department who then discussed the matter informally with an official of the State Education Department. His discussions indicated that it would be almost impossible within any limited period of time to get a statute in New York enacted for the certification of actuaries. He gave four or five reasons, and they were good reasons. We also found in discussing with your colleagues there are certain special problems in the Casualty field that we in the Life field had not been aware of. So, for a number of reasons we concluded that the approach of using a state certification of actuaries similar to that of the CPAs was not feasible, at least in the near future.

This prompted us to turn to another approach which would be the accreditation of actuaries. This means that any Government agency—whether it is on the Federal or State level—to which an actuarial certificate or report is required, could decide if it is in the public interest that those certificates be made by a person whom that agency recognizes and will accredit as a qualified consulting actuary.

This approach is very similar, I think, to those arrangements under which an accountant or a lawyer would be qualified to practice before the Internal Revenue Service. This is a lot simpler in its machinery than state certification. The conditions for accreditation would include character, professional conduct, independence, education and competence. While competence could be tested by examination, membership in a recognized professional body will be taken as the equivalent of an examination test and hence, there will be no need for the normal practicing actuary to go through the whole examination procedure again. There would also be a provision for a "grandfather clause" for those qualified able actuaries (and there are quite a few) who do not

belong to any of the four existing actuarial organizations to be accredited.

The actuarial organization whose primary interest is in the consulting field is the Conference of Actuaries in Public Practice which includes about 80 members and 140 associates. I think it is about 10 or 11 years old. It has no professional examinations with eligibility based upon competency, experience and field of activity.

There are members of your body in this organization, as well as members of the Society of Actuaries. The Conference has developed and matured very well. There were fears in the beginning of how it would work out, but I think a number of us are quite pleased to see the quality and the calibre of its work and we are very hopeful that it will continue on that road. So we come to the point that it is a very important body.

In exploring certification, we ran into a tough and touchy problem. The precedent of other professions, accountancy for example, is that whether you use a state certification or whether you use accreditation, there are very strict limitations and criteria that must be met as to individual independence in practice. You must be in independent practice.

In accountancy, as I recall for at least some states, a man cannot practice as a CPA unless he is self-employed or unless he is in the employ of another CPA. He can't practice as a CPA if he is employed by a layman. He can't practice as a CPA working with a corporation.

This poses a problem in the consulting actuarial field because there are consulting actuaries who for very good reasons accept commissions in lieu of fees where they are dealing with plans underwritten by Insurance Companies. There are also brokerage firms of national renown who do consulting actuarial work and have members of actuarial bodies employed on their staff. There are also insurance companies, which will offer consulting actuarial service by members of their staff. So we will have to face up in any approach, whether it is accreditation or certification, to some basic problems for those actuaries who do not meet the very strict tests of independence that are applicable to CPAs.

After reviewing these matters our Committee reported to the Board of Governors that the Society of Actuaries was faced with some very basic questions before it can decide if and how it should proceed in trying to get certification or accreditation. These were three alternatives presented to the Board:

> One was that the Society of Actuaries would make every effort to exercise primary and direct responsibility.
>
> A second alternative was to leave to others the primary responsibility, simply step out of the picture and let others worry about it.
>
> The third was to share responsibility and to work with the other interested professional groups such as your body, the Conference, and the Fraternal Actuarial Association in developing government criteria for qualified consulting actuaries.

It was this third alternative which was deemed as the only promising and practical alternative, and hence our Committee was instructed to initiate discussions with the Conference and your group and the Fraternal Actuarial Association.

We reported back to the Board last September that each of the other bodies had formed a similar committee. As a result of intensive discussions, all agreed that the most promising course of action was accreditation (rather than certification) by a governmental agency, such as the U. S. Internal Revenue Service or the Department of Labor, or both.

We had originally suggested that membership in any of the four actuarial bodies *per se* would constitute accreditation. On further consideration, we came to the conclusion that since the field would be primarily pensions, we knew that there are members who do not have the experience and competence to work as consultants in the pension field; hence, in addition to membership in one of the actuarial bodies, the individual also has to demonstrate that he has competence and ability in the pension field. Also the hope would be that the government agency would use as a guide and mentor in setting up the criteria for accreditation, an advisory group which would be represented by individuals appointed by each of the four organizations.

At least in some phase of the work ahead, the professional conduct committee is involved,—also the committees on membership requirements and public relations and education; hence there was a recognition, as we reported to the Board, that all of these problems come under the much broader head of the professional status of the actuaries. You can't deal with certification alone without spilling into professional conduct, without spilling into what the examination requirements are.

The desire for the benefits and privileges of professional status must be coupled with a willingness to accept certain additional responsibilities and limitations which involve the assignments of all those committees. If that sounds like a legal sentence, it is, taken almost verbatim from a statement Jim Donovan made to us a year ago last June. (I'll come back again to Jim in a few minutes.)

This led to a recommendation we made to our Board that each actuarial organization should coordinate the activities of their respective committees under a parent committee which would have responsibility for dealing with the overall subject of professional status. The Board of Governors authorized the appointment of such a committee; it authorized that committee in turn to get in touch with the Presidents of the other three bodies and make a similar suggestion. I'll come back to that also in several minutes.

Incidentally, I'd like to say I'm convinced it will take some years to develop and make effective a program of legal and public acceptance of professional status of actuaries and the conditions for an individual to be recognized as a qualified actuary. When I took on the assignment two or three years ago I was sure it would be completed well before my retirement. I'm convinced now I'll be retired for a period of time before it comes into full effect. There is a long and laborious process ahead and if you work in it you'll find it an extremely interesting intriguing one.

There is, however, no obstacle in the meantime to work toward the accreditation at the federal level of actuaries. That's one I would be hopeful could be accomplished in a reasonable period of time. It's also interesting to note that the British Institute of Actuaries is sweating over some of the same

professional problems we are. Also in the studies that have been put out by the Wharton School on the overall study of pensions by Dan McGill, you'll find again and again the need for some kind of recognition of qualification by actuaries by a public standard.

I referred to the Committee on Professional Status. That committee came about as the result of a luncheon on June 26 last year. Your President was the host; others there were Joe Linder, Jim Donovan whom I'd never heard of before—I didn't know why Bill Leslie distrusted me so much, he had to have a lawyer with him at the meeting—and myself.

It turned out to be that Jim not only knows our problems—he knows and has a wealth of experience with other professions. He listened to us talk and he made the statement I referred to earlier. In substance, if not in actual words, he also said: "You fellows have nothing until you recognize you have an overall problem of professional status. You've got to tackle it on that basis." As stated earlier, that is being done by setting up of Committees on Professional Status.

The composition of the Society of Actuaries' Professional Conduct Committee is four individuals. The individuals were appointed because of their committee status. One is Gil Fitzhugh, Chairman of the Committee to Review Membership Requirements. The other three members are John Miller, Chairman of the Public Relations Committee, Henry Rood, Chairman of Professional Conduct Committee, and myself as Chairman of the Committee on Certification.

It was a happy coincidence that two out of these four men are Fellows of your body. Fitzhugh's been a Fellow since 1935 and Miller since 1938. John Miller, when we were talking about it said there's much similarity between the casualty actuarial work and the life work. The main trouble is a difference of language. He said he lost a whole year studying for your exams before he learned the particular language that's used in the casualty business versus the life business. The basic principles are the same but it was like learning a completely different language.

Henry Rood told me that he took your exams through the associateship while with the Travelers but your Society wouldn't admit him as an Associate because he had no experience in the casualty business! Nevertheless he shares, as I do, a close kinship with your Society even though you did not accept his invitation when he was courting you for membership.

I've been in touch with the other three bodies. You have set up a professional conduct committee. The Fraternal Actuarial Association has and I'm waiting for word from the Conference. But that will get done I'm sure and by the end of the year we'll get something well on the road.

In closing I'd like to say that again I appreciate very much and have welcomed the cooperation of your Society. Jim Donovan gave us a real breakthrough when he came up with his concept of professional status. We are working in our own Society Committee on a long-range program. It's not far enough along to try to fill you in on it yet. I'm extremely optimistic that this long-range program is one that will be of interest and helpful not only to the Society of Actuaries but to your group as well.

Last but not least I want to express my appreciation to Laurie Longley-

Cook; he and I sat together one night a couple of years ago and discussed certification of actuaries and he brought out very vividly the problems in your own field of which we in the life field were not aware, and I hope you are satisfied that we have since taken them into account in a satisfactory way.

A CASUALTY ACTUARY IN EUROPE

(Address by Paul Johansen, Vice-Director and Actuary of Nye Danke, Copenhagen, Denmark—May 5, 1961)

Having expressed his appreciation for being asked to address the meeting, Dr. Johansen described the arrangements for training actuaries in his native Denmark. He explained that special courses in actuarial mathematics and statistics were provided at the University of Copenhagen, and the courses including the prerequisite general mathematics occupied 5 years of full time study. Dr. Johansen explained that when he took his courses, actuarial work was limited to life insurance and it was only afterwards that he became interested in the actuarial problems of fire insurance, initially on a consulting basis. He is now the only non-life actuary engaged on a full time basis in Denmark. The other Danish non-life actuaries are in rate making organizations or act as consultants to a number of companies. It seems that as long as business is profitable and the regulatory authorities are reasonable, most companies feel they can get along without an actuary, but as soon as loss ratios rise or regulation becomes difficult, actuarial assistance becomes necessary. Parallel developments had occurred in Norway and other Scandinavian countries and there are today some 20 actuaries employed in the non-life, or general, insurance field in these countries who meet regularly to exchange views. This interest in the actuarial aspects of general insurance, and in particular modern Risk Theory, existed also in other western European countries, in Japan and even behind the Iron Curtain in Poland and Russia. This led in a natural manner to the formation of the ASTIN section of the International Congress of Actuaries in 1957 at the New York Congress and, as Dr. Johansen modestly suggested, it was his command of several languages which led to his election as the first chairman. The position is now held by Mr. Marcel Henry of France.

Dr. Johansen referred to the Colloquium at La Baule, France, which was organized by ASTIN in 1959. The meeting, which extended over two days, discussed No Claim Discount (Merit Rating) in Insurance, with particular reference to Automobile Insurance. Merit rating is used much more extensively in Europe than in the U. S. A. In Denmark a 40% credit is allowed for one claim-free year and in Sweden credits up to 70% are allowed in a succession of steps. Each claim-free year takes the insured one step up the ladder and each claim brings him down two steps.

The actuarial problems of general insurance are considerably more complex than those of life insurance. In life insurance the loss occurs only once, and when it occurs it is total—you die once and death is absolute. In general insurance several losses may occur under a single policy and the amount

of each loss will normally be different. The mathematical model for life insurance is rather simple. The models for general insurance, which we study in the Theory of Risk, are still quite primitive and a large amout of work remains to be done. Much of the original work in this field was carried out about 50 years ago by Dr. Filip Lundberg of Sweden. His original work is very difficult to follow but has been wonderfully interpreted by Dr. Harold Cramér and others. Many other actuaries have contributed to the subject including Ammeter of Switzerland and Esscher and Philipson of Sweden. There is still much work to be done in developing the proper actuarial models for general insurance and Dr. Johansen ended by expressing the hope that young American actuaries would join with their European colleagues in these researches.

ASTIN Colloquium, Rättvik, Sweden, June 1961

(Report by Norton E. Masterson—November 17, 1961)

At the November 1961 meeting of the Casualty Actuarial Society, Norton E. Masterson, a director and treasurer of ASTIN, gave the following report of the 1961 Rättvik Colloquium.

The principal activity of ASTIN in 1961 was the Rättvik Colloquium organized by the Swedish Actuarial Society and held at the Hotel Persborg on Lake Siljan near Rättvik in the Dalecarlia section of Sweden, June 14-18.

Delegates from Belgium, Denmark, Finland, France, Germany, Great Britain, Holland, Israel, Italy, Norway, Poland, Sweden, Switzerland, and the United States were in attendance.

The full text of all papers will be published and distributed to ASTIN members, and brief reports of the discussions will be published in the ASTIN BULLETIN. The general categories of the papers and the groupings for discussion were: (1) Statistical Distribution of Claims by Amounts; (2) Theory of Risk, Fundamental Mathematics and Applications; (3) Motor Insurance; and (4) Reserves.

The languages of the colloquium were English and French, but the organizing committee had made arrangements for the speeches to be immediately translated into "the other language."

The ASTIN Section of the International Congress of Actuaries has made significant growth in the last ten years. Total membership in 1961 was 423, of which 115 were from Canada and the United States.

The growth and influence of ASTIN as an international group has paralleled that of the Casualty Actuarial Society in the United States and Canada, and for the same economic reasons. The increased standard of living and economic activity in Western Europe and North America have increased the need for an influence of actuaries in casualty, fire, and accident insurance on both sides of the Atlantic.

In concluding his report, Mr. Masterson urged that more members join and participate in the field of non-life actuarial research on an international basis.

REPORT OF COMMITTEE TO COOPERATE WITH THE INTERNATIONAL COOPERATION ADMINISTRATION

(Agency for International Development)

Certain contracts which are being made available by the International Cooperation Administration (now the Agency for International Development) covering investment guaranties in foreign countries have been the subject of a study by your Committee as the result of a request submitted by the ICA to the Casualty Actuarial Society for review and actuarial comment. The Casualty Actuarial Society, as a public service, agreed to cooperate with the ICA. The submission was in the form of a request for answers to specific questions. Pursuant to the appointment made by Mr. William Leslie, Jr., President of the Casualty Actuarial Society, Messrs. Frank Harwayne, Chairman, Charles C. Hewitt, Jr., and N. Matthew Franklin, actively conducted an investigation of the matter submitted.

The Committee made use of all available material, corresponded with Mr. Laurence E. Potter, Associate Chief, Investment Guaranties Division of the ICA, held several meetings during the year and met with the ICA in Washington, D. C.

A brief summary of the nature of the ICA program is in order.

PURPOSES OF THE ICA CONTRACTS

Pursuant to Act of Congress, the ICA is authorized to issue guaranties on investments in foreign projects which are approved by the President as furthering the development of economic resources and productive capacities of economically underdeveloped areas.

"The risks which may be covered by guaranties are:

a. Inability to convert foreign currency receipts into dollars.
b. Loss through expropriation or confiscation.
c. Loss from damage to physical assets caused by war.

". . . The Government does not offer guaranties against failure to make a profit, general devaluation of a foreign currency, inability or failure of a borrower to repay due to a decline in his assets, or against other normal business risks that attend any investment. But it does, subject to the conditions stated below, offer a practical means of insuring against three of the chief dangers which have troubled prospective American investors abroad in the past."[1]

A capsule description of the content of these guaranties follows:

a. *Convertibility Guaranty:*

"An ICA convertibility guaranty contract provides protection against the risk of inability to convert investment receipts into dollars from the cur-

[1] Investment Guaranty Handbook, p. 1. See also Export-Import Bank and The Foreign Credit Insurance Association.

rency of the country in which the investment is made. Both transfers of earnings and repatriation of capital are protected.

"The convertibility guaranty contract in essence insures that a means, available at the time the contract is issued, for converting foreign currency investment receipts into dollars will continue for the life of the contract. Thus the ICA will not guaranty convertibility in the face of exchange regulations and practices under which it would be clear at the time a contract was issued that conversion could be effected only through the guaranty."[2]

b. *Expropriation Guaranty:*

"Governments expropriating property of foreign investors may offer compensation in some form and amount. This compensation may, however, be unsatisfactory to the investor and may involve negotiation and litigation.

"It is frequently in the form of securities or foreign currencies which cannot freely be converted into dollars. By means of an ICA expropriation guaranty contract, American investors may assure themselves that they will be compensated by the United States Government, in the event of expropriation, in dollars, in accordance with a formula for determining loss which is fixed in the contract.

"A guaranty against loss by reason of expropriation is also protection against confiscation (a taking without compensation), such as may occur if an unfriendly government succeeds to power in a country where a guarantied investment has been made."[3]

c. *War Risk Guaranty:*

"This guaranty will protect against loss resulting from direct damage to the depreciable physical property of a foreign enterprise caused by war, whether or not under formal declaration, including any hostile act by any national or international force as well as action taken by the government of the project country in hindering, combatting, or defending against an actual pending or expected hostile attack. This does not include consequential damage whether caused by a peril guarantied against or otherwise, or damage caused by civil war, revolution, rebellion, insurrection, or civil strife arising therefrom or action taken by governmental authority in hindering, combatting or defending against such occurrences, or as a consequence of such occurrences."[4]

Each guaranty described above is issued for a "fee" which is expressed as a percentage per year of the face amount of the guaranty. Unless sooner terminated by the risk, the guaranty may continue in effect up to 20 years.

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[2] Ibid. p. 13.

[3] Ibid. p. 17.

[4] Ibid. p. 21.

Certain guaranties which were originated under the Development Loan Fund may have been authorized for longer periods (i.e., the Valco project). Although the use of the term "insurance" is avoided, there is apparently the hope that sufficient "fee" income could be accumulated so as to cover any significant losses which ultimately may be incurred under the guaranties. Therefore, to a certain extent there is some expectation that elements of the insurance mechanism would come into play here.

The actual report to the ICA follows:

REPORT TO THE INTERNATIONAL COOPERATION ADMINISTRATION

A review of the history and background of the Investment Guaranty Program convinces this Committee that the will of Congress goes beyond a pure insurance program. From the inception the Committee resolved to confine its expertise to the actuarial aspects of the program. It has attempted to isolate those elements of the program which are of an actuarial nature and has confined its attention thereto. The results of the Committee's activities take the form of answers to the specific questions posed by the ICA.

The conditions under which actuarial standards may be applied presuppose that there will be substantial continuity of valid and reliable experience. Under such circumstances past experience may be used as a guide to the future. If there is to be no continuity as to the significant nature of the exposure, then past experience, even if reliable to an acceptable level of confidence and whether favorable or unfavorable, is invalid, irrelevant and of doubtful value in measuring potential experience. Moreover, as the program contemplates free entry and egress from the conditions of the contract, it is important that the "fees" or premiums reflect the best estimates of costs to be incurred during the life of the contract. Adjustment of premiums or "fees" should not be contemplated for recoupment for adverse past experience. In this connection it is important to consider the role which the maximum authorized guaranty funds of $200 million (in United States Treasury Notes) plays in the program. It is the current belief of ICA representatives that, should it become necessary to draw upon these funds for payments under the guaranties, the fund would be replenished by future "fees" charged. The United States Treasury Notes therefore appear to function like a revolving fund. Replenishment of these funds probably would be in the form of an increase in the "fees" charged. This would effectively be a form of recoupment even though resulting from a re-evaluation of more reliable experience. In the situation described, some doubt naturally arises whether risks which are located in countries which honor their commitments would continue to purchase the guaranties, particularly if the cost of all guaranties were raised apparently to recoup for losses which had taken place in countries which do not honor their commitments. Under such circumstances there would appear to be created a type of anti-selection which would act counter to the maintenance of a market adequate for the continuance of the program.

The specific questions which have been posed by the ICA have been carefully reviewed and are discussed hereafter.

1. *CAN THE EXPERIENCE TO DATE BE USED IN ANY MEANINGFUL WAY?*

The magnitude of the potential liability is indicated by the fact that the guaranties outstanding as of December 31, 1960 were $443,634,000 (including some duplication for the three types of contracts). Against this, accumulated "fee" income through December 31, 1960 was $6,412,000, or less than 1.5% of the amount of guaranties outstanding. As of November 1961 the guaranties outstanding were $488 million.

Assuming that some portion of the guaranty liability would be realized in the years to come, one could formulate a table which would show how many years an annual premium of 0.5% of the amount of each guaranty would need to be accumulated to cover losses equal to the assumed portion of the guaranty liability.

Assuming the money deposited as premium could be assigned an interest yield, (although we understand the Treasury Department does not credit the ICA with interest on its deposits with the Department), calculations can be made which would indicate the number of years required for premium accumulation in order to cover losses of stated portions or percentages.

For example, a premium rate of $5 per thousand dollars of amount of guaranty would need to be accumulated for 28 years (assuming 4% interest) in order to cover a net loss at the end of the 28th year equal to 25% of guaranty liability. At a 6% interest rate, 24 years of premium accumulation would be required to cover the same net loss at the end of the 24th year.

If administrative costs[5] are chargeable against "fee" income then the number of years of accumulation required would be extended.

It is readily apparent that these guaranties are long term in nature. Coverage for such long term possibilities cannot be entirely separated from possible appreciation or depreciation of money rates of various currencies throughout the world. Also, the possibility of subrogation must reflect the likelihood of long periods of time elapsing for successful conclusion of subrogation claims between sovereign countries.

Assuming the business venture covered by guaranties is successful, as time goes on, the amount of the guaranty should become a lesser percentage of the value of the investment in the country. The investor would then acquire a larger stake in continuing the enterprise and in effect would become a co-insurer to a greater extent than at inception.

The evaluation of experience must be coupled with an evaluation (by our nation's policymakers) of the host government's attitude for a specified considerable time in the future.

Although the guaranty program has not actually incurred any loss at the present writing, it is fair to conclude that from an actuarial standpoint, the

[5] Whitman, Marina von Neumann, *The United States Investment Guaranty Program and Private Foreign Investment*, p. 70 reports administrative costs were approximately 12% of fee income for calendar year 1958 and about 20% for the previous year.

occurrence of a loss is more significant than the non-occurrence of a loss (where losses are assumed to occur relatively infrequently).

In this connection, it is only fair to draw attention to the potential for loss that recently existed in Cuba. The ICA has estimated that approximately $70 million of investments in Cuba would have been eligible for guaranty during the period 1957-1960. If we were to assume that such guaranties had been issued and were exposed to loss at the time the present Cuban Government came to power, and if we were further to assume that only 20% of the guaranties exposed produce a net loss to the guarantor, we find a potential loss to the guaranty program of approximately $14 million, or twice the amount of all "fee" collections to date.

The Cuban situation by itself, which is highly pertinent and suggestive of the potential loss inherent in the guaranty program, is obviously more meaningful from an actuarial standpoint than the non-occurrence of a loss on the guaranties issued to date.

An evaluation of the experience to date must recognize the increasing hazard resulting from the shift in emphasis since 1958 from guaranties issued with respect to the developed countries (principally the Western European countries whose post war reconstruction and rehabilitation had been largely completed) to guaranties issued with respect to the underdeveloped countries (in Latin America, Africa and Asia) as well as the increasing importance of th expropriation and war risk guaranties as more bilateral arrangements for such guaranties are effectuated in addition to the convertibility guaranties. The 1961 enactments by Congress emphasize there may be future changes in emphasis (e.g., housing developments) and coverage ("all risk coverage").

2. *DO THE RATES REFLECT THE RISKS TAKEN?*

It is self-evident that the risks taken by businesses when they invest in foreign countries vary by country. This probably accounts for the fact that capital tends to gravitate toward those countries which afford the greatest return with the least risk. Even short term guaranties, such as that afforded by a private American insurance company for export credit insurance, distinguishes among different countries in the world. In dealing with such credit insurance, that company's insurance rates take into consideration individual variations in the risk such as the insured buyer's

(a) general credit standing
(b) management and business experience record, and
(c) liquidity and past payments record

Recognition is also afforded to the degree of co-insurance and the length of time credit is outstanding after goods are shipped.

The values insured by the ICA are such that a single loss could wipe out all prior "fee" collections. Further, the nature of the convertibility and war risk coverages is such that all or most risks in a particular country would be affected simultaneously. Effects of expropriation may exhibit some temporary variation by type of industry. A mere listing of some countries which have been recently in the news suggests the widely diversified risk of loss under

a guaranty program for investments in such countries compared with other countries. It is suggested that areas such as Cuba, Congo (Leopoldville), Egypt, Laos, North Viet Nam, Korea, Venezuela, British Africa, Algeria, Tunisia, Berlin and Brazil present greater risks of loss on the guaranties than other more stable political areas.

3. *CAN ANY ACTUARIAL BASIS BE DEVELOPED FOR THE PROGRAM?*

As suggested in 1, it might be possible to consider a hypothetical investment including an assumed annual plowback of earnings to such time when accumulated "fee" income would cover possible losses with or without the compounding of interest earnings. Such a procedure would tend to be overly conservative, except that the element of contagion (i.e., broad scale renouncements of commitments by foreign countries) would need to be given separate and thorough consideration in formulating such a basis.

The "fee" for the guaranty might be considered somewhat akin to the charges for insurance or guaranties afforded by such United States Government agencies as the Federal Deposit Insurance Corporation, the Federal Savings and Loan Insurance Corporation and the Federal Housing Administration.

Consideration would need to be given to measuring geographical dispersion of risk and the possibility of an international program of "reinsuring" such risks (perhaps through the Organization for Economic Cooperation and Development). A system of fractional reserve[6] may be required. There should be a certain awareness in connection with the failure to limit the percentage of guaranties outstanding in any one country and the possible effect of such a failure upon the fiscal soundness of the program. A similar awareness is needed in connection with the failure to limit the maximum liability assumed on any one risk, dependent upon the total amount of guaranties outstanding and their concentration.

4. *HOW MUCH EXPERIENCE IS NEEDED TO DEVELOP AN ACTUARIAL BASIS?*

As implied by the discussion above, the amount of experience is not nearly as important as the expectation that future conditions would not be materially different from the past. This involves the continuation of existing attitudes on the part of sovereign powers. If some conclusion with respect to such continuation can be reached, then attention should be devoted to spread of risk within a country and among the various countries. If the ICA, for example, could be reasonably assured that it will not be required to cover a loss (net as to subrogation) of more than 10% of the face value within 15 years, the program could possibly be made self-supporting. However, the degree of reasonable assuredness must be weighed against the possible magnitude of the consequences of error. Moreover, if large individual risk values continue to be afforded guaranties, it is possible that the first claim

[6] Ibid. p. 33 indicates one fractional reserve basis has been effectuated.

could exhaust all "fee" income and create a demand upon the Treasury Notes, authorized as reserves. Tied in with this is the very deep evaluation of responsibility or irresponsibility (along the lines of Western custom and thought) of newly emerged governments.

CONCLUSION

The Committee is of the opinion that within the narrow limits outlined, actuarial aspects of the program may be soundly conceived and executed. It would appear more equitable to credit the ICA with interest earnings on deposits made with the Treasury or permit such deposits to be made in public depositories at interest. "Fees" or premiums proportional to the risks assumed in various parts of the world may be developed. However, it is by no means clear that the real world situation will remain confined within narrow limits. Questions which remain unanswered cover a wide range such as the responsibility or irresponsibility of newly emerged governments. In the face of dynamic and radical changes throughout the world, the amount of the Treasury Notes which implement the program may have to be increased so as to almost entirely absorb losses without being replenished by "fee" income at some future date. Likewise, with the large individual risk values that are commonly involved, it is possible that the first claim might be of such magnitude as to require such an increase in the "revolving fund".

Despite the conservative actuarial view which has here been expressed, the Committee wishes to re-emphasize that the actuarial aspects are by no means the complete consideration to be given to a program which envisions raising the living standards of peoples in underdeveloped countries. Indeed, in a world of ferment, the non-actuarial considerations (which, as stated at the outset, are excluded from this report) may be over-riding for the continuance of a free world. Such considerations may need to be met squarely by the government of the United States as outright subsidies or as indirect encouragement in this vital struggle.

The findings pursuant to the Committee's review of the situation are herewith respectfully submitted with grateful acknowledgment of the wealth of material which was made available to the Committee by Mr. Laurence E. Potter, Associate Chief, Investment Guaranties Division of the ICA.

Respectfully submitted,

Committee to Cooperate with the
International Cooperation Administration
FRANK HARWAYNE, *Chairman*
CHARLES C. HEWITT, JR.
N. MATTHEW FRANKLIN

December 14, 1961.

REVIEWS OF PUBLICATIONS

ALLEN L. MAYERSON, Book Review Editor

Calvin H. Brainard, *Automobile Insurance,* Richard D. Irwin, Inc., Homewood, Illinois, 1961, pp. 574.

This book is one of a series of insurance text books and has been designed to serve as the basis for a one-term college-level course in automobile insurance. The first part of the text covers the nature and economic dimensions of the automobile accident problem, describes the automobile insurance business and surveys policy forms and manual rules. Later chapters cover Financial Responsibility legislation, rating, underwriting, marketing and claims adjusting. The bulk of the book, however, presents automobile insurance by means of comprehensive explanations of the provisions of the various policy forms: The Family Automobile, the Special Automobile, the Basic Automobile and the Garage Liability Policies. The author provides many practical examples and actual cases to clarify the bare legal terminology of these contracts. The reviewer is not qualified to pass on the merits of this book as a college text as compared to others available. For the casualty actuary, however, the book furnishes a reference source that provides lucid explanations of some of the more obscure provisions of these policies.

WILLIAM S. GILLAM

Dan M. McGill, Editor, *All Lines Insurance,* (Huebner Foundation Lectures), Richard D. Irwin, Inc., Homewood, Illinois—1960, pp. 202.

This book is the publication of the Huebner Foundation lectures delivered at the University of Pennsylvania on the subject of "All Lines Insurance" by leading authorities in the fire and casualty insurance fields. While not directed specifically to actuarial problems, the lectures foreshadow the environment in which the actuarial science will operate in the years ahead. The book should be helpful for today's reader trying to fit current developments into a logical pattern as some guideposts for the future. It may well be of no less interest to future students as a record of the industry's thinking in the initial challenges of multiple line insurance.

The lectures reassess the very fundamentals of the insurance enterprise against a back-drop of the multi-peril trend. The scope of the book is indicated by the titles of the various chapters, which cover such subjects as: sales and agency relations, underwriting policy and risk selection, rating practices, loss and expense considerations, marketing philosophies, investment policies, personnel education, administration and company management and the regulatory problems created by all lines underwriting. The multi-peril concept is not confined to the packaging in one contract of various property coverages nor to its subsequent extensions into the liability field—but rather treats of the problems presented by all lines insurance, including life and annuity contracts.

Understandably not all the contributors reflect the same point of view.

Yet a spirit of optimism permeates the lectures. Possibly the differences in opinion might be reduced to the degree of optimism reflected in the various lectures. Some contributors have tempered their enthusiasm with a critical evaluation of current problems. Others have seemingly applied few, if any, restraints on their enthusiasms.

There is probably a tendency for many people to equate "All Lines Insurance" with the multi-peril package policy. Certainly this has been the trend of the times. However, in this book the term "All Lines" is often used for a combination of coverages written by one insurance organization, either on separate policies or in a single policy wherein the component coverages are individually rated and the experience is identified separately in the statistics. It is interesting to note that various lecturers point up organizational, sales, underwriting and other problems that result even from such a loose joining of coverages.

Understandably, more difficult problems arise as the coverage afforded by the single contract overleaps the statutory demarcations of traditional lines of insurance without separate rate and statistical identifications. Marketing officials temperamentally would ever broaden coverage on a single rating basis. The sales goal becomes the prospect willing to buy all his coverage at one rate in one contract on some installment plan if needs be. In the personal field this would be the homeowner who would place his fire, ECE, the allied property coverages on his dwelling and contents, his automobile, his legal liability, his life insurance, accident and health and retirement income in one contract at one rate.

As one lecturer points out, if "packaging" should ever attain such proportions, the position now occupied by the independent fire and casualty agent in the personal lines field may be lost forever. The life companies with long experience on group coverages might well work out retrospective rating plans for the employees of each of the larger business concerns in the country.

This publication does not slight the underwriting problems created by the trend to "All Lines" insurance. Many companies have long been confronted with the situation of a risk offering wherein a $5,000 WC premium was acceptable to their casualty underwriter but their fire underwriter would like to decline the $100,000 fire coverage on the plant. Some companies would make WC underwriters of their fire insurance specialists, and others would train their casualty men to underwrite fire lines. In some instances this has worked out successfully although there are types of risks in which cross training of underwriters presents somewhat unique problems.

However, as some of the lecturers indicate, the underwriting task would seem to approach almost an impossible assignment with any trend to package policies which would encompass all the lines written by fire, casualty and life companies. The underwriting function theoretically is the selection of the right risk at the right rate for the hazard presented. With a package rate for the multi-peril policy the underwriter must not only evaluate the loss cost potential of the various component coverages but also must determine whether or not the composite hazard is adequately reflected by the single policy rate.

Possibly the reviewer expected too much of the chapter on rate regulation. The particular lecturer did a thorough job in supplying the necessary background material on the development of multiple line underwriting. Ample coverage was afforded such topics as the licensing powers, the standard policy, capital and surplus requirements and taxation. However, the reader would undoubtedly have appreciated some analysis of the impact of the rate-regulatory laws on the basic problem of insurance regulation. It would seem that the Industry must have some basis for determining how the Insurance Departments will implement the legislative admonition that "Rates should be reasonable, adequate and not unfairly discriminatory," and at the same time permit healthy competition within the insurance society. It would have been valuable to have some indication as to the approach that the supervisory authorities might use in erecting standards to determine whether a particular "All Lines" filing complied with these prescribed legislative requirements. Possibly it is still too early to expect answers to the critical problems in this area, but they might well have been discussed in a chapter devoted to the regulatory problems presented by "All Lines" underwriting.

This book is a joint contribution of insurance executives, each attempting to appraise the significance of current developments. It is admittedly difficult in the rush of current business activities to fit each emerging development into its proper niche in the scheme of insurance affairs. Possibly we might have expected greater discontinuities from chapter to chapter since each lecturer was constrained to view the subject from basically his own vantage point. Their absence is probably due to the editor, who so skillfully arranged the lectures in chapters to achieve a maximum of continuity.

However, it still remains for some student of the insurance business to study the various problems, correlate them one to the other, and establish a code of fundamental principles whose observance would assist the Industry in formulating an orderly approach to the challenging concepts involved in "All Lines" insurance rating.

ROBERT L. HURLEY

Lincoln H. Day, Editor, *Social Insurance—Some Problems for Statistical Research,* The Bureau of Applied Social Research, Columbia University, New York, New York—1961.

While Editor Day's aim in publishing this worthy material to widen its audience is laudable, one questions the value to potential readers of using such an all-inclusive title. The material does not even discuss social insurance; the closest it comes is to indicate the difficulties confronting the statistician in social insurance research.

The eight papers that comprise this book were originally presented by the New York Area Chapter of the American Statistical Association at the 1960 meeting of the American Association for the Advancement of Science in two sessions entitled "Hospital Statistics in Community Planning" and "Some Statistical Problems in Social Insurance Research." These titles are fairer indicators of their contents. Broadly speaking, the papers stress the problems

of data collection, compilation, and analysis for the statistical researcher. For example, the first suggests the full utilization of data readily available from hospitals' operational facilities. The three that follow are descriptions of separate studies thus made. One of the studies, that of the Saskatchewan and Indiana Hospital Services, is a strained comparison of two unlike hospitalization schemes. Not only were their data-gathering methods and information classifications dissimilar, but certain opposing social factors introduced essential differences: rural *versus* urban populations, and a taxed government insurance plan as opposed to voluntary contribution and participation. Moreover, the studies were not made in the same year, one including an Asian "flu" epidemic.

The remaining four papers approach the social insurance field a little more closely—at least to the point where each indicates an aspect of various kinds of social insurance. These aspects vary from a dominant characteristic of unemployment insurance experience to uses of workmen's compensation statistics and problems inherent in statistical research for medical insurance programs.

Summing up: Difficulties naturally arise in changing a study's medium of presentation. But, in printed form, the lack of any significant mention of the Old-Age, Survivors, and Disability Insurance program, in a work purportedly dealing with social insurance, is a conspicuous omission.

ROBERT J. MYERS

David Lynn Bickelhaupt, *Transition to Multiple-Line Insurance Companies,* Richard D. Irwin, Inc., Homewood, Illinois—1961, pp. 226.

This doctoral dissertation was prepared at the University of Pennsylvania under the auspices of The S. S. Huebner Foundation for Insurance Education. It is the eleventh volume of "Studies" but the first in the property and casualty field, and therefore is a welcome addition.

The purpose of the author is to analyze the legal procedure followed and the changes in financial structure which have resulted as companies went through the transition from mono-line to multiple-line insurance companies. As a preliminary to embarking on the main purpose of the book, a historical review is given which traces the principal steps taken on the jagged course of progress toward multiple-line laws between the 1700's and the 1950's.

The presentation is thorough, careful, easy to read and easy to follow. The author frequently takes time to review past chapters, outline the next areas to be covered, but point out how the ensuing chapter will fit in. Sources of material are clearly indicated and each chapter is summarized in closing. In presenting certain financial data on assets, liabilities and premiums, he unfortunately chose to include data from two sources on each item. Since the sources differ (due to a different basis of presentation), statistical comparisons are severely hampered by a cloud of confusion. The reader must spend as much time analyzing the differences between the sources as he does in trying to draw meaningful conclusions.

The "Study" is one which will probably be of more value in the future

than it is today. By far the best section today is the almost incidental chapter which so succinctly summarizes the history of multiple-line developments. When the majority of the material presented in the book becomes less available due to the passage of time, the scholar of the future may find these other parts of similar value. Currently, it makes rather dry reading and often seems unnecessarily long.

One particularly significant statistical fact is sifted out on page 153 when it is shown that multiple-line companies had a marked reduction in the ratio of Net Written Premium to Policyholders' Surplus between 1948 and 1955 (from 1.39 to .86 or a 40% shrinkage) while other companies had relatively less (from 1.52 to 1.13 or a 25% shrinkage). Does this mean multiple-line operations have led to less utilization of capacity? Does this ratio really have much to do with capacity itself? How are the figures affected by distributions of business by line? How much distortion is introduced by adding the surplus of a subsidiary to the surplus of the parent company to determine total surplus? Such a startling result certainly calls for thoughtful investigation by some student of the business.

In presenting part of his general review of the field, the author lists the "underlying basic motives" and the "specific motives" of multiple-line insurance companies. Unfortunately, the policyholder fares rather badly on both lists—last in one case and next to last in the other. There is no question in this reviewer's mind that the responsibility to the policyholder must be the prime motivating force in any company that is to reach any of its other goals.

The author is to be commended on doing a diligent and thorough job. He exercised good judgment in defining and limiting the scope of the book. As time makes present records less accessible and our memories fade, this work will grow increasingly valuable.

LEROY J. SIMON

OBITUARY

GEORGE BURTON BUCK

1891-1961

George Burton Buck, Consulting Actuary, a Fellow of the Society of Actuaries, and a Fellow of the Casualty Actuarial Society, died on April 12, 1961, at his home in Larchmont, New York.

Mr. Buck was born in Baltimore on December 2, 1891. He was educated at George Washington University where he obtained a Bachelor of Law degree. He was a member of the Bar of the District of Columbia.

In 1914 Mr. Buck was employed by the New York City Committee on Pensions, as the working actuary for the Advisory Committee of the Actuarial Society of America, consisting of Mr. William A. Hutcheson, Mr. Robert Henderson and Mr. Henry Moir. As a result of this work, the New York City Teachers' Retirement System was the first governmental system in the United States to adopt the reserve basis for employer contributions. He served as consulting actuary for the City of New York until his retirement from the City in 1956.

The firm which Mr. Buck established in 1916 is retained as consulting actuary by hundreds of organizations, including banks, industrial firms, eleemosynary institutions and also a large number of governmental funds in the United States and abroad. For many years Mr. Buck served on the New York State Pension Commission. From 1920 on, he was Chairman of the Board of Actuaries of the United States Civil Service Retirement and Disability Fund, which covers employees of the classified Civil Service for the U. S. Government. He also served on the Actuarial Advisory Committee under the Railroad Retirement Act as the representative of the Railroad Brotherhoods.

Mr. Buck was an esthusiastic boatman, and had an extensive shop at his home working with metals and wood. He was a member of the Lawyers Club, the Merchants Club and the Larchmont Yacht Club, and was a Trustee of the Larchmont Manor Park Society and of the Horseshoe Harbor Yacht Club.

He will be remembered by his associates and his clients for the high professional standard he set for his office and for his strong advocacy of sound reserve financing of retirement plans.

Mr. Buck's first wife, Lyda Norris Buck, died in 1940. He is survived by his widow, Mrs. Mildred Medinger Buck, a son, George Burton Buck, Jr., and four grandchildren.

OBITUARY

ROBERT E. HAGGARD

1888-1958

Robert E. Haggard died on July 26, 1958, at Berkeley, California following a protracted illness.

He became an Associate of the Casualty Actuarial Society on November 18, 1921.

Born in Texas, Mr. Haggard came to California in childhood and received his early education in the public schools, and graduated from the University of California in 1913, as a Bachelor of Science. He joined the staff of the Industrial Accident Commission of California on April 22, 1915 and, with the exception of service in the Army during World War I, remained with the Commission until his retirement on March 1, 1953. Becoming Supervisor of the Permanent Disability Rating Bureau of the Commission on January 1, 1921, he served in this capacity until his retirement.

He was a student of Workmen's Compensation and an outstanding authority on permanent disability evaluation and rating. Under his direction the complex Permanent Disability Rating Schedule was completely revised and adopted by the Commission in 1950. In connection with this project he wrote extensively and was consulted by the California State Legislature on his work.

An exemplary public servant, Mr. Haggard enjoyed the esteem and respect of his co-workers and of the various parties associated with the Industrial Accident Commission.

He is survived by his widow, Amelia, three brothers and two sisters. He was a member of Theta Kappa Nu and Delta Gamma Sigma fraternities and of the Masonic Lodge.

OBITUARY

ROBERT J. McMANUS

1892-1960

Robert J. McManus was born in Hartford and lived all his life in that city. He served in the Navy during World War I and was an active member of Rau-Loche Post of The American Legion.

Mr. McManus came with The Travelers Insurance Company in 1910 following his education in the public schools of his home city. He became a Fellow in our Society by examination in 1917, being one of the first to obtain membership in this manner. He was Editor of our *Proceedings* from 1924-1932.

Mr. McManus was initially employed in the Accident Actuarial Department of The Travelers where he assisted in the development of the Non-Cancellable Accident and Health line. He became Assistant Statistician in the Casualty Actuarial Department in 1925, Statistician in 1928 and Assistant Actuary in 1950.

Mr. McManus' brother was the late James Goodwin McManus, the prominent Hartford artist, and Bob also had considerable ability as a landscape artist. He particularly enjoyed his summer home on Long Island Sound at Lyme, Connecticut.

At the time of his death, Mr. McManus was survived by his widow, Marie Dart McManus, and one son, Robert Dart McManus, and by three grandchildren.

OBITUARY

OTTO C. RICHTER

1899-1962

Otto C. Richter, chief actuary of the American Telephone and Telegraph Company, died on February 17, 1962, at the age of 62, of a heart attack in his home at Scarsdale, New York.

Mr. Richter attended the United States Naval Academy from 1917 to 1919 and graduated in 1923 from the University of Michigan, where he was a member of Phi Beta Kappa.

He joined the controller's department of A. T. & T. in 1923 and was named chief statistician in 1944 and chief actuary in 1952.

In 1934, on leave from the company, Mr. Richter served as actuarial consultant to the Committee on Economic Security in drafting the Social Security Act of 1935.

He became a Fellow of the Casualty Actuarial Society in 1926 and was also a Fellow of the Society of Actuaries, a member of the board of actuaries of the Federal Civil Service Retirement System, a member of the corporation of Presbyterian Hospital in New York and a trustee and member of the executive committee of the Teachers Insurance and Annuity Association in New York.

Surviving are his widow, two sons, Lawrence M. and Anthony B; a brother, Dr. Harry J. Richter, and a sister, Mrs. Henry P. McCartney.

OBITUARY

ANTONIO THOMAS TRAVERSI
1871-1961

Mr. Traversi, a Fellow of the Casualty Actuarial Society since 1922 and a long time resident of Sydney, Australia, died on April 20, 1961 at the age of 89 after a long illness.

He was born in New Zealand in 1871 and was the first New Zealander to become a Fellow of the Institute of Actuaries (London). While resident in New Zealand he was Actuary to the Friendly Societies Department and to the National Provident Fund of New Zealand from 1906 to 1917, Government Actuary to 1923 and Government Insurance Commissioner from 1923 to 1926. He was also a past President of the Actuarial Society of Australia.

On going to Australia in 1927 Mr. Traversi built up an extensive private practice, specializing in court evidence in compensation cases, in which he was considered an expert. He also carried out many valuations for Friendly Societies and Superannuation Funds. He was particularly noted for his grasp of currency matters. His Presidential address of June 1931, "The Economic Crisis", dealing with the causes of depressions, received wide recognition both at home and abroad.

Mr. Traversi willed his body to an Australian university. He is survived by his wife and a daughter, Mrs. A. C. Thackrah.

OBITUARY

PAUL A. TURNER
1902-1961

Paul A. Turner, a Fellow of our Society died on January 29, 1961, at the age of 58, at his home in Los Angeles, California.

Mr. Turner was a graduate of the University of Pennsylvania and was associated for many years with Joseph Froggatt & Company, Inc. where he held the position of assistant chief actuary. He was admitted to the Casualty Actuarial Society in 1947 and subsequently became a consulting actuary with offices in San Francisco and Los Angeles, and served as actuary for the Pacific Coast Advisory Association.

Mr. Turner, in addition to his business duties, found time to devote to his chief interest in life, the teaching of insurance accounting in universities throughout the country, his most recent assignment being with the University of Southern California.

MINUTES OF THE MEETING

May 3, 4 and 5, 1961

CONCORD HOTEL, LAKE KIAMESHA, NEW YORK

At the meeting the following 81 Fellows, 26 Associates and 34 invited guests, including 17 guests as subscribers to the "Invitational Program" registered as being in attendance. In addition many of the members and guests were accompanied to the meeting by their wives.

FELLOWS—81

Allen, E. S.
Bailey, R. A.
Barber, H. T.
Barter, J. L.
Bennett, N. J.
Berkeley, E. T.
Berquist, J. R.
Bevan, J. R.
Blodget, H. R.
Bondy, M.
Bornhuetter, R. L.
Boyajian, J. H.
Boyle, J. I.
Byrne, H. T.
Cahill, J. M.
Carlson, T. O.
Crowley, J. H., Jr.
Curry, H. E.
Dickerson, O. D.
Doremus, F. W.
Fairbanks, A. V.
Finnegan, J. H.
Foster, R. B.
Fowler, T. W.
Fredrickson, C. H.
Fuller, G. V.
Gillam, W. S.
Goddard, R. P.
Graham, C. M.
Graves, C. H.
Greene, W. W.
Hart, W. V. B., Jr.
Harwayne, F.
Hazam, W. J.
Hewitt, C. C., Jr.
Hope, F. J.
Hughey, M. S.
Hurley, R. L.
Johe, R. L.
Johnson, R. A.
Kallop, R. H.
Kormes, M.
LaCroix, H. F.
Latimer, M. W.
Leslie, W., Jr.
Linder, J.
Lino, R.
Liscord, P. S.
Longley-Cook, L. H.
MacKeen, H. E.
Makgill, S. S.
Masterson, N. E.
Matthews, A. N.
Menzel, H. W.
Muetterties, J. H.
Murrin, T. E.
Niles, C. L., Jr.
Oberhaus, T. M.
Otteson, P. M.
Pinney, A. D.
Pollack, R.
Roberts, L. H.
Rodermund, M.
Rosenberg, N.
Rowell, J. H.
Ruchlis, E.
Salzmann, R. E.
Simon, L. J.
Skelding, A. Z.
Smick, J. J.
Smith, E. M.
Smith, S. E.
Tapley, D. A.
Tarbell, L. L., Jr.
Thomas, J. W.
Trist, J. A. W.
Valerius, N. M.
Wilcken, C. L.
Williams, P. A.
Willsey, L. W.
Wittick, H. E.

ASSOCIATES—26

Ain, S. N.
Alexander, L. M.
Andrews, E. C.
Balcarek, R. J.
Berkman, J. M.
Budd, E. H.
DeMelio, J. J.
Feldman, M. F.
Grossman, E. A.
Harack, J.
McDonald, M. G.
McNamara, D. J.

ASSOCIATES *(Continued)*

Meenaghan, J. J.
Miller, N. F., Jr.
Moseley, J.
Muir, J. M.
Nelson, S. T.
Richards, H. R.
Roberts, F. A.
Royer, A. F.
Scammon, L. W.
Schneiker, H. C.
Sommer, A.
Strug, E. J.
Wilson, J. C.
Wooddy, J. C.

INVITED GUESTS—34

*Adams, J. R.
*Blane, R.
Booke, S. L.
*Brady, B. E.
Brody, L.
*Burney, C. T.
Caputo, R. N.
*Clarkin, D. J.
Dierauf, G. A.
*Donovan, H. G.
Donovan, J. B.
Erickson, E. A.
*Evans, G. M.
Forest, J. H.
Graham, E. E.
*Griffith, R. W.
Hohaus, R. A.
Johansen, P.
*Kaminoff, H.
*Korsan, P. J.
Ladner, G. R.
Martorana, J. F.
*Minsker, S. R.
*Nagel, J. R.
Parry, A. E.
*Peery, G. H.
*Sessa, F. E.
Sabbagh, M. J.
Schlier, C. L.
*Schoeck, R. J.
Smith, R. A.
Sohmer, H.
*Strong, H. L.
*Swart, S. H.

*Participants in Invitational Program.

The meeting convened at 2:00 P.M. with the holding of the following four concurrent seminars:

Seminar A

"Current Problems in Compensation Insurance"—Moderator: Russell P. Goddard, Actuary, New York Compensation Insurance Rating Board.

Seminar B

"Rate Making for Package Policies"—Moderator: LeRoy J. Simon, Associate Actuary, Insurance Company of North America.

Seminar C

"Accident Proneness"—Moderator: Ernest T. Berkeley, Actuary, Employers' Group.

Seminar D

"Marketing Research"—Moderator: Laurence H. Longley-Cook, Actuary, Insurance Company of North America.

Following the conclusion of the above sessions at about 3:30 P.M. the four seminars were repeated so that those in attendance were able to participate in 2 of the 4 seminars.

The seminar sessions having been completed, the gathering was then privileged to listen to the talk "Accreditation of Actuaries" by Mr. Reinhard

A. Hohaus, Senior Vice President and Chief Actuary of the Metropolitan Life Insurance Company and a Past President of the American Institute of Actuaries. Mr. Hohaus' talk was supplemented by additional interesting observations by Joe Linder, a Fellow of the C.A.S.

The formal session on May 3 terminated at 5:00 P.M. followed, later in the evening, by a brief social hour with light refreshments, sponsored by the management of the Concord Hotel, in honor of the C.A.S.

The meeting reconvened at 9:45 A.M. on Thursday, May 4, with President William Leslie, Jr. presiding.

At the start of the session President Leslie solicited the opinion of the members as to the type of future programs. By a show of hands the great majority of the members present indicated a preference for continuance of the seminar type.

The moderators of the seminar sessions held on Wednesday then presented a report of the proceedings and discussions at the respective seminars. Following each report there was further discussion and questions from the floor.

The President then introduced to the gathering Robert G. Young, Assistant Vice President of the Michigan Mutual Liability Company, admitted as a new Associate, and presented a diploma to Murray W. Latimer, Industrial Relations Consultant, who was admitted as a Fellow.

At this point Vice President Ernest T. Berkeley took over the conduct of the meeting. Thereupon a review and discussion of the following previously presented papers:

(1) "Coverage and Underwriting Aspects of Burglary Insurance" by Richard J. Wolfrum and Walker S. Richardson—reviewed by Thomas E. Murrin.

(2) "A New Approach to Infant and Juvenile Mortality" by Charles C. Hewitt, Jr.—reviewed by Allen L. Mayerson (read by Joseph Linder in the absence of Professor Mayerson). Mr. Hewitt, the author of the paper, then commented upon the review that had been presented.

(3) "Automobile Merit Rating and Inverse Probabilities" by Lester B. Dropkin—reviewed by Donald C. Weber, whose review was read to the gathering by Lewis H. Roberts.

This concluded the May 4th business session of the Spring Meeting. An informal banquet, preceded by a pleasant social hour, was held in the evening. However, in the interval between the conclusion of the business session and the social hour, a well attended, although unscheduled, symposium on "The Mathematical Theory of Risk" was held. As a result, the President later announced that he would appoint a Committee of the C.A.S. with the duty of exploring steps that might be taken to encourage the study and development of risk theory, a field in which there is currently a great deal of activity on the part of European actuaries but which, apparently, has not engaged the consideration of actuaries in this country, at least to the extent which the subject deserves.

The May 5th session of the Spring Meeting convened at 9:45 A.M. with Vice President Longley-Cook in the presiding chair.

The following new papers were then presented and reviews were read as indicated:

(1) "Cost of Hospital Benefits for Retired Employees" by Murray W. Latimer—reviewed by Allen D. Pinney.
(2) "A Study of the Size of An Assigned Risk Plan" by Frank Harwayne —reviewed by Paul Liscord.
(3) "Fitting Negative Binomial Distributions by the Method of Maximum Likelihood" by LeRoy J. Simon.
(4) "Reserves for Reopened Claims on Workmen's Compensation" by Rafal J. Balcarek.

Following the foregoing presentations a number of announcements were made. As a matter of interest some of them are reproduced here.

(1) The unscheduled symposium held in the evening of May 3rd was attended by about 50 interested members and guests.
(2) The sites of future meetings are—
    (a) November 15, 16, 17 of 1961. Palmer House, Chicago, Illinois.
    (b) May 21, 22, 23 of 1962. Hotel Griswold, Groton, Connecticut.
    (c) November 14, 15, 16 of 1962. Hotel Warwick, Philadelphia, Pennsylvania.
    (d) May of 1963. Concord Hotel, Lake Kiamesha, New York (tentative).
    (e) November of 1963, Boston, Massachusetts.
(3) The publication "Fire Insurance Ratemaking and Kindred Problems" has been completely sold out. It is now out-of-print and there are no plans for a reprinting.
(4) A revised edition of the publication "Workmen's Compensation Insurance Rate Making" by Ralph M. Marshall has been prepared and is available at a price of $1.50 per copy.
(5) A companion volume to the above, dealing with the automobile field, will be off the press in the late summer or early fall of 1961.

The gathering was then addressed by Mr. Paul Johansen, Vice-Director and Actuary of Nye Danke, Copenhagen, Denmark, and first Chairman of the ASTIN Section of the International Congress of Actuaries. The subject of Mr. Johansen's interesting and informative talk was "A Casualty Actuary in Europe".

Following Mr. Johansen's remarks, Professor O. D. Dickerson presented a review of the paper by Charles C. Hewitt, Jr., "The Negative Binomial Applied to the Canadian Merit Rating Plan for Individual Automobile Risks". Mr. Hewitt then presented some supplementary remarks following Professor Dickerson's review.

The Spring Meeting was then declared adjourned at 12:55 P.M. on Friday, May 5, 1961.

MINUTES OF THE MEETING

November 15, 16 and 17, 1961

PALMER HOUSE, CHICAGO, ILLINOIS

The November 1961 meeting of the Society opened at 2:00 P.M. on November 15 with the holding of four concurrent seminar sessions as follows:

A—Reinsurance
Paul M. Otteson, Chairman, assisted by Matthew Rodermund and Ruth E. Salzmann as discussion leaders.

B—Reports For Management
Clarence S. Coates, Chairman

C—Schedule Rating In Fire Insurance
Robert L. Hurley, Chairman

D—The Problem Of Substandard Automobile Risks
Frank Harwayne, Chairman

The four seminars were repeated for another session of about 75 minutes, beginning at 3:30 P.M.

The meeting reconvened at 9:30 A.M. on November 16, President William Leslie, Jr. presiding.

A tabulation of registrations indicates the following attendance:

FELLOWS—79

Bailey, R. A.
Barber, H. T.
Barker, L. M.
Bennett, N. J.
Berkeley, E. T.
Berquist, J. R.
Bondy, M.
Bornhuetter, R. L.
Boyajian, J. H.
Brannigan, J. F.
Brindise, R. S.
Budd, E. H.
Carlson, T. O.
Coates, C. S.
Curry, H. E.
Day, E. W.
Dickerson, O. D.
Doremus, F. W.
Drobisch, M. R.
Dropkin, L. B.
Elliott, G. B.
Espie, R. G.
Faust, J. E., Jr.
Fitzgibbon, W. J., Jr.
Fowler, T. W.
Fuller, G. V.
Gillam, W. S.
Ginsburgh, H. J.
Goddard, R. P.
Graham, C. M.
Graves, C. H.
Harwayne, F.
Hazam, W. J.
Hewitt, C. C., Jr.
Hobbs, E. J.
Hurley, R. L.
Johe, R. L.
Johnson, R. A.
Kallop, R. H.
Kates, P. B.
Klaassen, E. J.
Kormes, M.
Leslie, W., Jr.
Linden, J. R.
Linder, J.
Lino, R.
Liscord, P. S.
Longley-Cook, L. H.
Mackeen, H. E.
Makgill, S. S.
Masterson, N. E.
McGuinness, J. S.
Mills, R. J.
Moseley, J.
Muetterties, J. H.
Murrin, T. E.
Niles, C. L., Jr.
Otteson, P. M.
Perkins, W. J.
Petz, E. F.
Resony, A. V.
Roberts, L. H.
Rodermund, M.
Rowell, J. H.
Salzmann, R. E.
Schloss, H. W.

FELLOWS *(Continued)*

Simon, L. J.
Simoneau, P. W.
Skelding, A. Z.
Skillings, E. S.
Tapley, D. A.
Tarbell, L. L., Jr.
Uhthoff, D. R.
Wieder, J. W., Jr.
Wilcken, C. L.
Williams, P. A.
Wilson, J. C.
Wittick, H. E.
Wolfrum, R. J.

ASSOCIATES—45

Aldrich, W. C.
Alexander, L. M.
Balcarek, R. J.
Blumenfeld, M. E.
Coates, W. D.
Craig, R. A.
DeMelio, J. J.
Dorf, S. A.
Ehlert, D. W.
Gillespie, J. E.
Gould, D. E.
Greene, T. A.
Jones, N. F.
Kroeker, J. W.
Lange, J. T.
MacGinnitie, W. J.
McClure, R. D.
McDonald, M. G.
McIntosh, K. L.
McLean, G. E.
McNamara, D. J.
Meenaghan, J. J.
Miller, N. F., Jr.
Mohnblatt, A. S.
Morison, G. D.
Muir, J. M.
Nelson, R. E.
Nelson, S. T.
Parlin, R. W.
Peel, J. P.
Richards, H. R.
Roth, R. J.
Scammon, L. W.
Scheibl, J. A.
Schneiker, H. C.
Stankus, L. M.
Stern, P. K.
Stevens, W. A.
Stoke, K.
Strug, E. J.
Trudeau, D. E.
Walsh, A. J.
Wooddy, J. C.
Woodworth, J. H.
Young, R. G.

INVITED GUESTS—32

*Adams, J. R.
Adams, P.
Bradford, J. A.
Brady, B. E.
*Bussman, B. G.
Callahan, W. E.
Cherlin, G.
Crain, J.
*Donovan, H. G.
Fuller, H. H.
Gerber, J. S.
Gill, J. F.
*Griffith, R. W.
Hegarty, J. P., Jr.
Hommes, J.
*Ingall, H. E.
Jones, G.
Manza, H. L.
Marshall, R. E.
*Nagel, J. R.
O'Connor, J. C.
*Paczolt, P.
Ratnaswamy, R.
Reiner, J. G.
Rogers, D. J.
Sabbagh, M. J.
Shwide, H.
*Singer, P. E.
*Strong, H. L.
Sturgeon, E. R.
*Swift, C. W.
Tucker, T. F.

*Participants in Invitational Program.

The President announced that subsequent to the November 1960 meeting the Secretary-Treasurer had been informed of the death of the following members:

George B. Buck (Fellow)—Consulting Actuary, New York City
Robert E. Haggard (Associate)—Retired, Berkeley, California
Robert J. McManus (Fellow)—Retired, West Hartford, Connecticut
Antonio T. Traversi (Fellow)—Retired, Sydney, Australia

Paul A. Turner (Fellow)—Retired, Los Angeles, California

Vice President Ernest T. Berkeley then took over as presiding officer for the session.

The first order of business was a report from each of the seminar chairmen as to the discussions in their respective seminars. These reports were tape-recorded.

The gathering then received the Presidential Address of William Leslie, Jr. which will appear in the next volume of the *Proceedings.*

Following the President's Address the following new Associates were introduced:

WILLIAM C. ALDRICH
Assstant Secretary
National Council on Comp. Ins.
200 East 42nd Street
New York 17, New York

GEORGE CHERLIN
Assistant Mathematician
Mutual Benefit Life Insurance Co.
520 Broad Street
Newark 1, New Jersey

DARRELL W. EHLERT
Field Pricing Manager
Allstate Insurance Co.
7447 Skokie Boulevard
Skokie, Illinois

STEIN FERDEN
Actuary
Mutual Service Insurance Cos.
1919 University Avenue
St. Paul 4, Minnesota

DONALD E. GOULD
Senior Statistician
The State Insurance Fund
199 Church Street
New York 7, New York

THOMAS A. GREENE
Underwriting Department
American Re-Insurance Co.
99 John Street
New York 38, New York

MILTON HOROWITZ
Principal Actuary
The State Insurance Fund
199 Church Street
New York 7, New York

JEFFREY T. LANGE
Actuarial Division
Nat. Bu. of Casualty Underwriters
125 Maiden Lane
New York 38, New York

W. JAMES MACGINNITIE
Actuarial Department
Continental Casualty Co.
310 South Michigan Avenue
Chicago 4, Illinois

DONALD R. MARGOLIS
Actuarial Department
Insurance Co. of North America
1600 Arch Street
Philadelphia 1, Pennsylvania

RICHARD D. MCCLURE
Assistant Secretary
Am. Mutual Liab. Ins. Co.
Wakefield, Massachusetts

KENNETH L. MCINTOSH
Manager
La. Rating & Fire Prev. Bureau
P. O. Box 730
New Orleans 2, Louisiana

GEORGE E. MCLEAN
Manager
Actuarial-Statistical Services
Blue Cross-Blue Shield
133 Federal Street
Boston 6, Massachusetts

JERALD P. PEEL
Insurance Coordinator
Insurance Department
Standard Oil Co. (Indiana)
910 South Michigan
Chicago 80, Illinois

GEORGE D. MORISON
Actuarial Department
Aetna Casualty & Surety Company
and Standard Fire Insurance Co.
151 Farmington Avenue
Hartford 15, Connecticut

WILLIAM A. RIDDLESWORTH
Actuarial Department
Aetna Casualty & Surety Company
and Standard Fire Insurance Co.
151 Farmington Avenue
Hartford 15, Connecticut

ROBERT G. MOSS
Marsh & McLennan, Inc.
506 Olive Street
St. Louis 1, Missouri

JEROME A. SCHEIBL
Insurance Rater
Wisconsin Insurance Department
Madison 2, Wisconsin

ROLAND E. NELSON
Associate Actuary
State Farm Assurance Co.
112 East Washington Street
Bloomington, Illinois

DONALD E. TRUDEAU
Cas., Fire & Marine Actuarial Dept.
The Travelers Insurance Co.
700 Main Street
Hartford 15, Connecticut

ROBERT G. OIEN
Assistant Actuary
Mutual Service Insurance Co.
1919 University Avenue
St. Paul 4, Minnesota

ALBERT J. WALSH
Actuarial Assistant
Liberty Mutual Insurance Co.
175 Berkeley Street
Boston 17, Massachusetts

Diplomas were then presented to the new Fellows:

JAMES F. BRANNIGAN
Cas., Fire & Marine Actuarial Dept.
The Travelers Insurance Co.
700 Main Street
Hartford 15, Connecticut

WALTER J. FITZGIBBON, JR.
Actuarial Assistant
Aetna Casualty & Surety Company
and Standard Fire Insurance Co.
151 Farmington Avenue
Hartford 15, Connecticut

EDWARD H. BUDD
Cas., Fire & Marine Actuarial Dept.
The Travelers Insurance Co.
700 Main Street
Hartford 15, Connecticut

EDWARD J. HOBBS
Actuarial Department
Insurance Co. of North America
1600 Arch Street
Philadelphia 1, Pennsylvania

JOHN R. LINDEN
Actuarial Assistant
Aetna Casualty & Surety Company
and Standard Fire Insurance Co.
151 Farmington Avenue
Hartford 15, Connecticut

JACK MOSELEY
Assistant Actuary
U. S. Fidelity & Guaranty Co.
131 Redwood Street
Baltimore 3, Maryland

JAMES C. WILSON
Vice President and Actuary
Security General Insurance Co.
Winston-Salem, North Carolina

President Leslie then reported on various developments and the current interest expressed by individual members of the Casualty Actuarial Society and of the Society of Actuaries in bringing about a closer co-operation and relationship between the two organizations. Mr. Leslie's remarks were supplemented by additional comments from Robert G. Espie, Joseph Linder and Vice President Laurence H. Longley-Cook.

The report of the Secretary-Treasurer as to receipts and disbursements for the fiscal period October 1, 1960 through September 30, 1961 was then received. This report is attached to these Minutes.

The recommendations of the Nominating Committee for officers to be elected at this session were presented by Thomas O. Carlson, Chairman. Mr. Carlson reported that, as a result of a tabulation of ballots previously distributed to the Fellows, the Committee recommended the election of the following:

President	Laurence H. Longley-Cook
Vice President	Thomas E. Murrin
Vice President	Richard J. Wolfrum
Secretary-Treasurer	Albert Z. Skelding*
Member of Council	Robert L. Hurley
Member of Council	Roy H. Kallop
Member of Council	Paul S. Liscord

*Incumbent.

These nominations were then seconded by the Fellows present. There being no further nominations from the floor, the foregoing, as recommended by the Nominating Committee, were declared elected to the posts of President, Vice Presidents (2), Secretary-Treasurer and Members Of The Council (3), respectively. The meeting then approved the recommendations of the Council that Richard Lino be re-elected as Librarian and William J. Hazam as general chairman of the Examination Committee and empowered the Council to appoint an Editor to fill the vacancy occasioned by the resignation of the present Editor, Russell P. Goddard. (Note: Subsequent to the meeting, the Council appointed Harold W. Schloss as Editor for the coming year).

Mr. Frank Harwayne and Mr. George E. McLean gave a summary of their papers which had been prepared for presentation at this meeting. The titles of these papers, together with those of the other new papers presented at another time during the meeting, are set forth later in these Minutes.

The session was then recessed to reconvene on Friday morning, November 17.

On the evening of November 16, there was held a brief social hour followed by a banquet. Following the banquet the gathering was addressed by the Honorable Joseph S. Gerber, Director of Insurance for the State of Illinois.

The session reconvened at 9:45 A.M. on Friday, November 17.

At that time Norton E. Masterson gave an interesting report on the activities of the ASTIN colloquium held in Sweden in June of 1961.

Charles C. Hewitt, Jr., Chairman of the Committee on Mathematical Theory of Risk, presented a progress report and sketched, briefly, the contemplated activities of the Committee.

The following reviews of previously printed papers were read:

(1) "Fitting Negative Binomial Distributions By The Method Of Maximum Likelihood", author LeRoy J. Simon, reviewed by Martin Bondy.

(2) "Reserves For Reopened Claims On Workmen's Compensation", author Rafal J. Balcarek, reviewed by Ruth E. Salzmann.

The following new papers were presented:

(1) "Experience Rating Reassessed"—Robert A. Bailey.

(2) "Recent Trends and Innovations In Individual Hospital Insurance"—M. Eugene Blumenfeld.

(3) "Observations On The Latest Reported Stock Insurance Company Expenses For 1960"—Frank Harwayne.

(4) "Patterns Of Serious Illiness Insurance"—Mark Kormes.

(5) "Mathematical Limits To The Judgment Factor In Fire Schedule Rating"—Kenneth L. McIntosh.

(6) "An Actuarial Analysis Of A Prospective Experience Rating Approach For Group Hospital-Surgical-Medical Coverage"—George E. McLean.

The meeting adjourned at 12 Noon.

Attachments: Financial Report of Secretary-Treasurer
1961 Examinations—Successful Candidates

CASUALTY ACTUARIAL SOCIETY

Cash Receipts and Disbursements
from October 1, 1960 to September 30, 1961

Receipts			*Disbursements*	
On deposit in Chase Manhattan—October 1, 1960		$ 4,486.27	Printing & Stationery	$13,605.25
Members Dues	$10,560.00		Secretarial Services	900.00
Sale of Proceedings	3,123.90		Examination Expense	2,153.12
Sale of Readings	3,539.95		Luncheons & Dinners	1,881.68
Examination Fees	2,857.65		Library Fund	56.46
Luncheons and Dinners	2,128.25		Insurance	49.00
Interest on Bonds	147.15		Refunds—Lun. & Dins.	80.00
Michelbacher Fund	1,027.44		Refunds—Exam. Fees	79.00
Registration Fees	2,380.00		Miscellaneous	1,207.08
Invitational Program	2,400.00		—	—
Sale of Reprints	11.50		—	—
Miscellaneous	1,002.05	29,177.89		$20,011.59
Total		$33,664.16	On deposit 9-30-61 in Chase Manhattan	13,652.57
			Total	$33,664.16

Assets			*Liabilities*	
Cash in Bank 9-30-61	$13,652.57		Michelbacher Fund	$12,504.91
U. S. Savings Bonds	5,000.00		Other Surplus	6,147.66
Total		$18,652.57	Total	$18,652.57

* * *

Notes: The "Miscellaneous" item under "Income" includes $1,000 for the redemption of one 12 Yr. U.S. Savings Bond 2½% Series G No. M6,756,060G on November 1, 1960.

The "Miscellaneous" item under "Disbursements" includes $1,019.08 for purchase of one U.S. Treasury Bond 3⅞% No. 24277 due for $1,000 on May 15, 1968. This item also includes $150 for Organizational Membership dues to Insurance Society of New York.

* * *

Four 12 Yr. U.S. Savings Bonds 2½% Series G Nos. M7-228, 102G-103G-104G-105G—due for $4,000 on October 1, 1961.

One U.S. Treasury Bond 3⅞% No. 24277 due for $1,000 on May 15, 1968.

Employers' Fire Insurance Company Policy No. 31F169622 for $5,000 on Proceedings stored at 200 East 42nd Street, New York, N.Y. and $2,000

on Books kept in New York Insurance Society Library. Expires September 14, 1962.
Fidelity Bond for $10,000 in the Royal Indemnity Company.
Workmen's Compensation Policy No. 01-577362. Expires May 10, 1962.

* * *

This is to certify that we have audited the accounts, examined all vouchers and investments shown above and find same to be correct.

Howard G. Crane
October 26, 1961 Chairman, Auditing Committee

1961 EXAMINATIONS—SUCCESSFUL CANDIDATES

Following is a list of those who passed the examinations held by the Society on May 11 and 12, 1961:

ASSOCIATESHIP EXAMINATIONS

PART I	Amlie, W. P.	Dotchin, L. W.	MacGinnitie, W. J.
	Bachman, D. F.	Dunning, D. L.	Margolis, D. R.
	Bartik, R. F.	Durkin, J. H.	McClintock, J. S.
	Bell, A. A.	Dwyer, J. T.	Mertes, R. A.
	Brian, R. A.	Eyers, R. G.	Milsop, A. C.
	Brown, W. W.	Gibson, J. A., III	Murray, E. R.
	Burke, J.	Goldman, R.	Petersiel, A. S.
	Carlson, E. A.	Gould, D. E.	Pustaver, J. A., Jr.
	Cima, A.	Groeneveld, R. A.	Raid, G. A.
	Covitz, B.	Hansen, H. C.	Scott, J. E., Jr.
	Curry, A. C.	Hartmann, K. R.	Toren, C. J.
	Dahme, O. E.	Hindes, W. E.	Verhage, P.
	DeBolt, R. E.	Leslie, W. H.	Woodrum, L. J.
PART II (a)	Abbey, W. P.	Dahme, O. E.	Mertes, R. A.
	Allen, P. W., II	Dunning, D. L.	Mokros, B. F.
	Baine, M. B.	Goldman, R.	Mulvihill, F. X.
	Bandes, S.	Hanson, H. D.	Murray, E. R.
	Bell, A. A.	Herman, F. L.	Nelson, H.
	Bell. H.	Hillhouse, J. A .	Portermain, N. W.
	Bochichio, L. R.	Honebein, C. W.	Richardson, W. S.
	Bradford, J. A.	Kilbourne, F. W.	Tholen, J. P.
	Brown, W. W.	Lange, J. T.	Toren, C. J.
	Carson, D. E. A.	Leslie, W. H.	Verhage, P.
	Cima, A.	MacGinnitie, W. J.	Webb, B. L.
	Cleary, J. P.	Margolis, D. R.	Young, R. H.
		McBirney, B. H.	

PART II (b)	Cima, A.	MacGinnitie, W. J.	Portermain, N. W.
	Fowler, D. B.	Margolis, D. R.	Rubin, R. H.
	Hanson, H. D.	McClure, R. D.	Toren, C. J.
	Jensen, J. P.	Murray, E. R.	Trees, J. S.
	Lange, J. T.	Nelson, H.	Verhage, P.
	Leslie, W. H.		Walsh, A. J.
PART III (a)	Abbey, W. P.	Eyers, R. G.	Margolis, D. R.
	Aldrich, W. C.	Galson, S. P.	McClintock, J. S.
	Baine, M. B.	Gerundo, L. P., Jr.	Pillsbury, D. D.
	Bradford, J. A.	Goldberg, S.	Portermain, N. W.
	Brewer, R. T.	Honebein, C. W.	Rubin, R. H.
	Brian, R. A.	Hunter, J. R., Jr.	Streett, T. B., Jr.
	Brown, W. W.	Jensen, J. P.	Switzer, V. J.
	Chao, B.	Kaminoff, H.	Tholen, J. P.
	Corcoran, J. C.	Lange, J. T.	Trudeau, D. E.
	Dunham, G. B.	Linquanti, A. J.	Verhage, P.
	Edwards, R. J.	MacGinnitie, W. J.	Williams, W. T., Jr.
PART III (b)	Aldrich, W. C.	Hillhouse, J. A.	Naffziger, J. V.
	Bradford, J. A.	Honebein, C. W.	Nelson, H.
	Crandall, W. H.	Lange, J. T.	Oien, R. G.
	Curry, A. C.	Lofgren, P. G.	Priger, R. R.
	Even, C. A., Jr.	Lorman, W. E.	Reilly, F. V.
	Ferden, S.	MacGinnitie, W. J.	Stapley, K. R.
	Gerundo, L. P., Jr.	Margolis, D. R.	Switzer, V. J.
	Gibson, J. A., III	Morison, G. D.	Trudeau, D. E.
	Hammer, S. M.	Moss, R. G.	Walsh, A. J.
PART IV	Aldrich, W. C.	Lange, J. T .	Oien, R. G.
	Cherlin, G.	Levis, J. J.	Peel, J. P.
	Crain, J.	MacGinnitie, W. J.	Ratnaswamy, R.
	Ferden, S.	Margolis, D. R.	Scheibl, J. A.
	Finkel, D.	McLean, G. E.	Thompson, P.
	Gould, D. E.	Morison, G. D.	Trudeau, D. E.
	Horowitz, M.	Moss, R. G.	Zory, P. B.
		Nelson, R. E.	

FELLOWSHIP EXAMINATIONS

PART I	Carson, D. E. A.	Greene, T. A.	Riddlesworth, W. A.
	Ehlert, D. W.	Morison, G. D.	Roth, R. J.
		Parlin, R. W.	
PART II	Brannigan, J. F.	McNamara, D. J.	Moseley, J.
	DeMelio, J. J.	Meenaghan, J. J.	Parlin, R. W.
	Even, C. A., Jr.	Miller, N. F., Jr.	Richards, H. R.
	Gillespie, J. E.	Mohnblatt, A. S.	Schneiker, H. C.
	Kroeker, J. W.		Strug, E. J.

PART III	Budd, E. H.	Linden, J. R.	Meenaghan, J. J.
	Hobbs, E. J.		Stankus, L. M.
PART IV	Brannigan, J. F.	Hobbs, E. J.	McClure, R. D.
(a) and (b)	Budd, E. H.	Linden, J. R.	Moseley, J.
	Fitzgibbon, W. J., Jr.		Walsh, A. J.

*PART IV (b) Wilson, J. C.

*Credit for other section previously granted.

Note: There were no successful candidates for Part IV (a).

NEW ASSOCIATES

The following 21 candidates, having been successful in completing the examinations, will be admitted as Associates of the Society as of the date of the Annual Meeting in November 1961:

Aldrich, W. C.	Lange, J. T.	Nelson, R. E.
Cherlin, G.	MacGinnitie, W. J.	Oien, R. G.
Ehlert, D. W.	Margolis, D. R.	Peel, J. P.
Ferden, S.	McClure, R. D.	Riddlesworth, W. A.
Gould, D. E.	McLean, G. E.	Scheibl, J. A.
Greene, T. A.	Morison, G. D.	Trudeau, D. E.
Horowitz, M.	Moss, R. G.	Walsh, A. J.

NEW FELLOWS

The following 7 Associates, having been successful in completing the examinations, will be admitted as Fellows of the Society as of the date of the Annual Meeting in November 1961:

Brannigan, J. F.	Fitzgibbon, W. J., Jr.	Moseley, J.
Budd, E. H.	Hobbs, E. J.	Wilson, J. C.
	Linden, J. R.	

EXAMINATION FOR ENROLLMENT AS ASSOCIATE

PART I GENERAL MATHEMATICS

The questions for Part I were prepared and copyrighted by the Educational Testing Service of Princeton, N. J., and cannot be reprinted. Students may obtain a set of similar questions from the Secretary-Treasurer.

PART II SECTION (a)

1. The hearts and diamonds are removed from a deck of cards and dealt face up in a row. The remaining clubs and spades are shuffled and dealt face up in a row beneath the hearts and diamonds. What is the probability that all the clubs will be beneath the diamonds? Express your answer in the form of factorials

2. If six balls are tossed into three boxes so that each is equally likely to fall in any box, what is the probability that all boxes will be occupied?

3. A box contains 3 black balls and 1 white ball; a second box contains 4 red balls and 2 blue balls. A drawing consists of selecting 2 balls at random from each box. (The 4 balls are then replaced after the drawing.) What is the probability that in 5 drawings, 2 black balls and 2 red balls appear simultaneously exactly 3 times?

4. From an urn containing 3 white balls and 1 black ball, 2 balls are transferred to an urn containing 4 black and 2 white balls. Two balls are then drawn from this second urn and placed in the first. What is the probability that the original composition of the first urn has been restored?

5. A and B play a game which pays \$2 to the winner. If each game must result in a winner and a series of 3 games is played, find B's expectation, given that the odds in favor of A's winning a game are 3:1.

6. A point is selected at random in a square whose side is 1 inch long. If a circle of diameter ½ inch is drawn about the point as center, what is the probability that the circle contains a corner point of the square?

7. A box contains 10 balls, exactly 5 of which are black. If 5 balls are drawn from the box, without replacement, what is the probability that the last ball drawn is the third black ball to appear?

8. Three men alternately toss a die until a five turns up. What is the probability that the man who goes second will be the first to turn up the five?

PART II SECTION (b)

AREAS OF THE NORMAL CURVE

Z	AREA
0.00	.00000
.50	.19146
1.00	.34134
1.50	.43319
1.96	.47500
2.00	.47725
2.50	.49379
2.52	.49413
2.58	.49506
3.00	.49865

1. Define the following terms:
   (a) Mean absolute deviation
   (b) Coefficient of variation
   (c) Null hypothesis
   (d) Skewness

2. If x is a Poisson variable for which the probabilities of $x = 0$ and $x = 1$ are .050 and .150 respectively, find the probability that x will be greater than or equal to 3.

3. Given the following information about two sets of data:

   $n_1 = 20, \quad \bar{x}_1 = 25, \quad s_1^2 = 5; \qquad n_2 = 30, \quad \bar{x}_2 = 20, \quad s_2^2 = 4$

   Find the mean and variance of the composite set.

4. A normal population has a standard deviation of 2. What is the smallest sample size that will ensure with 95% confidence, that the sample mean will not differ from the population mean by more than 0.5?

5. A manufacturer of men's sport shirts is going to manufacture 10,000 shirts of a particular style. If we assume that men's shirt sizes are normally distributed and that four sizes, small, medium, large and extra large are to be made, how many should be made of each size?

6. Suppose you are one of a group of one hundred telephone subscribers whose practice is to make one three-minute call each during the busiest hour of the day. What is the probability that more than ten of you will be talking at once?

7. If $Y = a + bx$ is the regression line of y on x, and $X = a' + b'y$ is the regression line of x on y for the same data, find the coordinates of the point of intersection and the value of b/b' given that

$$N = 10, \quad \sum x = 20, \quad \sum x^2 = 100, \quad \sum y = 10, \quad \sum y^2 = 20$$

PART III SECTION (a)

Assume that you have C.S.O. $2\frac{1}{2}\%$ tables for $(1 + i)^n$, $s_{\overline{n}|}$, $a_{\overline{n}|}$, l_x, d_x, q_x, D_x, N_x, S_x, C_x, M_x, and R_x. Express your solutions in terms of these symbols where appropriate.

1. A mortality study indicates that out of 100 males born at the same time 1 dies annually until there are no survivors. If 3 men were known to be alive 5 years ago when their ages were 20, 30 and 60, find the probability that all are now alive.

2. An individual aged 25 agrees to pay \$200 to an insurance company at the beginning of every year for 40 years or until prior death. If he should die before making the 40th payment, his estate will receive the accumulated value of his payments. If he lives to make the fortieth payment, his original contract will be exchanged for a contract under which the company agrees to pay him R dollars at the end of every year as long as he lives. Calculate R if the first payment of R dollars is made one year after the last \$200 payment.

3. Prove that $\frac{1}{i}$ is equal to the present value of a perpetuity of \$1 per year at an annual rate of interest i.

4. A life insurance policy issued to (21) provides for a death benefit of \$3,000 in the event of death before age 60. If the policyholder survives to age 60, the sum of \$5,000 is paid to him. Calculate the net single premium for this policy.

5. Express the net single premium for an n year endowment insurance deferred r years in terms of commutation symbols.

6. A life insurance policy issued at age 32 provides for 28 annual premiums. If the insured dies before age 65, the death benefit is \$5,000; if he dies after age 65 the death benefit is \$2,000. Calculate the net annual premium.

7. Find the retrospective reserve for the tenth year for a \$1,000, 20 pay endowment at 85, policy issued at age 30.

8. A child's endowment policy issued at age 1 provides for a death benefit of \$100 in event of death in the first year, \$200 in the event of death in the second year, and so on, increasing by \$100 per year until a maximum of \$1,000 is reached. The policy matures at 21 with an endowment of \$1,000. Find the net annual premium.

9. Given the following New York State Annuity values per $100 annual wage:

Age of Child	First and Second Child	Third Child
0	401.39	113.98
1	385.07	108.23
2	368.16	102.40
3	350.66	96.48
4	332.54	90.47
5	313.78	84.39
6	294.35	78.22

Find the present value, as of the date of death, of an employee covered by the Workmen's Compensation Law of New York State, to three orphan children. The employee, who received annual wages of $3,000 was killed 3/12/61 and his children were born on 6/15/59, 1/30/58 and 12/18/55.

PART III SECTION (b)

1. Describe briefly four requirements of an insurable hazard.

2. Explain why insurance is the reverse of gambling

3. (a) What information must be known in order to determine the current yield on a common stock?

   (b) The value of a bond consists of the present value of what two sums?

4. Distinguish between chance and uncertainty. To which is risk related?

5. Briefly explain why the risk, as defined by Willet, that an insurance company carries is far less than the sum of the risks of the individual insureds.

6. Briefly explain the reason for and describe the dissimilarity in the distribution of assets of fire insurance companies and life insurance companies.

7. Briefly explain why some investors look upon stock casualty insurance companies as investment trusts.

8. How may it be determined whether or not the exercise of stock rights will create taxable income?

9. Define fundamental hazard and particular hazard and give an example of each.

PART IV SECTION (a)

1. What is a "sidetrack agreement"?

2. What reference is made to "abandonment" in many property insurance contracts? Define "abandonment."

3. What is meant by a "floater" type of policy?

4. Explain a consequential loss.

5. Which of the following types of benefits may an employee draw simultaneously?

   (1) Workmen's compensation
   (2) Unemployment insurance
   (3) Nonoccupational disability

6. Under what conditions, if any, can a carrier cancel workmen's compensation insurance?

7. What is the insured's obligation, under an automobile liability policy, with respect to any payment made by the company not otherwise required under the terms of the policy.

8. A fire policy covers direct loss, yet, the property does not have to burn in order to collect. Explain.

9. What perils are covered by the inchmaree clause in ocean marine insurance?

10. Inherent vice is listed as an exclusion in the jewelry-fur floater policy and other inland marine policies. Define inherent vice and give an example.

11. Give an illustration of the difference between "Straight deductibles" and "franchise clauses" as methods of deducting designated amounts from eligible loss under stipulated conditions.

12. Describe how the prudence and diligence required of property owners differs with respect to (1) trespassers, (2) licensees and (3) invitees.

13. Name and describe briefly three common law defenses of an employer under the law of negligence.

14. Explain how a "joint control" plan is used in connection with fiduciary bonds and how it works to the advantage of both the principal and the surety.

15. What insurance would be paid under a fire insurance policy with an 80% co-insurance clause on a property with a sound value of $10,000 at time of a

    a. $10,000 loss with $9,000 insurance in force
    b. 9,000 " " 7,000 " " "
    c. 4,000 " " 6,000 " " "

16. Name and describe three types of indirect loss which may be covered by endorsement on the direct damage boiler and machinery policy.

17. In ocean marine insurance, what is the difference between a "particular average loss" and a "general average loss"?

18. What are the causes of loss excluded under the comprehensive glass policy?

19. Define (a) Fire In Flight and (b) Fire While Not In Flight as used in an Aircraft Physical Damage Policy.

20. Define the purpose and operation of a "Two Thirds Vacancy Clause."

SECTION (b)

1. (a) Briefly describe the function of "credibility" in the rate making process.

   (b) The following statistics are developed in the preparation of a fire insurance rate revision in New York State for a class with an assigned credibility of 30%:

Earned premiums	$600,000
Incurred losses	399,000

   Using a "permissible loss ratio" of 47.5%, determine the formula change in rate level.

2. Briefly describe the use of and discuss the reasons underlying the need for "Trend" and "Projection" factors in the determination of automobile liability rates.

3. Discuss the merits of "Restricted Payroll" and "Value of Product" as possible media for measuring exposure under the Workmen's Compensation line of insurance.

4. (a) What is the purpose of the "Law Amendment Factor" as used in Workmen's Compensation insurance rate making?

   (b) Fill in the missing information in the following table:

Workmen's Compensation

Limit Factor Calculation and Effect of Law Amendment

		After Amendment	*Before Amendment*
(1)	State average weekly wage	$50.00	$50.00
(2)	Rate of compensation	66⅔%	50%
(3)	Minimum weekly benefit	$10.00	$ 5.00
(4)	Maximum weekly benefit	$36.67	$25.00
(5)	Ratio: Actual wage to average wage	25%	25%
(6)	Average weekly benefit — without limits	_____	_____
(7)	Average weekly benefit — with limits	_____	_____
(8)	Limit Factor	_____	_____
(9)	Effect of Law Amendment	_____	

5. What is the purpose of a loss development factor as used in automobile liability rate making? From the following data calculate the loss development factor applicable to the 1957 incurred losses:

Policy Year	*Incurred Losses — Basic Limits*	
	As of 24 months	*As of 36 months*
1954	$60,000,000	$60,120,000
1955	$60,000,000	$59,760,000
1956	$70,000,000	$69,510,000
1957	$75,000,000	

6. Outline the method used by the National Automobile Underwriters Association in the making of rates for private passenger automobile comprehensive and collision coverages.

EXAMINATION FOR ENROLLMENT AS FELLOW

PART I SECTION (a)

1. In December 1960 a small stock casualty insurance company had acquired an unusually large portfolio of new business. Explain how this acquisition may affect the federal income taxes incurred by the company during calendar year 1960.

2. Describe the Connecticut tax on investment income and discuss how this bears upon retaliatory taxes levied against carriers domiciled in that state by other states.

3. One of the most important areas with which the Federal Government is concerned in connection with State regulation of insurance is the existence of reasonable competition. Name five manifestations of competition. Compare the status of competition in Fire insurance with that in Casualty insurance.

4. Define an "equitable estoppel." What must be done to establish an estoppel?

5. Recently the Barrett-Russo Bill was passed in New York State amending Section 183-1(d) of the New York Insurance Law. The bill deals with commission cost provisions in rates. Give a brief description of the bill; why was it enacted? Discuss its merits.

6. As a result of his findings in a recent investigation of Regulation of the Insurance Industry by the States, Senator O'Mahoney formulated a Model Rate Regulatory Law.
Describe the provisions of this Law with respect to
   (a) Rating Organizations
   (b) Deviations
   (c) Criterion for rate adequacy
   (d) Approval of rates

7. At the December 1960 meeting of the N.A.I.C. nine principles to be included in rate regulatory laws were advocated by the National Board of Fire Underwriters in conjunction with the Association of Casualty and Surety Companies. Cite six of these recommendations.

8. One belief is that rate regulation which sanctions ratemaking in concert will provide rates which are inadequate for some companies and redundant for others. What are your thoughts on this subject?

SECTION (b)

1. Name and briefly describe five methods of solving the problem of the uninsured motorist.

2. In a given state a single private passenger automobile liability rate applies to all "vehicles" within a given rating territory. How and why might this type of rating system affect the Assigned Risk Plan in this state?

3. What recent methods have been developed to reduce the following automobile assigned risk problems?
   (a) Unfavorable underwriting results.
   (b) Relatively high proportion of youthful drivers in the Plan.
   (c) More coverage for assigned risks.

4. Cite the arguments for and against the "segregation of costs" by using private disability insurance plans along with state funds in a given state.

5. On May 10 a worker in New York State is fired from his job. On June 15 of the same year he becomes ill.

   (a) For what type of statutory benefits is he eligible after this date?

   (b) Who makes the payments to him?
   (c) How are these payments financed?

6. Distinguish between a fully insured and a currently insured Social Security status. To which types of benefit does a currently insured status entitle a person or his family.

7. Name and briefly describe three types of Unemployment Insurance Experience Rating Plans.

8. Cite four factors that cause the need for adjustment of the estimates of the volume of compensable unemployment derived on the basis of hypothetical models.

PART II SECTION (a)

1. (a) How does the advent of multiple line underwriting affect the relative size of the unearned premium reserves of a fire company and a casualty company? Why?

   (b) A given company begins to vigorously write a new line of insurance. What would you do as Actuary of this company to insure a proper unearned premium reserve for this line?

2. A policy subject to monthly audit requires a deposit premium of 25% of a full year's estimated premium. Suppose the estimated annual premium on such a policy written in January is $100,000. Give the unearned premium reserve at the end of each month from January to June. Show all calculations.

3. Describe two methods of recording unequal installment premiums and developing unearned premium reserves for three year burglary policies. Which method is preferable? Why?

4. Explain the need for Incurred But Not Reported Loss Reserves. Name and comment briefly upon three bases against which such losses are measured.

5. (a) Distinguish between retrospective and prospective tests of loss reserves.

   (b) Describe how certain schedules in the Annual Statement assist in retrospective tests.

   (c) Comment on the use of these tests.

6. (a) What three major items comprise the reserve for contingent commissions?

   (b) How can this reserve be determined?

   (c) What situation must be reflected in determining the reserve for contingent commission contracts on a fiscal year basis?

7. Mutual insurance companies domiciled in New York State are required to use Schedule R as a minimum reserve standard for Workmen's Compensation losses. Describe Schedule R and give a brief comparison with Schedule P. Under what circumstances would you expect a higher liability under Schedule P than under Schedule R?

SECTION (b)

1. A growing company showed the following underwriting results for calendar year 1960:

Written Premiums	$12,000,000
Earned Premiums	10,000,000
Losses Incurred	5,000,000
Loss Adjustment Expenses Incurred	500,000
Commissions Incurred	2,400,000
Other Acquisition Expenses Incurred	600,000
General Expenses Incurrred	1,440,000
Taxes, Licenses and Fees Incurred	240,000

How would you appraise these results?

2. (a) It has been said that insurance accounting is on a modified cash basis. Explain.

(b) Explain the difference in premium accounting for an agency company on an individual item basis and one on an account current basis. What are the advantages of each system?

(c) Where are the following general ledger accounts allocated in the annual statement blank and what is the normal balance?

(i) Direct Premiums Written
(ii) Commission on Reinsurance Ceded
(iii) Unpaid Contingent Commission
(iv) Commission Payable
(v) Dividends Paid to Policyholders Direct

3. You are given the ratios of General Administration Expenses to Net Earned Premiums for Workmen's Compensation of non-participating stock carriers for a specified period of years and the provision in the basic rates for this item. How would you go about determining whether the current provision is satisfactory? Describe the information you would require to determine this and, in a general way, the method you would use in arriving at a conclusion.

4. (a) What are the five basic parts of the Uniform Accounting Instructions?

   (b) Discuss the advantages and limitations of the Insurance Expense Exhibit and how might some of the data be supplemented for a more realistic picture of underwriting results.

5. Assume that a decision has been made to introduce an expense constant for automobile liability insurance. How would the amount of the expense constant be determined? Develop a method of adjusting the present expense provisions to reflect such a change in order that the rate structure will provide the same aggregate amount for expenses.

6. A company has the opportunity to write a block of business on January 1 which will produce monthly earned premiums of $100,000. Assuming a premium breakdown as shown below, what will be the difference in policyholders surplus at the end of February if the business is written in six month policies as compared with full year policies? Assume that Earned Premiums are calculated exactly and, further, that actual costs follow the premium breakdown:

Loss and loss expense	60%
General expense	12%
Acquisition	20%
Taxes	3%
Profit	5%

PART III SECTION (a)

1. Discuss the applicability of individual risk rating to each of the following risks:

   (a) An assured with an average annual payroll of $120,000 for each of the last 2 years with an average WC rate of 50¢ prevailing over the 2 years.

   (b) A 500 location chain store for fire insurance.

   (c) A single private passenger car for Bodily Injury Liability.

2. Calculate the rate credit for a $500 OL & T Public Liability Deductible policy at $10,000 Normal Limits, given:

(a)	Total number of losses	2,000
(b)	Number of losses under $500 per claim	1,100
(c)	Number of excess losses*	15
(d)	Total amount paid on all losses	1,000,000
(e)	Amount paid on losses under $500 per claim	150,000
(f)	Total amount paid on excess losses*	250,000
(g)	Permissible loss ratio (excluding claim expense)	50%
(h)	Allocated claim expense ratio	5%
(i)	Unallocated claim expense ratio	7%
(j)	Administration	5%
(k)	Inspection	3%
(l)	Acquisition, taxes and profit	30%
(m)	Safety factor	10%

*on the basis of $10,000 limit per person

3. Distinguish between the "stop loss" provision as applied in Workmen's Compensation retrospective rating and the "per accident limitation" as used in Liability retrospective rating.

4. The "Premium Return Plan" is a unique form of retrospective rating. Express the rating formula for this plan and explain how it differs from the normal retrospective formula.

5. Under the present Workmen's Compensation Experience rating plan determine the value for K and the maximum charge for a single loss, given a risk of $750 annual premium with expected losses of $450 and a D ratio of .60.

6. During the year 1960, a number of Fire Rating Bureaus adopted revisions in the "Rating Plan — Rules and Forms for Multiple Location Forms No. 1, No. 2, No. 4 and No. 5." What was the nature of the revisions in the following mathematical phases of the Plan?

   (a) Loss limitation for individual loss occurrences

   (b) Premium discount tables

   (c) Distribution of total risk insurance liabilities

   (d) Loss Frequencies

   (e) Risk Loss Ratio Table

7. (a) Describe the multi-split principle as it is applied in Workmen's Compensation experience rating.

   (b) Discuss the propriety of extending this principle to a line such as Automobile Liability.

8. In PCAS XXIV F. S. Perryman offered 3 conditions for a satisfactory credibility criteria for individual risk rating.

   (a) What are they?

   (b) Express them in mathematical symbols.

   (c) Prove that the formula $Z = \frac{E}{E + K}$ meets the specified conditions where

   Z = credibility
   E = expected losses
   K = a constant greater than zero

Section (b)

1. The chief Executive Officer of a Company enjoying a substantial growth notices that there is a sporadic movement in the Company's monthly fire losses. He requests his Actuary to investigate and prepare a recommendation for monthly standards of expected losses whereby he can measure the departures of actual results from expected. As the Actuary responsible for constructing a seasonal index of the Company's monthly fire losses:

   (a) What major factors would you expect to influence the monthly fire losses?

   (b) What steps would you take to adjust for these factors in preparing a seasonal index of monthly fire losses?

2. In Workmen's Compensation, underwriters are frequently being asked to erect separate and distinct classifications and rates for a new business or industrial operation. Briefly describe the criteria necessary for the determination of such a classification and outline three methods for the determination of its rate.

3. What is meant by multiple line underwriting? Enumerate at least six reasons in favor of the multiple line approach.

4. Roger Kenney has offered criteria for gauging the strength of fire and casualty companies. Comment on the criteria in the following areas:

   (a) It is generally desirable that a fire company show an impressive relationship between surplus and unearned premiums.

   (b) In the case of a casualty or a multiple line company much information can be obtained from Schedules "O" and "P".

   (c) Is the company writing larger gross lines (before reinsurance) than it ought to — considering the size of its surplus?

5. Recently the New York Automobile Assigned Risk plan has been amended in an effort to "depopulate" the plan. Describe some of the more important changes and explain how the depopulation could be effected.

6. Briefly outline the type of reinsurance program you would recommend to the management of a large Company writing:

   (a) Only fire risks on specialized industrial and commercial properties

   (b) Only Homeowners policies — no excess liability limits

   (c) Only private passenger automobile liability and physical damage.

7. (a) What is the Industry Credit Rating Plan of the nuclear energy liability insurance pools?

   (b) What provisions are made for additional assessments if the total pool develops a loss ratio in excess of 100%?

   (c) Describe the provisions for any potential refunds to assureds based on a retrospective review of the assured's own experience in the pool.

8. (d) Discuss the extension of group marketing principles into the property and casualty field.

PART IV SECTION (a)

1. In 1959 the National Council changed its Statistical Plan for Workmen's Compensation insurance as a result of its new rule regarding the application of experience modifications to premium rather than rates. Describe the changes in the plan pertaining to this feature and outline what steps would be necessary for a carrier reporting on a mechanized basis to conform to these changes.

2. (a) What is meant by an "exposure" statistic in Fire and Casualty insurance and discuss examples?

   (b) For which of the following coverages is an "exposure" measure provided in the applicable statistical plans: General Liability — Products, Personal Property Floater, Glass, Burglary, Homeowners?

   (c) How are exposures to be recorded under the General Liability Statistical Plan for: (1) audited risks and (2) three year policies?

3. "Since fire rates are generally based on a schedule approach and fire loss experience is filed by classifications, the published experience is meaningless and the Fire Statistical Plan is of no value." Do you believe this statement is true? Discuss.

4. Prudent company management is always seeking information as to its relative position within the industry both from an underwriting and financial standpoint. Enumerate the various statistics which you feel most accurately assess a carrier's relative position, and indicate from what publication each may be most easily obtained.

5. Identify the source for the following statistical series:

   (a) Gross National Product

   (b) Industrial Production

   (c) Total Labor Force

   (d) The Number of Non Farm Mortgages

   (e) Business Failures

   (f) Average Weekly Earnings Per Worker in Manufacturing Industries

   (g) Consumers' Price (Cost of Living) Index

6. Describe two approaches that might be taken to expand the amount of statistical information presently limited by the use of an 80 column punch card, and evaluate the merits of each approach.

7. What advantages are there in the use of "turn-around" or "re-entry" documents? How might these documents be applied to casualty insurance data processing?

8. Describe the three basic elements of an electronic digital computer and the necessary peripheral equipment.

SECTION (b)

1. The key provision in establishing rates for nuclear energy liability coverage is the application of a retrospective plan to a risk's experience over a ten-year period. Briefly outline the retrospective formula.

2. With the introduction of safe-driver plans for Automobile Liability insurance by the National Bureau came a new element of rating recognizing individual driving records by means of sub-classification rates. These rates were established initially by simply applying percentages to existing classifications rates determined by the rate-making formula as outlined in Stern's articles in P.C.A.S. XLIII. Obviously, an adjustment in Stern's ratemaking approach will be necessary to incorporate this new feature in computing future rates. Outline what you feel is a proper adjustment and give reasons supporting your thesis.

3. In Workmen's Compensation it has long been established that loss ratios vary by size of risk. How is this reflected in manual rate-making?

4. Outline the essential differences between the credibility treatment used in the New York 1958 fire rate revisions and the later recommendations by the Inter-Regional Insurance Conference.

5. It has been said the Fidelity coverage is of such a nature as to lend itself to a pure premium approach in ratemaking. Outline such an approach to the determination of rates for Bankers Blanket Bonds.

6. Comment on the observation that the formula for Massachusetts compulsory rates on private passenger automobiles ought to be revised to reflect the traffic congestion caused by the drivers coming into the more populous cities from the rural and smaller suburban communities.

7. A comparison was made of the 1951-1954 New York Disability Benefits Law experience with the data on which the initial rates were based in 1950. What reasons were advanced for the indicated disparities?

8. (a) What are rate revision adjustment factors and on what lines of coverage would you recommend their use in evaluating prior experience for possible rate adjustments?

(b) Derive a rate revision adjustment factor (F) given:

S = Exposure units or sum insured

a = Portion of the period after the rate change

(1-a) = Portion of the period prior to the rate change

r = rate per unit of exposure prior to the rate change

r′ = rate per unit of exposure after the rate change

d = rate change expressed as a decimal number

P = premium actually recorded on the Company's books during the year

P′ = corresponding premium with all premiums for year at r′ rates

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CASUALTY ACTUARIAL SOCIETY

ORGANIZED 1914

1962 YEAR BOOK

(Addendum to Volume XLVIII of the *Proceedings*.)

Corrected to December 1, 1961

FOREWORD

The Casualty Actuarial Society was organized November 7, 1914 as the Casualty Actuarial and Statistical Society of America, with 97 charter members of the grade of Fellow. The present title was adopted on May 14, 1921. The object of the Society shall be the promotion of actuarial and statistical science as applied to the problems of insurance, other than life insurance, by means of personal intercourse, the presentation and discussion of appropriate papers, the collection of a library and such other means as may be found desirable. The organization of the Society was brought about through the suggestion of Dr. I. M. Rubinow, who became the first president. The problems surrounding workmen's compensation were at that time the most urgent, and consequently many of the members played a leading part in the development of the scientific basis upon which workmen's compensation insurance now rests.

The members of the Society have also presented original papers to the *Proceedings* upon the scientific formulation of standards for the computation of both rates and reserves in accident and health insurance, liability, burglary, fire, and the various automobile coverages. The presidential addresses constitute a valuable record of the current problems facing the casualty insurance business. Other papers in the *Proceedings* deal with acquisition costs, pension funds, legal decisions, investments, claims, reinsurance, accounting, statutory requirements, loss reserves, statistics, and the examination of insurance companies. The Report of the Committee on Mortality for Disabled Lives together with commutation tables and life annuities has been printed in Volume XXXII. The Committee on Compensation and Liability Loss and Loss Expense Reserves submitted a report which appears in Volume XXXV. Other publications of the Society and the prices thereof are listed on the inside of the front cover of this *Year Book*.

At the November 1950 meeting of the Society the Constitution and By-Laws were amended to enlarge the scope of the Society to include all lines of insurance other than life insurance. The effect of the amendment was to include fire insurance and allied lines in recognition of multiple line writing power granted by many states to both casualty companies and fire companies.

The membership of the Society consists of actuaries, statisticians, and executives who are connected with the principal casualty companies and organizations in the United States and Canada. The Society has a total membership of 379 consisting of 203 Fellows and 176 Associates. Examinations for these two grades of membership are held during the second or third week of the month of May, in various cities in the United States and Canada.

The Society issues a publication entitled the *Proceedings* which contains original papers presented at the meetings, together with discussions of the papers and reviews of books. The *Year Book* is published annually. *Recommendations for Study* is a pamphlet which outlines the course of study to be followed in connection with the examination for admission. These two booklets may be obtained free upon application to the Secretary-Treasurer, Albert Z. Skelding, 200 E. 42nd Street, New York 17, N. Y.

CASUALTY ACTUARIAL SOCIETY

NOVEMBER 17, 1961

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MEMBERSHIP OF THE SOCIETY, NOVEMBER 17, 1961

FELLOWS

Those marked (†) were Charter Members at date of organization, November 7, 1914

Admitted	
Nov. 21, 1930	AINLEY, JOHN W., Assistant Actuary, The Travelers Insurance Company, 700 Main Street, Hartford 15, Conn.
Nov. 14, 1947	ALLEN, EDWARD S., Actuary, The Phoenix of Hartford Insurance Companies, 61 Woodland Street, Hartford 15, Conn.
Nov. 13, 1931	AULT, GILBERT E., Actuary, Church Pension Fund & Church Life Insurance Corporation, 20 Exchange Place, New York 5, N. Y.
Nov. 18, 1955	BAILEY, ROBERT A., Associate Actuary, Insurance Company of North America, 1600 Arch Street, Philadelphia 1, Pa.
Nov. 20, 1924	BARBER, HARMON T., Second Vice President and Actuary, The Travelers Insurance Company, 700 Main Street, Hartford 15, Conn.
Nov. 19, 1954	BARKER, GORDON M., c/o Bowles, Andrews & Towne, 1004 Thompson Street, Richmond 21, Va.
Nov. 14, 1947	BARKER, LORING M., Actuary, The Fund Insurance Companies, 3333 California Street, San Francisco, Calif.
Nov. 20, 1942	BART, ROBERT D., Director of Employee Relations and Assistant Treasurer, The West Bend Company, 400 Division Street, West Bend, Wis.
Nov. 18, 1932	BARTER, JOHN L., *(Retired), 90 Tunxis Road, West Hartford 7, Conn.*
Nov. 13, 1931	BATHO, ELGIN R., Vice President and Actuary, Berkshire Life Insurance Company, 7 North Street, Pittsfield, Mass.
Nov. 14, 1958	BENBROOK, PAUL, Vice President, American General Insurance Company, *700 Rusk Bldg., P.O. Box 2179, Houston 2, Texas.*
Nov. 16, 1956	BENNETT, NORMAN J., Actuary, America Fore Loyalty Group, 80 Maiden Lane, New York 38, N. Y.
Nov 22, 1934	BERKELEY, ERNEST T., Actuary, Employers' Group, 110 Milk Street, Boston 7, Mass.
Nov. 22, 1957	BERQUIST, JAMES R., Associate Actuary, Employers Mutuals of Wausau, 407 Grant Street, Wausau, Wis.
Nov. 19, 1953	BEVAN, JOHN R., Assistant Actuary, Liberty Mutual Insurance Company, 175 Berkeley Street, Boston 17, Mass.
†	BLACK, S. BRUCE, Chairman, Liberty Mutual Insurance Company, 175 Berkeley Street, Boston 17, Mass.
Apr. 20, 1917	BLANCHARD, RALPH H., Professor Emeritus of Insurance, Graduate School of Business, Columbia University, Plympton, Mass.
Nov. 19, 1959	BLODGET, HUGH R., Assistant Actuary, Aetna Casualty and Surety Company & Standard Fire Insurance Company, 151 Farmington Avenue, Hartford 15, Conn.
Nov. 16, 1956	BONDY, MARTIN, Actuary and Assistant Treasurer, Consolidated Mutual Insurance Company, 345 Adams Street, Brooklyn 1, N. Y.
Nov. 22, 1957	BORNHUETTER, RONALD L., Associate Actuary, National Bureau of Casualty Underwriters, 125 Maiden Lane, New York 38, N. Y.
Nov. 16, 1956	BOYAJIAN, JOHN H., Actuary, National Board of Fire Underwriters, 85 John Street, New York 38, N. Y.
Nov. 19, 1959	BOYLE, JAMES L., Assistant Actuary, The Travelers Insurance Company, 700 Main Street, Hartford 15, Conn.
Nov. 16, 1961	BRANNIGAN, JAMES F., Casualty, Fire & Marine Actuarial Dept., The Travelers Insurance Company, 700 Main Street, Hartford 15, Conn.

FELLOWS

Admitted †	
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Nov. 21, 1952	BRINDISE, RALPH S., Casualty Actuary, Standard Oil Company (Indiana), 910 S. Michigan Avenue, Chicago 80, Ill.
Nov. 18, 1927	BROWN, F. STUART, The American Insurance Company, 15 Washington Street, Newark 1, N. J.
Oct. 22, 1915	BROWN, HERBERT D., (Retired), Glenora-on-Lake Seneca, Dundee, N. Y.
Nov. 16, 1961	BUDD, EDWARD H., Assistant Actuary, The Travelers Insurance Company, 700 Main Street, Hartford 15, Conn.
Apr. 20, 1917	BURHOP, WILLIAM H., Chairman of the Board, Employers' Mutual Liability Insurance Company of Wisconsin, 407 Grant Street, Wausau, Wis.
Nov. 23, 1928	BURLING, WILLIAM H., Secretary, Group Dept., The Travelers Insurance Company, 700 Main Street, Hartford 15, Conn.
Nov. 19, 1959	BYRNE, HARRY T., Assistant Actuary, Aetna Casualty and Surety Company & Standard Fire Insurance Company, 151 Farmington Avenue, Hartford 15, Conn.
Nov. 19, 1929	CAHILL, JAMES M., Secretary, National Bureau of Casualty Underwriters, 125 Maiden Lane, New York 38, N. Y.
Nov. 18, 1932	CAMERON, FREELAND R., Senior Vice President, American-Equity Insurance Group, 901 N.E. 2nd Avenue, Miami 1, Fla.
Nov. 17, 1938	CARLETON, JOHN W., Vice President, Liberty Mutual Insurance Company, 175 Berkeley Street, Boston 17, Mass.
Nov. 21, 1930	CARLSON, THOMAS O., Manager, Southeastern Branch, National Bureau of Casualty Underwriters, 1627 Peachtree Street, N. E., Atlanta 9, Ga.
Nov. 18, 1949	CLARKE, JOHN W., President, General Reinsurance Life Corporation, 400 Park Avenue, New York 22, N. Y.
Nov. 15, 1918	COATES, BARRETT N., 1007 Cragmont Avenue, Berkeley 8, Calif.
Nov. 17, 1922	COATES, CLARENCE S., Actuary, Lumbermens Mutual Casualty Company, 4750 Sheridan Road, Chicago 40, Ill.
Feb. 19, 1915	COLLINS, HENRY, (Retired), Lochbrae, Windermere, Fla.
Nov. 22, 1934	COOK, EDWIN A., President and General Manager, Interboro Mutual Indemnity Insurance Company, 270 Madison Avenue, New York 16, N. Y.
Nov. 18, 1925	CORCORAN, WILLIAM M., Consulting Actuary, Wolfe, Corcoran & Linder, 116 John Street, New York 38, N. Y.
Nov. 19, 1926	CRANE, HOWARD G., Vice President and Treasurer, General Reinsurance Corporation, 400 Park Avenue, New York 22, N. Y.
Nov. 21, 1952	CRITCHLEY, DOUGLAS, E. B. Savory & Company, London, England.
Nov. 22, 1946	CROUSE, CHARLES W., Consulting Actuary, C. E. Preslan & Company, Inc., 20015 Detroit Road, Cleveland 16, Ohio.
Nov. 18, 1960	CROWLEY, JAMES H., JR., Actuarial Assistant, Aetna Casualty and Surety Company & Standard Fire Insurance Company, 151 Farmington Avenue, Hartford 15, Conn.
Nov. 19, 1953	CURRY, HAROLD E., Vice President, State Farm Mutual Automobile Insurance Company, 112 E. Washington Street, Bloomington, Ill.
Nov. 18, 1932	DAVIES, E. ALFRED, (Retired), Falls Village, Conn.
Nov. 18, 1927	DAVIS, EVELYN M., Partner, Woodward, Ryan, Sharp & Davis, Consulting Actuaries, 26 Broadway, Room 708, New York 4, N. Y.

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Admitted	
May 25, 1956	DAY, ELDEN W., Resident Secretary, Lumbermens Mutual Casualty Company, 342 Madison Avenue, New York 17, N. Y.
Nov. 18, 1960	DICKERSON, O. D., Associate Professor, Florida State University, Tallahassee, Fla.
Nov. 16, 1951	DOREMUS, FREDERICK W., Assistant General Manager, Inter-Regional Insurance Conference, 125 Maiden Lane, New York 38, N. Y.
Nov. 17, 1920	DORWEILER, PAUL, (Retired), 51 Wethersfield Avenue, Hartford 14, Conn.
Nov. 22, 1957	DROBISCH, MILES R., Assistant Actuary, California Inspection Rating Bureau, 1453 Mission Street, San Francisco 3, Calif.
Nov. 14, 1958	DROPKIN, LESTER B., Actuary, California Inspection Rating Bureau, 1453 Mission Street, San Francisco 3, Calif.
Nov. 24, 1933	EDWARDS, JOHN, Actuary, Ontario Department of Insurance, 145 Queen Street West, Toronto 1, Ontario.
Nov. 19, 1959	EIDE, K. ARNE, Statistical Bureau, Actuarial Div., Metropolitan Life Insurance Company, 1 Madison Avenue, New York 10, N. Y.
Nov. 15, 1940	ELLIOTT, GEORGE B., General Manager, Pennsylvania Compensation Rating Bureau, 315 Chestnut Street, Philadelphia 6, Pa.
Nov. 17, 1922	ELSTON, JAMES S., (Retired), 1640 Palmer Avenue, Winter Park, Fla.
Nov. 15, 1935	EPPINK, WALTER T., 2nd Vice President, Treasurer and Actuary, Merchants Mutual Insurance Company, 268 Main Street, Buffalo 5, N. Y.
Nov. 14, 1958	ESPIE, ROBERT G., Vice President and Assistant Comptroller, Aetna Life Affiliated Companies, 151 Farmington Avenue, Hartford 15, Conn.
Nov. 18, 1955	FAIRBANKS, ALFRED V., Associate Actuary, Monarch Life Insurance Company, 1250 State Street, Springfield, Mass.
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†	FARRER, HENRY, (Retired), 1352 Overlea Street, Clearwater, Fla.
Nov. 18, 1960	FAUST, J. EDWARD, JR., Consulting Actuary, 4117 Central Avenue, Indianapolis, Ind.
May 25, 1956	FINNEGAN, JOSEPH H., Manager, Actuarial Bureau, National Board of Fire Underwriters, 85 John Street, New York 38, N. Y.
Nov. 16, 1961	FITZGIBBON, WALTER J., JR., Actuarial Assistant, Aetna Casualty and Surety Company & Standard Fire Insurance Company, 151 Farmington Avenue, Hartford 15, Conn.
Nov. 15, 1935	FITZHUGH, GILBERT W., Executive Vice President, Metropolitan Life Insurance Company, One Madison Avenue, New York 10, N. Y.
Feb. 19, 1915	FONDILLER, RICHARD, Consulting Actuary, Woodward and Fondiller, Inc., 420 Madison Avenue, New York 17, N. Y.
Nov. 18, 1955	FOSTER, ROBERT B., Associate Actuary, Casualty, Fire & Marine Actuarial Dept., The Travelers Insurance Company, 700 Main Street, Hartford 15, Conn.
Nov. 18, 1955	FOWLER, THOMAS W., Associate Group Actuary, Nationwide Mutual Insurance Company, 246 N. High Street, Columbus, Ohio.
Nov. 18, 1927	FREDRICKSON, CARL H., Actuary, Canadian Underwriters Association, 12 Upjohn Road, Don Mills, Ontario, Canada.

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Nov. 22, 1934	FULLER, GARDNER V., (Retired), Conover, Wis.
Nov. 22, 1957	GILLAM, WILLIAM S., Director of Research, National Bureau of Casualty Underwriters, 125 Maiden Lane, New York 38, N. Y.
Nov. 20, 1924	GINSBURGH, HAROLD J., 14 Crestview Road, Belmont 78, Mass.
Nov. 21, 1930	GLENN, JOSEPH B., Consulting Actuary, 6110 Valley Road, Washington 14, D. C.
Nov. 13, 1931	GODDARD, RUSSELL P., Actuary, New York Compensation Insurance Rating Board, 200 E. 42nd Street, New York 17, N. Y.
†	GOODWIN, EDWARD S., (Retired), Investment Counselor, 96 Garvan Street, East Hartford 8, Conn.
Nov. 19, 1926	GRAHAM, CHARLES M., Fire and Casualty Actuary, Florida Insurance Department, State Capitol, Tallahassee, Fla.
†	GRAHAM, WILLIAM J., Consultant, 1070 Park Avenue, New York 18, N. Y.
Nov. 19, 1953	GRAVES, CLYDE H., Actuary, Mutual Insurance Rating Bureau & Assistant Manager, Mutual Insurance Advisory Association, 733 Third Avenue, New York 17, N. Y.
†	GREENE, WINFIELD W., President, W. W. Greene, Inc., Reinsurance Intermediaries and Actuarial Consultants, 32 Cliff Street, New York 38, N. Y.
Nov. 19, 1953	HALEY, JAMES B., JR., Coates, Herfurth & England, Consulting Actuaries, Crocker Bldg., San Francisco, Calif.
†	HAMMOND, H. PIERSON, (Retired), 22 Vanderbilt Road, West Hartford 7, Conn.
Nov. 16, 1956	HART, W. VAN BUREN, JR., Rating Div., Compensation & Liability Dept., Aetna Insurance Company, 55 Elm Street, Hartford 15, Conn.
Nov. 17, 1950	HARWAYNE, FRANK, Chief Actuary, New York State Insurance Department, 123 William Street, New York 38, N. Y.
Nov. 19, 1926	HAUGH, CHARLES J., Vice President, The Travelers Insurance Company & The Travelers Indemnity Company, 700 Main Street, Hartford 15, Conn.
Nov. 17, 1950	HAZAM, WILLIAM J., Assistant Vice President and Actuary, American Mutual Liability Insurance Company, Wakefield, Mass.
Nov. 16, 1951	HEWITT, CHARLES C., JR., 1123 Stilford Avenue, Plainfield, N. J.
Nov. 16, 1961	HOBBS, EDWARD J., Insurance Company of North America, 1600 Arch Street, Philadelphia 1, Pa.
Nov. 22, 1934	HOOKER, RUSSELL O., Consulting Actuary, 750 Main Street, Hartford 3, Conn.; & President and Actuary, Insurance City Life Company.
Nov. 17, 1950	HOPE, FRANCIS J., Assistant Secretary, Hartford Accident and Indemnity Company, 690 Asylum Avenue, Hartford 15, Conn.
Nov. 18, 1932	HUEBNER, S. S., President Emeritus, American College of Life Underwriters, 266 Bryn Mawr Avenue, Bryn Mawr, Pa.
Nov. 14, 1947	HUGHEY, M. STANLEY, Vice President, Lumbermens Mutual Casualty Company, 4750 Sheridan Road, Chicago 40, Ill.
Nov. 19, 1959	HUNT, FREDERIC J., JR., Associate Actuary, Insurance Company of North America, 1600 Arch Street, Philadelphia 1, Pa.
†	HUNTER, ARTHUR, (Retired), 124 Lloyd Road, Montclair, N. J.
Nov. 18, 1955	HURLEY, ROBERT L., Actuary, Inter-Regional Insurance Conference, 125 Maiden Lane, New York 38, N. Y.

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Admitted	
Nov. 19, 1954	JOHE, RICHARD L., Vice President and Actuary, United States Fidelity and Guaranty Company, Calvert & Redwood Streets, Baltimore 3, Md.
Nov. 14, 1941	JOHNSON, ROGER A., Actuary, The Associated Hospital Service of Philadelphia, 112 S. 16th Street, Philadelphia 2, Pa.
Nov. 16, 1939	JONES, HAROLD M., Supervisor, Group Insurance Research Div., John Hancock Mutual Life Insurance Company, 200 Berkeley Street, Boston 17, Mass.
Nov. 16, 1956	KALLOP, ROY H., Actuary, National Council on Compensation Insurance, 200 E. 42nd Street, New York 17, N. Y.
Nov. 22, 1957	KATES, PHILLIP B., Vice President and Actuary, Southern Fire and Casualty Company, P.O. Box 240, Knoxville, Tenn.
Nov. 19, 1926	KELTON, WILLIAM H., (Retired), 122 Arundel Avenue, West Hartford 7, Conn.
Nov. 19, 1959	KLAASSEN, ELDON J., Associate Actuary, Continental Casualty Company, 310 S. Michigan Avenue, Chicago 4, Ill.
Nov. 14, 1941	KOLE, MORRIS B., Director of Insurance Fund Planning and Data Processing, The State Insurance Fund, 199 Church Street, New York 7, N. Y.
Nov. 24, 1933	KORMES, MARK, President, Actuarial Associates Incorporated, 285 Madison Avenue, New York 17, N. Y.
Nov. 19, 1953	KUENKLER, ARTHUR S., Executive Vice President, Security-Connecticut Insurance Group, 175 Whitney Avenue, New Haven, Conn.
Nov. 18, 1949	LACROIX, HAROLD F., Second Vice President, The Travelers Insurance Company, 700 Main Street, Hartford 15, Conn.
May 5, 1961	LATIMER, MURRAY, W., Industrial Relations Consultant, 1625 K Street, N.W., Washington 6, D.C.
†	LESLIE, WILLIAM, SR., (Retired), 20 Schoolhouse Hill Road, Newtown, Conn.
Nov. 17, 1950	LESLIE, WILLIAM, JR., General Manager, National Bureau of Casualty Underwriters, 125 Maiden Lane, New York 38, N. Y.
Nov. 16, 1961	LINDEN, JOHN R., Actuarial Assistant, Aetna Casualty and Surety Company & Standard Fire Insurance Company, 151 Farmington Avenue, Hartford 15, Conn.
Nov. 20, 1924	LINDER, JOSEPH, Consulting Actuary, Wolfe, Corcoran & Linder, 116 John Street, New York 38, N. Y.
Nov. 16, 1956	LINO, RICHARD, Actuary, National Bureau of Casualty Underwriters, 125 Maiden Lane, New York 38, N. Y.
Nov. 18, 1955	LISCORD, PAUL S., Associate Actuary, The Travelers Insurance Company, 700 Main Street, Hartford 15, Conn.
Nov. 17, 1950	LIVINGSTON, GILBERT R., Casualty Actuary, Connecticut Insurance Department, State Office Bldg., Hartford 15, Conn.
Nov. 16, 1951	LONGLEY-COOK, LAURENCE H., Actuary, Insurance Company of North America, 1600 Arch Street, Philadelphia 1, Pa.
Nov. 13, 1936	LYONS, DANIEL J., Senior Vice President, Guardian Life Insurance Company, Park Avenue South at 17th Street, New York 3, N. Y.
Nov. 19, 1954	MACKEEN, HAROLD E., *Assistant Actuary; Casualty, Fire & Marine* Actuarial Dept., The Travelers Insurance Company, 700 Main Street, Hartford 15, Conn.
Nov. 14, 1958	MAGRATH, JOSEPH J., Secretary, Federal Insurance Company, 90 John Street, New York 38, N. Y.
Nov. 22, 1957	MAKGILL, STEPHEN, S., Assistant Actuary; Casualty, Fire & Marine Actuarial Dept., The Travelers Insurance Company, 700 Main Street, Hartford 15, Conn.

FELLOWS

Admitted	
Nov. 23, 1928	MARSHALL, RALPH M., (Retired), Catts Corner, Worton, Kent County, Md.
Nov. 18, 1927	MASTERSON, NORTON E., Vice President and Actuary, Hardware Mutual Casualty Company & Hardware Dealers Mutual Fire Insurance Company, 200 Strongs Avenue, Stevens Point, Wis.
Nov. 19, 1926	MATTHEWS, ARTHUR N., Actuary, The Travelers Insurance Company, 700 Main Street, Hartford 15, Conn.
May 19, 1915	MAYCRINK, EMMA C., 32 Chittenden Avenue, Crestwood, N. Y.
Nov. 14, 1958	MAYERSON, ALLEN L., Associate Professor, Mathematics and Insurance, University of Michigan, Ann Arbor, Mich.
Nov. 15, 1935	MCCONNELL, MATTHEW H., Superintendent, Compensation & Liability Dept., General Accident Fire and Life Assurance Corporation, Ltd., Fourth and Walnut Streets, Philadelphia 5, Pa.
Nov. 18, 1960	MCGUINNESS, JOHN S., Budget Director, Glens Falls Insurance Company, Glens Falls, N. Y.
Nov. 18, 1955	MENZEL, HENRY W., Actuary, Springfield-Monarch Insurance Companies, 1250 State Street, Springfield, Mass.
†	MICHELBACHER, GUSTAV F., (Retired), 15201 Quito Road, Saratoga, Calif.
Nov. 17, 1938	MILLER, JOHN H., Vice President and Senior Actuary, Springfield-Monarch Insurance Companies, 1250 State Street, Springfield 1, Mass.
†	MILLIGAN, SAMUEL, Senior Vice President, Metropolitan Life Insurance Company, 1 Madison Avenue, New York 10, N. Y.
Nov. 18, 1937	MILLS, JOHN A., (Retired), Point Placid, Reeds Spring, Mo.
Nov. 22, 1957	MILLS, RICHARD J., Statistical Dept., Lumbermens Mutual Casualty Company, 4750 Sheridan Road, Chicago 40, Ill.
Nov. 16, 1961	MOSELEY, JACK, Assistant Actuary, United States Fidelity and Guaranty Company, Calvert and Redwood Streets, Baltimore 3, Md.
Nov. 17, 1920	MUELLER, LOUIS H., 2845 Lake Street, San Francisco 21, Calif.
Nov. 16, 1956	MUETTERTIES, JOHN H., Associate Actuary, Hardware Mutual Casualty Company & Hardware Dealers Mutual Fire Insurance Company, 200 Strongs Avenue, Stevens Point, Wis.
Nov. 17, 1950	MUNTERICH, GEORGE C., Assistant Secretary, Hartford Fire Insurance Company, Hartford Accident and Indemnity Company & Citizens Insurance Company of New Jersey, 690 Asylum Avenue, Hartford 15, Conn.
May 28, 1920	MURPHY, RAY D., (Retired), 28 Godfrey Road, Upper Montclair, N. J.
Nov. 19, 1954	MURRIN, THOMAS E., Vice President and Actuary, The American Insurance Company, 15 Washington Street, Newark 1, N. J.
Nov. 19, 1959	MYERS, ROBERT J., Chief Actuary, Department of Health, Education and Welfare, Social Security Administration, Washington 25, D. C.
Nov. 14, 1958	NILES, CHARLES L., JR., Actuary, General Accident Group, General Bldg., 414 Walnut Street, Philadelphia 5, Pa.
Nov. 15, 1935	OBERHAUS, THOMAS M., Vice President, Woodward and Fondiller, Inc., 420 Madison Avenue, New York 17, N. Y.
†	OLIFIERS, EDWARD, Consulting Actuary, Caixa Postal 8, Petropolis, Rio, Brazil.
†	ORR, ROBERT K., (Retired), 757 S. Johnson Avenue, Lakeland, Fla.

FELLOWS

Admitted	
Nov. 22, 1957	OTTESON, PAUL M. Vice, President and Actuary, Federated Mutual Implement and Hardware Insurance Company & Federated Life Insurance Company, 129 East Broadway, Owatonna, Minn.
Nov. 21, 1919	OUTWATER, OLIVE E., (Retired), Harbert, Mich.
Nov. 18, 1960	PENNYCOOK, ROD B., Health Insurance Assistant, The Great-West Life Assurance Company, 60 Osborne Street, Winnipeg, Manitoba.
Nov. 22, 1957	PERKINS, WILLIAM J., Assistant Group Actuary, The London Life Insurance Company, London, Ontario, Canada.
Nov. 14, 1941	PETERS, STEFAN, Consulting Actuary, 64 Mt. Vernon Street, Cambridge, Mass.
Nov. 21, 1952	PETZ, EARL F., Assistant Secretary, Lumbermens Mutual Casualty Company, 4750 Sheridan Road, Chicago 40, Ill.
Nov. 19, 1959	PHILLIPS, HERBERT J., JR., Assistant Actuary, Employers' Liability Assurance Corporation, Ltd., 110 Milk Street, Boston 7, Mass.
Nov. 24, 1933	PICKETT, SAMUEL C., (Retired), 126 Macktown Road, Windsor, Conn.
Nov. 22, 1957	PINNEY, ALLEN D., Assistant Secretary, The Travelers Insurance Company, 700 Main Street, Hartford 15, Conn.
Nov. 17, 1922	PINNEY, SYDNEY D., 290 Wolcott Hill Road, Wethersfield 9, Conn.
Nov. 19, 1959	POLLACK, ROBERT, Assistant Actuary, American Mutual Liability Insurance Company, Wakefield, Mass.
Nov. 13, 1931	PRUITT, DUDLEY M., Field Director, American Friends Service Committee, 28 Azabu Fujimi-cho, Minato-ku, Tokyo, Japan.
Nov. 18, 1955	RESONY, ALLIE V., Actuary; Accident & Sickness Div., Actuarial Dept., Hartford Accident and Indemnity Company, 690 Asylum Avenue, Hartford 15, Conn.
Nov. 18, 1949	RESONY, JOHN A., Secretary, Group Dept., The Travelers Insurance Company, 700 Main Street, Hartford 15, Conn.
Nov. 16, 1951	RICE, HOMER D., (Retired), 1731 Morningside Drive, Mount Dora, Fla.
Nov. 19, 1926	RICHTER, OTTO C., Chief Actuary, American Telephone & Telegraph Company, 195 Broadway, New York 7, N. Y.
May 24, 1921	RIEGEL, ROBERT, Professor Emeritus of Statistics and Insurance, University of Buffalo, Buffalo 14, N. Y.
Nov. 14, 1958	ROBERTS, LEWIS H., Actuary, National of Hartford Companies, 1000 Asylum Avenue, Hartford 15, Conn.
Nov. 14, 1947	RODERMUND, MATTHEW, Vice President-Actuary, Munich Reinsurance Company, 410 Park Avenue, New York 22, N. Y.
Nov. 14, 1947	ROSENBERG, NORMAN, Executive Assistant, Farmers Insurance Group, 4680 Wilshire Boulevard, Los Angeles 54, Calif.
Nov. 14, 1947	ROWELL, JOHN H., Actuary, Marsh & McLennan, Inc., 231 S. LaSalle Street, Chicago 4, Ill.
Nov. 17, 1938	RUCHLIS, ELSIE, Actuarial Supervisor, National Bureau of Casualty Underwriters, 125 Maiden Lane, New York 38, N. Y.
Nov. 14, 1947	SALZMANN, RUTH E., Associate Actuary, Insurance Company of North America, 1600 Arch Street, Philadelphia 1, Pa.
Nov. 19, 1948	SCHLOSS, HAROLD W., Secretary and Actuary, Royal-Globe Insurance Group, 150 William Street, New York 38, N. Y.
Nov. 18, 1937	SHAPIRO, GEORGE I., 934 E. 9th Street, Brooklyn 30, N. Y.
Nov. 13, 1931	SILVERMAN, DAVID, Consulting Actuary, Wolfe, Corcoran & Linder, 116 John Street, New York 38, N. Y.

FELLOWS

Admitted	
Nov. 19, 1954	SIMON, LEROY J., Associate Actuary, Insurance Company of North America, 1600 Arch Street, Philadelphia 1, Pa.
Nov. 18, 1960	SIMONEAU, PAUL W., Assistant Actuary, Aetna Casualty and Surety Company & Standard Fire Insurance Company, 151 Farmington Avenue, Hartford 15, Conn.
Nov. 19, 1929	SKELDING, ALBERT Z., Secretary-Treasurer, Casualty Actuarial Society, 200 E. 42nd Street, New York 17, N. Y.
Nov. 19, 1929	SKILLINGS, E. SHAW, Assistant Vice President and Actuary, Allstate Insurance Company, 7447 Skokie Boulevard, Skokie, Ill.
Nov. 18, 1932	SMICK, J. J., Partner, Smick & Steinhaus, Consulting Actuaries, 135 E. 42nd Street, New York 17, N. Y.
Nov. 14, 1958	SMITH, EDWARD M., Assistant Actuary, The Travelers Insurance Company, 700 Main Street, Hartford 15, Conn.
Nov. 15, 1940	SMITH, SEYMOUR E., Vice President and Actuary, The Travelers Insurance Company, 700 Main Street, Hartford 15, Conn.
Nov. 24, 1933	ST. JOHN, JOHN B., Consulting Actuary, Box 57, Penllyn, Pa.
Nov. 18, 1927	STONE, EDWARD C., Chairman of the Board, American Employers' Insurance Company, 40 Central Street, Boston 9, Mass.
Nov. 19, 1959	SYKES, ZENAS M., Actuary, Social Security Administration, United States Department of Health, Education and Welfare, Washington 25, D. C.
May 25, 1956	TAPLEY, DAVID A., Senior Vice President and Actuary, Wolverine Insurance Company, Wolverine-Federal Tower, Battle Creek, Mich.
Nov. 14, 1958	TARBELL, LUTHER L., JR., Assistant Actuary; Casualty, Fire & Marine Actuarial Dept., The Travelers Insurance Company, 700 Main Street, Hartford 15, Conn.
Nov. 16, 1956	THOMAS, JAMES W., Assistant Actuary; Casualty, Fire & Marine Actuarial Dept., The Travelers Insurance Company, 700 Main Street, Hartford 15, Conn.
†	THOMPSON, JOHN S., (Retired), Vice Chairman of Board, Mutual Benefit Life Insurance Company, 520 Broad Street, Newark 2, N. J.
Nov. 19, 1953	TRIST, JOHN A. W., Insurance Company of North America, 1600 Arch Street, Philadelphia 1, Pa.
Nov. 14, 1947	UHTHOFF, DUNBAR R., Vice President and Actuary, Employers' Mutual Liability Insurance Company of Wisconsin, 407 Grant Street, Wausau, Wis.
Nov. 23, 1928	VALERIUS, NELS M., Associate Actuary, Aetna Casualty and Surety Company & Standard Fire Insurance Company, 151 Farmington Avenue, Hartford 15, Conn.
Nov. 21, 1919	VAN TUYL, HIRAM O., (Retired), 17 Coolidge Avenue, White Plains, N. Y.
Nov. 16, 1951	VINCENT, LEWIS A., General Manager, National Board of Fire Underwriters, 85 John Street, New York 38, N. Y.
Nov. 17, 1920	WAITE, ALAN W., 16 Penwood Road, Bloomfield, Conn.
Nov. 14, 1947	WIEDER, JOHN W., JR., Actuary, Aetna Casualty and Surety Company & Standard Fire Insurance Company, 151 Farmington Avenue, Hartford 15, Conn.
Nov. 18, 1960	WILCKEN, CARL L., Assistant Actuary, Canadian Underwriters' Association, 12 UpJohn Road, Don Mills, Ontario, Canada.
Nov. 15, 1935	WILLIAMS, HARRY V., Vice President, Hartford Accident and Indemnity Company & Hartford Fire Insurance Company, 690 Asylum Avenue, Hartford 15, Conn.

FELLOWS

Admitted	
Nov. 22, 1957	WILLIAMS, PHILLIP A., Associate Actuary, The Travelers Insurance Company, 700 Main Street, Hartford 15, Conn.
Nov. 14, 1941	WILLIAMSON, W. RULON, Research Actuary, 3400 Fairhill Drive, Washington 23, D. C.
Nov. 18, 1960	WILLSEY, LYNN W., Assistant Secretary, Group Dept., The Travelers Insurance Company, 700 Main Street, Hartford 15, Conn.
Nov. 16, 1961	WILSON, JAMES C., Vice President and Actuary, Security General Insurance Company, 639 W. Fifth Street, Winston-Salem, N. C.
Nov. 18, 1931	WITTICK, HERBERT E., Vice President and General Manager, Pilot Insurance Company, 1315 Yonge Street, Toronto 7, Ontario, Canada.
Nov. 18, 1949	WOLFRUM, RICHARD J., Actuary, Liberty Mutual Insurance Company, 175 Berkeley Street, Boston 17, Mass.
Nov. 16, 1951	WOODALL, JOHN P., Manager, South-Eastern Underwriters Association, 327 Trust Co. of Georgia Bldg., Atlanta 2, Ga.
Nov. 14, 1958	WRIGHT, BYRON, Actuary, Department of Banking and Insurance, State of New Jersey, State House Annex, Trenton 25, N. J.
Nov. 19, 1953	YOUNT, HUBERT W., Executive Vice President, Liberty Mutual Insurance Company, 175 Berkeley Street, Boston 17, Mass.

ASSOCIATES

Admitted	
Nov. 15, 1918	ACKERMAN, SAUL B., 405 Lexington Avenue, New York 17, N. Y.
Nov. 16, 1939	AIN, SAMUEL N., Consulting Actuary, 120 Broadway, New York 5, N. Y.
Nov. 16, 1961	ALDRICH, WILLIAM C., Assistant Secretary, National Council on Compensation Insurance, 200 E. 42nd Street, New York 17, N. Y.
Nov. 22, 1957	ALEXANDER, LEE M., American Mutual Liability Insurance Company, Wakefield, Mass.
Apr. 5, 1928	ALLEN, AUSTIN F., Chairman of the Board, Texas Employers' Insurance Association, P.O. Box 2759, Dallas 21, Texas.
Nov. 18, 1955	ANDREWS, EDWARD C., Associate Actuary; Casualty, Fire & Marine Actuarial Dept., The Travelers Insurance Company, 700 Main Street, Hartford 15, Conn.
Nov. 15, 1918	ANKERS, ROBERT E., (Retired), 414 E. Broad Street, Falls Church, Va.
Nov. 21, 1930	ARCHIBALD, A. EDWARD, Vice President, Investors Diversified Services, Inc., Minneapolis 2, Minn.
Nov. 19, 1959	BALCAREK, RAFAL J., Assistant Actuary, Standard Accident Insurance Company, 640 Temple Avenue, Detroit 32, Mich.
Nov. 19, 1959	BANNISTER, DAN W., Vice President, Security Insurance Company, 175 Whitney Avenue, New Haven, Conn.
Nov. 24, 1933	BARRON, JAMES C., Comptroller, American Mercury Insurance Company, 2251 Wisconsin Avenue, N.W., Washington 7, D. C.
Nov. 23, 1928	BATEMAN, ARTHUR E., Pine Grove Rest Home, Marlboro, Mass.
Nov. 15, 1940	BATHO, BRUCE, Vice President and Comptroller, Life Insurance Company of Georgia, 573 W. Peachtree Street, N.E., Atlanta 8, Ga.
Nov. 16, 1956	BERG, ROY A., JR., Assistant Actuary, Old Republic Life Insurance Company, 307 N. Michigan Avenue, Chicago 1, Ill.
Nov. 19, 1959	BERKMAN, JOAN M., Assistant Actuary, National Bureau of Casualty Underwriters, 125 Maiden Lane, New York 38, N. Y.
Nov. 14, 1958	BERNAT, LEO ALLEN, Consultant, Minnesota Research Associates, 688 Holly Avenue, Apt. 7, St. Paul 4, Minn.
Nov. 18, 1925	BITTEL, W. HAROLD, Chief Actuary, Department of Banking and Insurance, State of New Jersey, Trenton 25, N. J.
Nov. 17, 1920	BLACK, NELLAS C., (Retired), 4310 Norwood Road, Baltimore 18, Md.
Nov. 14, 1958	BLUMENFELD, M. EUGENE, Assistant Actuary, Federal Life and Casualty Company, Wolverine-Federal Tower, Battle Creek, Mich.
Nov. 22, 1934	BOMSE, EDWARD L., Manager, Casualty Underwriting Planning Dept., (C & L), Royal-Globe Insurance Group, 150 William Street, New York 38, N. Y.
Nov. 23, 1928	BOWER, PERRY S., Vice President and Treasurer, The Great-West Life Assurance Company, 60 Osborne Street, N., Winnipeg 1, Manitoba, Canada
Nov. 22, 1957	BRAGG, JOHN M., Vice President and Actuary, Life Insurance Company of Georgia, 573 W. Peachtree Street, N. E., Atlanta 8, Ga.
Oct. 22, 1915	BUFFLER, LOUIS, (Retired), 196-05C-65 Crescent, 2-C, Fresh Meadows 65, N. Y.
Nov. 20, 1924	BUGBEE, JAMES M., Vice President, Maryland Casualty Company, Box 1228, Baltimore 3, Md.

ASSOCIATES

Admitted	
Mar. 31, 1920	BURT, MARGARET A., Office of George B. Buck, Consulting Actuary, 60 Worth Street, New York 13, N. Y.
Nov. 19, 1959	BUTLER, RICHARD H., Secretary, The Travelers Insurance Company, 700 Main Street, Hartford 15, Conn.
Nov. 17, 1922	CAVANAUGH, LEO D., Consultant-Life Insurance Management, 55 E. Washington Street, Chicago 2, Ill.
Nov. 18, 1927	CHEN, S. T., Consulting Actuary, The Wing On Life Assurance Company, Ltd., Wing On Life Bldg., 22 Des Voeux Road, Central, Hong Kong.
Nov. 16, 1961	CHERLIN, GEORGE, Assistant Mathematician, Mutual Benefit Life Insurance Company, 520 Broad Street, Newark 1, N. J.
Nov. 22, 1957	CHURCH, HARRY M., Coates, Herfurth & England, Consulting Actuaries, 325 North Lake, Pasadena, Calif.
Nov. 18, 1955	COATES, WILLIAM D., Assistant Superintendent, Association Group Div., Continental Casualty Company, 310 S. Michigan Avenue, Chicago 4, Ill.
Nov. 19, 1953	CONTE, JOSEPH P., Vice President and Secretary, Columbian Mutual Life Insurance Company, 305 Main Street, Binghamton, N. Y.
Nov. 19, 1959	COPESTAKES, ARTHUR D., Assistant Vice President, American Mutual Liability Insurance Company, Wakefield, Mass.
Nov. 19, 1959	CRAIG, ROBERT A., Casualty, Fire & Marine Actuarial Dept., The Travelers Insurance Company, 700 Main Street, Hartford 15, Conn.
Nov. 24, 1933	CRAWFORD, WILLIAM H., Vice President and Treasurer, Industrial Indemnity Company, 155 Sansome Street, San Francisco 4, Calif.
Nov. 19, 1953	CROFTS, GEOFFREY, Actuarial Training Director, Occidental Life Insurance Company of California, Box 2101, Terminal Annex, Los Angeles 54, Calif.
Nov. 21, 1952	DANIEL, C. M., Applied Science Representative, International Business Machines Corporation, 2116 Grand, Des Moines 12, Iowa
Nov. 18, 1925	DAVIS, MALVIN E., Senior Vice President and Chief Actuary, Metropolitan Life Insurance Company, 1 Madison Avenue, New York 10, N. Y.
Nov. 18, 1960	DEMELIO, JOSEPH J., Actuary, The Home Insurance Company, 59 Maiden Lane, New York 8, N. Y.
Nov. 16, 1956	DORF, STANLEY A., Senior Actuary, New York State Insurance Department, 123 William Street, New York 38, N. Y.
Nov. 14, 1941	DOWLING, WILLIAM F., President, Nymco Agency, Inc., 150 Fifth Avenue, New York 11, N. Y.
Nov. 14, 1958	DUROSE, STANLEY C., JR., Assistant Deputy Commissioner, Wisconsin Insurance Department, 127 South, State Capitol, Madison 2, Wis.
Nov. 19, 1954	EATON, KARL F., Manager, Electronics Analysis, Business Men's Assurance Company, 215 Pershing Road, Kansas City 41, Mo.
June 5, 1925	EGER, FRANK A., (Retired), 1119 Prospect Ridge, Haddon Heights, N. J.
Nov. 16, 1961	EHLERT, DARRELL W., Field Pricing Manager, Allstate Insurance Company, 7447 Skokie Blvd., Skokie, Ill.
Nov. 22, 1957	FELDMAN, MARTIN F., Associate Actuary, New York State Insurance Department, 123 William Street, New York 38, N. Y.
Nov. 16, 1961	FERDEN, STEIN, Actuary, Mutaul Service Insurance Companies, 1919 University Avenue, St. Paul 4, Minn.

ASSOCIATES

Admitted	
Nov. 16, 1956	FLACK, PAUL R., Actuarial Assistant, General Accident Fire and Life Assurance Corporation, Ltd., 414 Walnut Street, Philadelphia, Pa.
Nov. 16, 1923	FLEMING, FRANK A., (Retired), c/o Mutual Insurance Rating Bureau, 733 Third Avenue, New York 3, N. Y.
Nov. 21, 1952	FRANKLIN, NATHAN M., Actuary, The Surety Association of America, 60 John Street, New York 38, N. Y.
Nov. 19, 1929	FURNIVALL, MAURICE L., (Retired), 1186 Farmington Avenue, West Hartford 7, Conn.
Nov. 19, 1954	GAINES, NATHANIEL, Office of George B. Buck, Consulting Actuary, 60 Worth Street, New York 13, N. Y.
Nov. 18, 1932	GETMAN, RICHARD A., Assistant Actuary, Life Dept., The Travelers Insurance Company, 700 Main Street, Hartford 15, Conn.
Nov. 17, 1922	GIBSON, JOSEPH P., JR., (Retired), Assistant to the President, American Mutual Reinsurance Company, 919 N. Michigan Avenue, Chicago 11, Ill.
Nov. 16, 1923	GILDEA, JAMES F., (Retired), 236 Nott Street, Wethersfield, Conn.
Nov. 18, 1960	GILLESPIE, JAMES E., Actuarial Assistant, Continental Casualty Company, 310 S. Michigan Avenue, Chicago, Ill.
Nov. 14, 1947	GINGERY, STANLEY W., Associate Actuary, The Prudential Insurance Company of America, Newark 1, N. J.
Nov. 19, 1959	GOLD, MELVIN L., Consulting Actuary, 29 Lakeview Drive, West Orange, N. J.
Nov. 16, 1961	GOULD, DONALD E., Senior Statistician, The State Insurance Fund, 199 Church Street, New York 7, N. Y.
Nov. 18, 1927	GREEN, WALTER C., Consulting Actuary, Walter C. Green and Associates, 1405 S. Main Street, Salt Lake City, Utah.
Nov. 16, 1961	GREENE, THOMAS A., Underwriting Dept., American Re-Insurance Company, 99 John Street, New York 38, N. Y.
Nov. 15, 1940	GROSSMAN, ELI A., Vice President, The Great Eastern Life Insurance Company, 10 Dorrance St., Providence 3, R. I.
Nov. 15, 1935	GUERTIN, ALFRED N., Actuary, American Life Convention, 230 N. Michigan Avenue, Chicago 1, Ill.
Nov. 16, 1939	HAGEN, OLAF E., Metropolitan Life Insurance Company, 1 Madison Avenue, New York 10, N. Y.
Nov. 17, 1922	HALL, HARTWELL L., (Retired), 34 Lincoln Avenue, West Hartford 7, Conn.
Nov. 13, 1936	HAM, HUGH P., President and General Manager, The Western Assurance Company, 40 Scott Street, Toronto 1, Ontario, Canada
Nov. 19, 1953	HARACK, JOHN, Actuary, Health Service, Inc., and Medical Indemnity of America, Inc., 200 N. Michigan Avenue, Chicago 1, Ill.
Mar. 24, 1932	HARRIS, SCOTT, Executive Vice President, Joseph Froggatt & Company, Inc., 74 Trinity Place, New York 6, N. Y.
Mar. 25, 1924	HART, WARD VAN B., 49 Robbins Drive, Wethersfield 9, Conn.
Nov. 21, 1919	HAYDON, GEORGE F., Manager Emeritus, Wisconsin Compensation Rating Bureau, 623 N. 2nd Street, Milwaukee 3, Wis.
Nov. 19, 1958	HEAD, GLENN O., Vice President and Actuary, The United States Life Insurance Company, 125 Maiden Lane, New York 38, N. Y.
Nov. 19, 1959	HICKMAN, JAMES C., Assistant Professor, Department of Mathematics, University of Iowa, Iowa City, Iowa
Nov. 17, 1927	HIPP, GRADY H., (Retired), 216 Pine Forest Drive, Greenville, S. C.

ASSOCIATES

Admitted	
Nov. 16, 1961	HOROWITZ, MILTON, Principal Actuary, The State Insurance Fund, 199 Church Street, New York 7, N. Y.
Nov. 19, 1929	JACOBS, CARL N., Chairman of the Board, Hardware Mutual Casualty Company, Hardware Dealers Mutual Fire Insurance Company & Sentry Life Insurance Company, 200 Strongs Avenue, Stevens Point, Wis.
Nov. 18, 1921	JENSEN, EDWARD S., Assistant Vice President, Group Dept., Occidental Life Insurance Company of California, 1151 South Broadway, Los Angeles 55, Calif.
Nov. 21, 1930	JONES, H. LLOYD, (Retired), 9 Midland Gardens, Bronxville, N. Y.
Nov. 21, 1919	JONES, LORING D., (Retired), 64 Raymond Avenue, Rockville Centre, L. I., N. Y.
Nov. 21, 1952	JONES, NATHAN F., Associate Actuary, The Prudential Insurance Company of America, Prudential Plaza, Newark 1, N. J.
Nov. 19, 1959	KROEKER, JOHN W., Senior Actuary, Department of Insurance, Ottawa, Ontario, Canada.
Nov. 16, 1961	LANGE, JEFFREY T., National Bureau of Casualty Underwriters, 125 Maiden Lane, New York 38, N. Y.
Nov. 19, 1959	LEIGHT, ARTHUR S., Actuarial Associate, Metropolitan Life Insurance Company, 1 Madison Avenue, New York 10, N. Y.
Nov. 14, 1947	LUFKIN, ROBERT W., Office Manager, Craftsman Insurance Company, 851 Boylston Street, Boston 16, Mass.
Nov. 16, 1961	MACGINNITIE, W. JAMES, Actuarial Assistant, Continental Casualty Company, 310 S. Michigan Avenue, Chicago 4, Ill.
Nov. 18, 1925	MALMUTH, JACOB J., Chief—Rating Bureau, New York State Insurance Department, 123 William Street, New York 38, N. Y.
Nov. 16, 1961	MARGOLIS, DONALD R., Actuarial Dept., Insurance Company of North America, 1600 Arch Street, Philadelphia 1, Pa.
Mar. 24, 1927	MARSH, CHARLES V-R., (Retired), 125-56 Avenue South, St. Petersburg, Fla.
Nov. 16, 1956	MATHWICK, LLOYD F., Senior Group Underwriter, Employers' Mutual Liability Insurance Company of Wisconsin, 407 Grant Street, Wausau, Wis.
Nov. 13, 1936	MAYER, WILLIAM H., JR., Manager, Group Contract Bureau, Metropolitan Life Insurance Company, 1 Madison Avenue, New York 10, N. Y.
Nov. 16, 1961	MCCLURE, RICHARD D., Assistant Vice President, American Mutual Liability Insurance Company, Wakefield, Mass.
May 26, 1955	MCDONALD, MILTON G., Fire and Casualty Actuary, Department of Banking and Insurance, 100 Nashua Street, Boston 14, Mass.
Nov. 16, 1961	MCINTOSH, KENNETH L., Manager, Louisiana Rating and Fire Prevention Bureau, P.O. Box 730, New Orleans 2, La.
Nov. 16, 1961	MCLEAN, GEORGE E., Manager, Actuarial-Statistical Services, Massachusetts Hospital Service, Inc., 133 Federal Street, Boston 6, Mass.
Nov. 19, 1959	MCNAMARA, DANIEL J., Secretary, National Bureau of Casualty Underwriters, 125 Maiden Lane, New York 38, N. Y.
Nov. 18, 1960	MEENAGHAN, JAMES J., Assistant Actuary, National Bureau of Casualty Underwriters, 125 Maiden Lane, New York 38, N. Y.
Nov. 13, 1931	MILLER, HENRY C., Comptroller, California State Compensation Insurance Fund, 525 Golden Gate Avenue, San Francisco 1, Calif.
Nov. 18, 1960	MILLER, NICHOLAS F., JR., Aetna Casualty and Surety Company, 151 Farmington Avenue, Hartford 15, Conn.

ASSOCIATES

Admitted	
Nov. 18, 1937	MINOR, EDUARD H., Associate Actuary, Metropolitan Life Insurance Company, 1 Madison Avenue, New York 10, N. Y.
Nov. 18, 1960	MOHNBLATT, ARNOLD S., Actuarial Assistant, Consolidated Mutual Insurance Company, 345 Adams Street, Brooklyn 1, N. Y.
Nov. 17, 1922	MONTGOMERY, JOHN C., (Retired), 165 Westervelt Avenue, Tenafly, N. J.
May 25, 1923	MOORE, JOSEPH P., 115 St. Catherine Road, Outremont, Quebec, Canada.
Nov. 16, 1961	MORISON, GEORGE D., Actuarial Dept., Aetna Casualty and Surety Company & Standard Fire Insurance Company, 151 Farmington Avenue, Hartford 15, Conn.
Nov. 16, 1961	MOSS, ROBERT G., Actuary, Marsh & McLennan, Inc., 506 Olive Street, St. Louis 1, Mo.
Nov. 22, 1957	MUIR, JOSEPH M., General Manager, Mutual Insurance Advisory Association & Mutual Insurance Rating Bureau, 733 Third Avenue, New York 17, N. Y.
Nov. 16, 1961	NELSON, ROLAND E., Associate Actuary, State Farm Assurance Company, 112 E. Washington Street, Bloomington, Ill.
Nov. 15, 1935	NELSON, S. TYLER, Casualty Division Manager, American Agricultural Mutual Insurance Company, Room 2300 Merchandise Mart, Chicago 54, Ill.
Oct. 27, 1916	NEWELL, WILLIAM, (Retired), 1225 Park Avenue, New York 28, N. Y.
Nov. 18, 1925	NICHOLSON, EARL H., Actuary and Deputy Insurance Commissioner, Nevada Insurance Department, Carson City, Nevada
Nov. 16, 1961	OIEN, Robert G., Assistant Actuary, Mutual Service Insurance Companies, 1919 University Avenue, St. Paul, Minn.
May 23, 1919	OTTO, WALTER E., Chairman of the Board, Michigan Mutual Liability Company, 28 W. Adams Avenue, Detroit 26, Mich.
Nov. 19, 1926	OVERHOLSER, DONALD M., Office of George B. Buck, Consulting Actuary, 60 Worth Street, New York 13, N. Y.
Nov. 18, 1960	PARLIN, R. WILLIS, Actuary, Mutual Service Insurance Companies, 1919 University Avenue, St. Paul 4, Minn.
Nov. 16, 1961	PEEL, JERALD P., Insurance Coordinator, Standard Oil Company (Indiana), 910 S. Michigan Avenue, Chicago 80, Ill.
Nov. 20, 1924	PENNOCK, RICHARD M., (Retired), 12 E. Lodges Lane, Bala-Cynwyd, Pa.
Nov. 14, 1947	PERRY, ROBERT C., First Vice President, State Farm Life Insurance Company, 112 E. Washington Street, Bloomington, Ill.
Nov. 19, 1929	PHILLIPS, JOHN H., (Retired), 915 Steuben Street, Wausau, Wis.
Nov. 17, 1920	PIKE, MORRIS, (Retired), 531 East 20th Street, New York, N. Y.
Nov. 23, 1928	PIPER, KENNETH B., Vice President, Provident Life and Accident Insurance Company, Fountain Square, Chattanooga 2, Tenn.
Nov. 17, 1922	POORMAN, WILLIAM F., President, Central Life Assurance Company, Box 1555, Des Moines, Iowa.
Nov. 13, 1936	POTOFSKY, SYLVIA, Senior Actuary, The State Insurance Fund, 199 Church Street, New York 7, N. Y.
Nov. 15, 1918	RAYWID, JOSEPH, Vice President, Woodward and Fondiller, Inc., 420 Madison Avenue, New York 17, N. Y.
Nov. 18, 1960	RICCARDO, JOSEPH F., JR., Actuarial Dept., Aetna Casualty and Surety Company & Standard Fire Insurance Company, 151 Farmington Avenue, Hartford 15, Conn.
Nov. 18, 1960	RICHARDS, HARRY R., Chief Supervisor, The Travelers Insurance Company, 700 Main Street, Hartford 15, Conn.
Nov. 19, 1932	RICHARDSON, HARRY F., (Retired), Seven Oaks, Bozman, Md.

ASSOCIATES

Admitted	
Nov. 19, 1953	RICHMOND, OWEN D., Controller, Business Men's Assurance Company, 215 Pershing Road, Kansas City 41, Mo.
Nov. 16, 1961	RIDDLESWORTH, WILLIAM A., Actuarial Dept., Aetna Casualty and Surety Company & Standard Fire Insurance Company, 151 Farmington Avenue, Hartford 15, Conn.
Nov. 18, 1960	RIPANDELLI, JOHN S., Consulting Actuary, Lewis State Bank Bldg., No. 13, Tallahassee, Fla.
Nov. 22, 1957	ROBERTS, FRANCES A., Assistant Actuary, National of Hartford Companies, 1000 Asylum Avenue, Hartford 15, Conn.
Nov. 18, 1932	ROBERTS, JAMES, A., Group Statistician, The Travelers Insurance Company, 700 Main Street, Hartford 15, Conn.
Nov. 18, 1960	ROTH, RICHARD J., Vice President, The Travelers Research Center, Inc., 650 Main Street, Hartford 3, Conn.
Nov. 19, 1959	ROYER, ALAN F., Actuary, Insurance Dept., Commonwealth of Pennsylvania, North Office Bldg., State Capitol, Harrisburg, Pa.
Nov. 18, 1927	SARASON, HARRY M., Managing Actuary, Woodward and Fondiller, Inc., 3625 W. 6th Street, Los Angeles 5, Calif.
Nov. 14, 1958	SARNOFF, PAUL E. Associate Actuarial Director, Prudential Insurance Company of America, Prudential Plaza, Newark 1, N. J.
Nov. 16, 1923	SAWYER, ARTHUR, (Retired), 217 San Antonio West, San Clemente, Calif.
Nov. 14, 1947	SCAMMON, LAWRENCE W., Manager, Massachusetts Automobile Rating & Accident Prevention Bureau, Massachusetts Workmen's Compensation Rating & Inspection Bureau, & Massachusetts Motor Vehicle Assigned Risk Plan, 89 Broad Street, Boston, Mass.
Nov. 16, 1961	SCHEIBEL, JEROME A., Insurance Rater, Wisconsin Insurance Department, State Capitol, Madison 2, Wis.
Nov. 14, 1958	SCHLENZ, JOHN W., Senior Vice President and Actuary, Federal Life and Casualty Company, Wolverine-Federal Tower, Battle Creek, Mich.
Nov. 22, 1957	SCHNEIKER, HENRY C., Assistant Actuary, The Home Insurance Company, 59 Maiden Lane, New York 38, N. Y.
Nov. 19, 1954	SCHULMAN, JUSTIN, Methods (Computer), R.C.A., 501 Service Center, Cherry Hill, N. J.
Nov. 14, 1947	SCHWARTZ, MAX J., Principal Actuary, New York State Insurance Department, 324 State Street, Albany 10, N. Y.
Nov. 20, 1930	SEVILLA, EXEQUIEL S., President, Manager and Actuary, National Life Insurance Company of the Philippines, Regina Bldg., P.O. Box 2056, Manila, Philippines.
Nov. 22, 1957	SHAVER, C. OTIS, Actuary, Nationwide Mutual Fire Insurance Company, 246 N. High Street, Columbus 16, Ohio.
Nov. 20, 1924	SHEPPARD, NORRIS E., Professor of Mathematics, University of Toronto, Toronto 5, Canada.
Nov. 19, 1926	SOMERVILLE, WILLIAM F., (Retired), 1258 St. Louis Avenue, Excelsior Springs, Mo.
Nov. 18, 1925	SOMMER, ARMAND, Vice President, Continental Casualty Company, Transportation Insurance Company & United States Life Insurance Company, 310 S. Michigan Avenue, Chicago 4, Ill.
Nov. 15, 1918	SPENCER, HAROLD S., (Retired), 8 Chelsea Lane, West Hartford, Conn.
Nov. 14, 1958	STANKUS, LEO M., Actuary, Allstate Insurance Company, 7447 Skokie Boulevard, Skokie, Ill.
Nov. 19, 1959	STEINHAUS, HENRY W., Partner, Smick and Steinhaus, Consulting Actuaries, 135 E. 42nd Street, New York 17, N. Y.
Nov. 20, 1924	STELLWAGEN, HERBERT P., Executive Vice President, Insurance Company of North America, 1600 Arch Street, Philadelphia 1, Pa.
Nov. 16, 1956	STERN, PHILIPP K., Actuary, Mutual Insurance Rating Bureau, 733 Third Avenue, New York 17, N. Y.

ASSOCIATES

Admitted	
Nov. 19, 1959	STEVENS, WALDO A., Actuary, Massachusetts Automobile Rating and Accident Prevention Bureau & Massachusetts Workmen's Compensation Rating and Inspection Bureau, 89 Broad Street, Boston, Mass.
Nov. 16, 1923	STOKE, KENDRICK, Actuary, Michigan Mutual Liability Company, 28 W. Adams Avenue, Detroit 26, Mich.
Nov. 19, 1959	STRUG, EMIL J., Assistant Manager, Actuarial-Statistical Services, Massachusetts Hospital Service, Inc., 133 Federal Street, Boston 6, Mass.
Nov. 21, 1930	SULLIVAN, WALTER F., Actuary, California State Compensation Insurance Fund, 525 Golden Gate Avenue, San Francisco 1, Calif.
Nov. 21, 1919	TRENCH, FREDERICK H., Treasurer, Utica Mutual Insurance Company, P.O. Box 530, Utica 1, N. Y.
Nov. 16, 1961	TRUDEAU, DONALD E., Casualty, Fire & Marine Actuarial Dept., The Travelers Insurance Company, 700 Main Street, Hartford 15, Conn.
Nov. 20, 1924	UHL, M. ELIZABETH, National Bureau of Casualty Underwriters, 60 John Street, New York 38, N. Y.
Nov. 14, 1958	VAN CLEAVE, MARVIN E., Chief, Rate Div., Wisconsin Insurance Department, 113 South, State Capitol, Madison 2, Wis.
Nov. 16, 1961	WALSH, ALBERT J., Assistant Actuary, Liberty Mutual Insurance Company, 175 Berkeley Street, Boston 17, Mass.
Nov. 19, 1959	WEBER, DONALD C., Assistant Professor of Mathematics, Wisconsin State College and Institute of Technology, Platteville, Wis.
Nov. 18, 1932	WEINSTEIN, MAX S., Actuary, New York State Employees' Retirement System, 90 S. Swan Street, Albany 1, N. Y.
Nov. 18, 1925	WELLMAN, ALEX C., Senior Vice President, Protective Life Insurance Company, Birmingham, Ala.
Nov. 21, 1930	WELLS, WALTER I., Second Vice President, State Mutual Life Assurance Company of America, 440 Lincoln Street, Worcester, Mass.
Nov. 16, 1951	WERMEL, MICHAEL T., Consulting Actuary, Woodward and Fondiller, Inc., 4583 Kolohala Street, Honolulu 16, Hawaii
Nov. 18, 1927	WHITBREAD, F. G., Assistant Vice President, Lincoln National Life Insurance Company, 1301-27 S. Harrison Street, Fort Wayne, Ind.
Nov. 19, 1948	WHITE, AUBREY, Vice President and Actuary, Ostheimer & Company, 1510 Chestnut Street, Philadelphia 2, Pa.
Nov. 19, 1954	WILLIAMS, DEWEY G., Manager, Actuarial Dept., Texas Employers' Insurance Association, P. O. Box 2759, Dallas, Texas.
Nov. 16, 1939	WITTLAKE, J. CLARKE, Vice President, Business Men's Assurance Company, B.M.A. Bldg., Kansas City 10, Mo.
Oct. 22, 1915	WOOD, DONALD M., Partner, Childs & Wood, 175 W. Jackson Boulevard, Chicago 4, Ill.
Nov. 18, 1937	WOOD, DONALD M., JR., Partner, Childs & Wood, 175 W. Jackson Boulevard, Chicago 4, Ill.
Nov. 18, 1927	WOOD, MILTON J., Vice President and Actuary, Life, Accident & Group Actuarial Dept., The Travelers Insurance Company, 700 Main Street, Hartford 15, Conn.
Nov. 17, 1950	WOODDY, JOHN C., Actuary, North American Reassurance Company, 161 E. 42nd Street, New York 17, N. Y.
Nov. 22, 1934	WOODWARD, BARBARA H., Assistant Secretary and Regional General Counsel, *The Reuben H. Donnelley Corporation*, 466 Lexington Avenue, New York 17, N. Y.
Nov. 16, 1956	WOODWORTH, JAMES H., Superintendent, Rating Div. of Actuarial Dept., Hartford Accident and Indemnity Company, 690 Asylum Avenue, Hartford 15, Conn.
Nov. 18, 1925	WOOLERY, JAMES M., Vice President-Actuary, Occidental Life Insurance Company of North Carolina, Cameron Village, Raleigh, N. C.
May 5, 1961	YOUNG, ROBERT G., Assistant Vice President, Michigan Mutual Liability Company, 28 West Adams, Detroit 26, Mich.

STUDENTS

This list includes those, not yet Associates of the CAS, who have received credit within the last 2 years for one or more parts of the Associateship examinations. Unless indicated by the symbol "F", the indicated parts credited are for the Associateship examinations.

ABBEY, WILLIAM P., U. S. Fidelity & Guaranty Co., Baltimore 3, Md. (I, IIa, IIIa)

ALLEN, PARK W., II, Bowdoin College, Brunswick, Me. (IIa)

AMLIE, WILLIAM P., Lumbermens Mutual Casualty Co., Chicago 40, Ill. (I, II, III)

BACHER, WILLIAM C., Employers Mutuals of Wausau, Wausau, Wis. (I)

BACHMAN, DAVID F., Lumbermens Mutual Casualty Co., Chicago 40, Ill. (I)

BAINE, MORTON B., 128 Ave. N, Brooklyn 30, N. Y. (II, IIIa)

BANDES, STEPHEN, Mutual Insurance Rating Bureau, New York, N. Y. (IIa)

BARTIK, ROBERT F., 743 Countryside Highway, Mundelein, Ill. (I, II, IIIb)

BATISTA, SAMUEL, Puerto Rico Insurance Dept., Santurce, P.R. (IIb, IIIa)

BAUMWART, NEAL L., 224 Ramsey, Stillwater, Okla. (I)

BELL, ALLAN A., Aetna Casualty & Surety Co., Hartford 15, Conn. (I, IIa)

BELL, HERBERT, Peerless Ins. Co., New York 38, N. Y. (IIa, III, IF)

BLAHA, JAMES M., JR., Continental Casualty Co., Chicago 4, Ill. (I)

BOCHICHIO, LOUIS R., 414 S. 4th St., Brooklyn 11, N. Y. (IIa)

BOGUE, JAMES L., Continental Casualty Co., Chicago 4, Ill. (IIa)

BRADFORD, JOHN A., Continental Casualty Co., Chicago 4, Ill. (I, IIa, III)

BREWER, RICHARD T., National Bureau of Casualty Underwriters, New York 38, N. Y. (IIIa)

BRIAN, ROBERT A., Travelers Ins. Co., Hartford 15, Conn. (I, IIIa)

BROWN, LAWRENCE E., JR., 531 Glenmoor, East Lansing, Mich. (I)

BROWN, WILLIAM W., JR., Liberty Mutual Ins. Co., Boston 17, Mass. (I, IIa, IIIa)

BURKE, JOSEPH, 873 N. LaSalle St., Chicago, Ill. (I)

BURNEY, CHARLES T., Transportation Ins. Rating Bureau, Chicago 4, Ill. (IIIb, IV, IF)

CARLSON, EDWIN A., 3 Ames St., Cambridge 39, Mass. (I)

CARSON, DAVID E. A., Hartford Fire Ins. Group, Hartford 15, Conn. (I, IIa, III, IV, IF)

CASSEL, DOYT L., 79 Redar Drive, Schererville, Ind. (I, II)

CHAO, BEATRICE, 105-25 67th Ave., Forest Hills 75, N. Y. (I, IIIa)

CIMA, AUGUSTIN, Allstate Ins. Co., Skokie, Ill. (I, II, IIIa)

CLEARY, JAMES P., Aetna Casualty & Surety Co., Hartford 15, Conn. (IIa)

CORCORAN, JAMES C., American Motorists Ins. Co., Chicago 40, Ill. (III, IV, IF)

COVITZ, BURTON, American Mutual Liability Ins. Co., Wakefield, Mass. (I)

CRAIN, JASON, 1232 Union Commerce Bldg., Cleveland, Ohio (IV)

CRANDALL, WILLIAM H., Insurance Co. of North America, Philadelphia 1, Pa. (I, IIa, III, IV)

CURRY, ALAN C., State Farm Mutual Automobile Ins. Co., Bloomington, Ill. (I, II, III)

DAHME, ORVAL E., State Farm Mutual Automobile Ins. Co., Bloomington, Ill. (I, IIa)

DAVIDSON, WILLIAM G., Allstate Ins. Co., Skokie, Ill. (IIIb)

DEBOLT, ROBERT E., State Automobile Mutual Ins. Co., Columbus 16, Ohio (I)

DENISOFF, BASILE A., Continental Casualty Co., Chicago 4, Ill. (I)

DOTCHIN, LESLIE W., JR., 41 Woodland St., Wethersfield 9, Conn. (I)

DUNHAM, GORDON B., Continental Casualty Co., Chicago 4, Ill. (I, II, IIIa)

DUNNING, DONALD L., Zurich Ins. Co., Chicago 6, Ill. (I, IIa)

DURKIN, JAMES H., Wolfe, Corcoran & Linder, New York 38, N. Y. (I, IIIb)

DWYER, JOHN T., Continental Casualty Co., Chicago 4, Ill. (I, III)

EDWARDS, RANDOLPH J., U. S. Fidelity & Guaranty Co., Baltimore 3, Md. (IIIa)

EVEN, CHARLES A., JR., Travelers Ins. Co., Hartford 15, Conn. (II, III, IV, IIF)

EYERS, ROBERT G., Hardware Mutual Casualty Co., Stevens Point, Wis. (II, IIIa)

FINKEL, DANIEL, 125 Ashland Pl., Brooklyn 1, N. Y. (IIb, IIIb, IV, IF)

FOWLER, DAVID B., 24 Westerly Terrace, East Hartford, Conn. (I, IIb)

GALSON, S. P., National Bureau of Casualty Underwriters, New York 38, N. Y. (III)

GARRETT, SANDRA B., Insurance Co. of North America, Philadelphia 1, Pa. (I, IIb)

GERUNDO, LOUIS P., JR., 74 Two Brook Rd., Wethersfield 9, Conn. (I, II, III)

GIBSON, JOHN A., III, Travelers Ins. Co., Hartford 15, Conn. (I, III)

GOLDBERG, SARAH, New York State Insurance Dept., New York 38, N. Y. (IIIa)

GOLDMAN, ROBERT, 1534 Stevens St., Philadelphia, Pa. (I, IIa)

GROENEVELD, RICHARD A., Liberty Mutual Ins. Co., Boston, Mass. (I)

HAMMER, SIDNEY M., 1570 Dutch Broadway, Elmont, N. Y. (II, III)

HANSEN, HANS C., 451 W. Mifflin, Madison, Wis. (I)

HANSON, H. DONALD, Continental Cas. Co., Chicago 4, Ill. (I, II)

HARTMANN, KENNETH R., Continental Cas. Co., Chicago 4, Ill. (I)

HERMAN, F. LEE., State Farm Mutual Automobile Ins. Co., Bloomington, Ill. (II, III)

HILLHOUSE, JERRY A., State Farm Insurance Cos., Bloomington, Ill. (I, II, III)

HINDES, WALTER E., The Fund Insurance Cos., San Francisco, Calif. (I)

HONEBEIN, CARLTON W., *National Bureau of Casualty Underwriters*, New York 38, N. Y. (I, IIa, III)

HUNTER, JOHN R., JR., Atlantic Mutual Ins. Co., New York 5, N. Y. (IIIa)

JENSEN, JAMES P., Liberty Mutual Ins. Co., Boston 17, Mass. (I, II, IIIa)

KAMINOFF, HARVEY, Great American Ins. Co., New York 38, N. Y. (IIa, IIIa)

KILBOURNE, FREDERICK W., 4627 Jessica Drive, Los Angeles 65, Calif. (I, IIa)

LEINWAND, HENRY, 144-41 Roosevelt Ave., Flushing 54, N. Y. (IIIa)

LESLIE, WILLIAM H., 6 Whipple Ave., Cranston, R. I. (I, II)

LEVIS, JAMES J., Lumbermens Mutual Cas. Co., Chicago 40, Ill. (IV)

LEWIS, ANTHONY L., Continental Cas. Co., Chicago 40, Ill. (I)

LINQUANTI, AUGUST J., 3260 Perry Ave., Bronx 67, N. Y. (IIa, IIIa)

LOFGREN, PAUL G., Liberty Mutual Ins. Co., Boston 17, Mass. (IIIb, IV)

LORMAN, WALTER E., III, Federated Mutual Implement & Hardware Ins. Co., Owatonna, Minn. (III, IV)

McBIRNEY, BRUCE H., 629 S. Spring St., Los Angeles 14, Calif. (IIa, IV, IF)

McCLINTOCK, JOHN S., Travelers Ins. Co., Hartford 15, Conn. (I, IIIa)

MAIDANICK, CHARLES I., 5234 S. Dorchester Ave., Chicago 15, Ill. (I, II, IIIa)

MASTERSON, WILLIAM E., JR., Wesleyan University, Middletown, Conn. (I)

MERTES, ROBERT A., 5235 Pensacola, Chicago, Ill. (I, IIa)

MILLER, PAUL V., Employers Reinsurance Corp., Kansas City, Mo. (III, IV, IF)

MILSOP, ALLAN C., 285 Maple Rd., Springfield, Mass. (I)

MOKROS, BERTRAM F., Allstate Ins. Co., Menlo Park, Calif. (I, IIa)

MORRISON, D. IAN, U. S. Fidelity & Guaranty Co., Baltimore 3, Md. (I, II, III, IIF)

MULVIHILL, FRANCIS X., Continental Cas. Co., Chicago 4, Ill. (IIa)

MUNIZ, ROBERT M., National Bureau of Casualty Underwriters, New York 38, N. Y. (I, II, III)

MURRAY, EDWARD R., 5927 Ridge Ave., Berkeley, Ill. (I, II)

NAFFZIGER, J. V., State Farm Mutual Automobile Ins. Co., Bloomington, Ill. (IIIb, IV)

NAGEL, J. RICHARD, Maryland Casualty Co., Baltimore 3, Md. (IIb, III, IV)

NELSON, HOMER, Great American of Dallas, Dallas 1, Texas (I, II, IIIb)

NIELDS, NORMAN B., Insurance Co. of North America, Philadelphia 1, Pa. (I)

PERREAULT, STEPHEN L., Trinity College, Hartford, Conn. (I)

PETERSIEL, ALFRED S., Mutual Insurance Advisory Assn., New York, N. Y. (I)

PIERSOL, DONALD E., Travelers Ins. Co., Hartford 15, Conn. (IIb, III, IV, IF)

PILLSBURY, DONALD D., National Bureau of Casualty Underwriters, New York 38, N. Y. (IIIa)

PORTERMAIN, NEILL W., Mutual Service Ins. Cos., St. Paul 4, Minn. (I, II, IIIa)

PRIGER, RAYMOND, National Council on Compensation Insurance, New York 17, N. Y. (IIIb)

PUSTAVER, JOHN A., JR., Kemper Insurance, Chicago, Ill. (I)

RAID, GARY A., State Farm Insurance Cos., Bloomington, Ill. (I)

RATNASWAMY, RAJARATNAM, Mutual Service Ins. Cos., St. Paul 4, Minn. (II, III, IV)

REILLY, FRANCIS V., 2073 E. 9th St., Brooklyn 1, N. Y. (I, IIa, III)

RICHARDSON, WALTER S., Liberty Mutual Ins. Co., Boston 17, Mass. (IIa, IIIb, IV, IF)

ROGERS, DANIEL J., Continental Casualty Co., Chicago 4, Ill. (II, III, IF)

RUBIN, ROBERT H., Continental Casualty Co., Chicago 4, Ill. (I, II, III)

SCHEEL, PAUL J., U. S. Fidelity & Guaranty Co., Baltimore 3, Md. (I, IIa, IIIa)

SCOTT, JAMES E., JR., Great American Reserve Ins. Co., Dallas, Texas (I)

SELIG, JOHN G., Nationwide Life, Columbus 16, Ohio (I, II, III)

SINGER, PAUL E., Continental Casualty Co., Chicago 4, Ill. (I, II, III)

SMITH, CHARLES P., 825 W. 187th St., New York 33, N. Y. (I, II, IIIa)

SMITH, EDWARD R., Hartford Accident & Indemnity Co., Hartford 15, Conn. (II, III)

STAPLEY, KENYON R., Allstate Ins. Co., Skokie, Ill. (III)

STREETT, THOMAS B., JR., U. S. Fidelity & Guaranty Co., Baltimore 3, Md. (IIIa)

SWITZER, VERNON J., State Farm Mutual Automobile Ins. Co., Bloomington, Ill. (I, II, III)

TAFT, ROBERT L., 11 Montague Terrace, Brooklyn, N. Y. (I, IIa)

THOLEN, JOHN P., 130-53 220th St., Springfield Gardens 13, N. Y. (IIa, IIIa)

THOMPSON, PHILIP, Federated Mutual Implement & Hardware Ins. Co., Owatonna, Minn. (II, III, IV)

TOREN, CHESTER J., Zurich Ins. Co., Chicago 6, Ill. (I, II)

TREES, JOHN S., Allstate Ins. Co., Skokie, Ill. (I, IIb)

VERHAGE, PAUL, Hardware Mutual Casualty Co., Stevens Point, Wis. (I, II, IIIa)

WEBB, BERNARD L., Insurance Advisory Committee, Richmond 21, Va. (II, III, IV)

WEBB, JACK C., 942 E. 84th St., Chicago 19, Ill. (IIIa)

WILLIAMS, WILLIAM T., JR., 400 N. Stanwick Rd., Moorestown, N. J. (IIIa)

WOODRUM, LUTHER J., Continental Casualty Co., Chicago 4, Ill. (I)

YOUNG, RICHARD H., Consolidated Mutual Ins. Co., Brooklyn 1, N. Y. (IIa)

ZORY, PETER B., 80-09 Cowles Court, Middle Village, N. Y. (II, IIIa, IV)

OFFICERS OF THE SOCIETY

Since Date of Organization

Elected	*President*	*Vice-Presidents*	
1914-1915	*Isaac M. Rubinow	*Albert H. Mowbray	*Benedict D. Flynn
1916-1917	*James D. Craig	*Joseph H. Woodward	*Harwood E. Ryan
1918	*Joseph H. Woodward	*Benedict D. Flynn	*George D. Moore
1919	*Benedict D. Flynn	*George D. Moore	William Leslie
1920	*Albert H. Mowbray	William Leslie	*Leon S. Senior
1921	*Albert H. Mowbray	*Leon S. Senior	*Harwood E. Ryan
1922	*Harwood E. Ryan	Gustav F. Michelbacher	*Edmund E. Cammack
1923	William Leslie	Gustav F. Michelbacher	*Edmund E. Cammack
1924-1925	Gustav F. Michelbacher	*Sanford B. Perkins	Ralph H. Blanchard
1926-1927	*Sanford B. Perkins	*George D. Moore	*Thomas F. Tarbell
1928-1929	*George D. Moore	Sydney D. Pinney	Paul Dorweiler
1930-1931	*Thomas F. Tarbell	*Roy A. Wheeler	Winfield W. Greene
1932-1933	Paul Dorweiler	*William F. Rocber	*Leon S. Senior
1934-1935	Winfield W. Greene	Ralph H. Blanchard	Charles J. Haugh
1936-1937	*Leon S. Senior	Sydney D. Pinney	*Francis S. Perryman
1938-1939	*Francis S. Perryman	Harmon T. Barber	*William J. Constable
1940	Sydney D. Pinney	Harold J. Ginsburgh	James M. Cahill
1941	Ralph H. Blanchard	Harold J. Ginsburgh	James M. Cahill
1942	Ralph H. Blanchard	Albert Z. Skelding	Charles J. Haugh
1943-1944	Harold J. Ginsburgh	Albert Z. Skelding	Charles J. Haugh
1945-1946	Charles J. Haugh	James M. Cahill	Harry V. Williams
1947-1948	James M. Cahill	Harmon T. Barber	Russell P. Goddard
1949-1950	Harmon T. Barber	Thomas O. Carlson	Norton E. Masterson
1951-1952	Thomas O. Carlson	Joseph Linder	Seymour E. Smith
1953-1954	Seymour E. Smith	Dudley M. Pruitt	John A. Mills
1955-1956	Norton E. Masterson	*Clarence A. Kulp	Arthur N. Matthews
1957-1958	Dudley M. Pruitt	John W. Carleton	William Leslie, Jr.
1959-1960	William Leslie, Jr.	Ernest T. Berkeley	Laurence H. Longley-Cook
1961	Laurence H. Longley-Cook	Thomas E. Murrin	Richard J. Wolfrum

Secretary-Treasurer

1914-1917....*C. E. Scattergood
1918-1953.....R. Fondiller
1954-1961.....A. Z. Skelding

Editor†

1914.....W. W. Greene
1915-1917.....R. Fondiller
1918.....W. W. Greene
1919-1921....G. F. Michelbacher
1922-1923.....O. E. Outwater
1924-1932.....*R. J. McManus
1933-1943.....*C. W. Hobbs
1944-1954.....E. C. Mayerink
1955-1958.....E. S. Allen
1959-1960.....R. P. Goddard
1961.....H. W. Schloss

General Chairman
Examination Committee

1949-1951.....R. A. Johnson
1952-1956....J. W. Wieder, Jr.
1957-1961.....W. J. Hazam

Librarian†

1914.....W. W. Greene
1915.....R. Fondiller
1916-1921.....L. I. Dublin
1922-1924.....*E. R. Hardy
1925-1936.....W. Breiby
1937-1947.....T. O. Carlson
1948-1950.....*S. M. Ross
1951-1957.....G. R. Livingston
1958-1961.....R. Lino

*Deceased.
†The offices of Editor and Librarian were not separated until 1916.

FELLOWS WHO HAVE DIED

The (†) denotes charter members at date of organization, November 7, 1914.

Admitted		Died
Nov. 19, 1948	Arthur L. Bailey	Aug. 12, 1954
May 23, 1924	William B. Bailey	Jan. 10, 1952
†	Roland Benjamin	July 2, 1949
May 24, 1921	Edward J. Bond	Nov. 12, 1941
May 19, 1915	Thomas Bradshaw	Nov. 10, 1939
June 5, 1925	William Brosmith	Aug. 22, 1937
†	George B. Buck, Sr.	Apr. 12, 1961
†	William A. Budlong	June 4, 1934
Nov. 18, 1932	Charles H. Burhans	June 15, 1942
Feb. 19, 1915	F. Highlands Burns	Mar. 30, 1935
†	Edmund E. Cammack	Dec. 17, 1958
†	Raymond V. Carpenter	Mar. 11, 1947
Feb. 19, 1915	Gorden Case	Feb. 4, 1920
Oct. 27, 1916	Edmund S. Cogswell	Apr. 25, 1957
Nov. 23, 1928	Walter P. Comstock	May 11, 1951
Nov. 22, 1934	William J. Constable	Apr. 19, 1959
†	Charles T. Conway	July 23, 1921
†	John A. Copeland	June 12, 1953
†	Walter G. Cowles	May 30, 1942
†	James D. Craig	May 27, 1940
†	James McIntosh Craig	Jan. 20, 1922
May 26, 1916	Frederick S. Crum	Sept. 2, 1921
†	Alfred Burnett Dawson	June 21, 1931
†	Miles Menander Dawson	Mar. 27, 1942
†	Elmer H. Dearth	Mar. 26, 1947
†	Eckford C. DeKay	July 31, 1951
May 19, 1915	Samuel Deutschberger	Jan. 18, 1929
†	Ezekiel Hinton Downey	July 9, 1922
May 19, 1915	Earl O. Dunlap	July 5, 1944
†	David Parks Fackler	Oct. 30, 1924
†	Edward B. Fackler	Jan. 8, 1952
Feb. 19, 1915	Claude W. Fellows	July 15, 1938
†	Benedict D. Flynn	Aug. 22, 1944
†	Charles S. Forbes	Oct. 2, 1943
May 26, 1916	Lee K. Frankel	July 25, 1931
†	Charles H. Franklin	May 1951
Feb. 25, 1916	Joseph Froggatt	Sept. 28, 1940
†	Harry Furze	Dec. 26, 1945
Feb. 19, 1915	Fred S. Garrison	Nov. 14, 1949
†	Theodore E. Gaty	Aug. 22, 1925
May 19, 1915	James W. Glover	July 15, 1941
Oct. 22, 1915	George Graham	Apr. 15, 1937
Oct. 22, 1915	Thompson B. Graham	July 24, 1946
May 25, 1923	William A. Granville	Feb. 4, 1943
†	William H. Gould	Oct. 28, 1936
†	Robert Cowen Lees Hamilton	Nov. 15, 1941
Oct. 27, 1916	Edward R. Hardy	June 29, 1951
Oct. 22, 1915	Leonard W. Hatch	Nov. 23, 1958
Nov. 21, 1919	Robert Henderson	Feb. 16, 1942
†	Robert J. Hillas	May 17, 1940
Nov. 15, 1918	Frank Webster Hinsdale	Mar. 18, 1932
May 23, 1924	Clarence W. Hobbs	July 21, 1944
Nov. 19, 1926	Charles E. Hodges	Jan. 22, 1937
Oct. 22, 1915	Lemuel G. Hodgkins	Dec. 26, 1951
†	Frederick L. Hoffman	Feb. 23, 1946
Oct. 22, 1915	Charles H. Holland	Dec. 28, 1951
Nov. 21, 1919	Carl Hookstadt	Mar. 10, 1924
†	Charles Hughes	Aug. 27, 1948
Nov. 19, 1929	Robert S. Hull	Nov. 30, 1947

FELLOWS WHO HAVE DIED—*Continued*

Admitted		Died
†	Burritt A. Hunt	Sept. 3, 1943
Nov. 28, 1921	William Anderson Hutcheson	Nov. 19, 1942
Feb. 25, 1916	Charles William Jackson	Sept. 21, 1959
Nov. 19, 1929	Henry Hollister Jackson	May 27, 1955
May 19, 1915	William C. Johnson	Oct. 7, 1943
Nov. 23, 1928	F. Robertson Jones	Dec. 26, 1941
Nov. 18, 1921	Thomas P. Kearney	Feb. 11, 1928
Nov. 19, 1926	Gregory Cook Kelly	Sept. 11, 1948
Oct. 22, 1915	Virgil Morrison Kime	Oct. 15, 1918
†	Edwin W. Kopf	Aug. 3, 1933
Nov. 23, 1928	Clarence Arthur Kulp	Aug. 20, 1957
Feb. 17, 1915	John M. Laird	June 20, 1942
Nov. 13, 1931	Stewart M. LaMont	Aug. 22, 1960
Feb. 19, 1915	Abb Landis	Dec. 9, 1937
Nov. 24, 1933	John Robert Lange	Apr. 12, 1957
Nov. 17, 1922	Arnette Roy Lawrence	Dec. 1, 1942
†	James R. Leal, Sr.	Dec. 26, 1957
Nov. 18, 1921	James Fulton Little	Aug. 11, 1938
Nov. 23, 1928	Edward C. Lunt	Jan. 13, 1941
Feb. 19, 1915	Harry Lubin	Dec. 20, 1920
†	William N. Magoun	Dec. 11, 1954
Nov. 16, 1923	D. Ralph McClurg	Apr. 27, 1947
May 23, 1919	Alfred McDougald	July 28, 1944
Oct. 31, 1917	Robert J. McManus	Aug. 15, 1960
Feb. 15, 1915	Franklin B. Mead	Nov. 29, 1933
Apr. 20, 1917	Marcus Meltzer	Mar. 27, 1931
†	David W. Miller	Jan. 18, 1936
†	James F. Mitchell	Feb. 9, 1941
†	Henry Moir	June 8, 1937
Nov. 18, 1921	Victor Montgomery	May 2, 1960
Feb. 19, 1915	William J. Montgomery	Aug. 20, 1915
Nov. 19, 1926	William L. Mooney	Oct. 21, 1948
†	George D. Moore	Mar. 11, 1959
May 19, 1915	Edward Bontecou Morris	Dec. 19, 1929
†	Albert H. Mowbray	Jan. 7, 1949
†	Frank Mullaney	Jan. 22, 1953
†	Lewis A. Nicholas	Apr. 21, 1940
†	Stanley L. Otis	Oct. 12, 1937
Nov. 13, 1926	Bertrand A. Page	July 30, 1941
Nov. 18, 1921	Sanford B. Perkins	Sept. 16, 1945
Nov. 15, 1918	William Thomas Perry	Oct. 25, 1940
Nov. 21, 1930	Francis S. Perryman	Nov. 30, 1959
†	Edward B. Phelps	July 24, 1915
Nov. 19, 1926	Jesse S. Phillips	Nov. 6, 1954
†	Charles Grant Reiter	July 30, 1937
†	Charles H. Remington	Mar. 21, 1938
May 23, 1919	Frederick Richardson	July 22, 1955
Nov. **16, 1923**	William F. Roeber	Mar. 21, 1960
Nov. 17, 1943	Samuel M. Ross	July 24, 1951
†	Isaac M. Rubinow	Sept. 1, 1936
†	Harwood Eldridge Ryan	Nov. 2, 1930
†	Arthur F. Saxton	Feb. 26, 1927
†	Emil Scheitlin	May 2, 1946
†	Leon S. Senior	Feb. 3, 1940
Nov. 24, 1933	Robert V. Sinnott	Dec. 15, 1952
Apr. 20, 1917	Charles Gordon Smith	June 22, 1938
Feb. 19, 1915	John T. Stone	May 9, 1920
Feb. 25, 1916	Wendell Melville Strong	Mar. 30, 1942
Oct. 22, 1915	William R. Strong	Jan. 10, 1946
†	Robert J. Sullivan	July 19, 1934

FELLOWS WHO HAVE DIED—*Continued*

Admitted		Died
Nov. 17, 1920	Thomas F. Tarbell	July 2, 1958
Nov. 22, 1934	Walter H. Thompson	May 25, 1935
Nov. 18, 1921	Guido Toja	Feb. 28, 1933
†	John L. Train	June 12, 1958
Nov. 17, 1922	Antonio Thomas Traversi	Apr. 20, 1961
Nov. 19, 1948	Paul A. Turner	Jan. 30, 1961
Nov. 15, 1935	Harry V. Waite	Aug. 14, 1951
Nov. 18, 1925	Lloyd A. H. Warren	Sept. 30, 1949
May 23, 1919	Archibald A. Welch	May 8, 1945
Nov. 19, 1926	Roy A. Wheeler	Aug. 26, 1932
†	Albert W. Whitney	July 27, 1943
†	Lee J. Wolfe	Apr. 28, 1949
†	S. Herbert Wolfe	Dec. 31, 1927
May 24, 1921	Arthur B. Wood	June 14, 1952
†	Joseph H. Woodward	May 15, 1928
†	William Young	Oct. 23, 1927

ASSOCIATES WHO HAVE DIED

Admitted		Died
May 23, 1924	Milton Acker	Aug. 16, 1956
Oct. 22, 1915	Don A. Baxter	Feb. 10, 1920
Nov. 15, 1940	John M. Blackhall	Nov. 14, 1957
Nov. 15, 1918	Helmuth G. Brunnquell	June 3, 1958
May 25, 1923	Harilaus E. Economidy	Apr. 13, 1948
Nov. 20, 1924	John Froberg	Oct. 11, 1949
Nov. 22, 1934	John J. Gately	Nov. 3, 1943
Nov. 14, 1947	Harold J. George	Apr. 1, 1952
Nov. 19, 1929	Harold R. Gordon	July 8, 1948
Nov. 18, 1921	Robert E. Haggard	
Nov. 20, 1924	Leslie LeVant Hall	Mar. 8, 1931
Oct. 31, 1917	Edward T. Jackson	May 8, 1939
Nov. 17, 1922	Rosswel A. McIver	Apr. 1, 1959
Nov. 21, 1919	Rolland V. Mothersill	July 25, 1949
Nov. 19, 1929	Fritz Muller	Apr. 27, 1945
Nov. 23, 1928	Karl Newhall	Oct. 24, 1944
Nov. 15, 1918	John L. Sibley	Mar. 10, 1957
Nov. 18, 1921	Arthur G. Smith	May 2, 1956
Nov. 18, 1927	Alexander A. Speers	June 25, 1941
Mar. 23, 1921	Arthur E. Thompson	Jan. 17, 1944
Nov. 21, 1919	Walter G. Voogt	May 8, 1945
May 23, 1919	Charles S. Warren	May 1, 1952
Nov. 18, 1925	James H. Washburn	Aug. 19, 1946
Nov. 17, 1920	James J. Watson	Feb. 23, 1937
Nov. 18, 1921	Eugene R. Welch	Jan. 17, 1945
Mar. 21, 1929	Charles A. Wheeler	July 2, 1956
Nov. 15, 1918	Albert Edward Wilkinson	June 11, 1930
Oct. 22, 1915	Charles E. Woodman	Dec. 16, 1955

SCHEDULE OF MEMBERSHIP, NOVEMBER 17, 1961

	Fellows	Associates	Total
Membership, November 18, 1960.....	199	163	362
Additions:			
By Election	...	...	...
By Reinstatement	...	...	...
By Examination	8	23	31
	207	186	393
Deductions:			
By Death	4	1	5
By Withdrawal	...	1	1
By Transfer from Associate to Fellow	...	8	8
	203	176	379

CONSTITUTION

(As Amended November 17, 1950)

Article I.—*Name.*

This organization shall be called the Casualty Actuarial Society.

Article II.—*Object.*

The object of the Society shall be the promotion of actuarial and statistical science as applied to the problems of insurance, other than life insurance, by means of personal intercourse, the presentation and discussion of appropriate papers, the collection of a library and such other means as may be found desirable.

The Society shall take no partisan attitude, by resolution or otherwise, upon any question relating to insurance.

Article III.—*Membership.*

The membership of the Society shall be composed of two classes, Fellows and Associates. Fellows only shall be eligible to office or have the right to vote.

The Fellows of the Society shall be the present Fellows and those who may be duly admitted to Fellowship as hereinafter provided. The Associates shall be the present Associates and those who may be duly admitted to Associateship as hereinafter provided.

Any person may, upon nomination to the Council by two Fellows of the Society and approval by the Council of such nomination with not more than one negative vote, become enrolled as an Associate of the Society, provided that he shall pass such examination as the Council may prescribe. Such examination may be waived in the case of a candidate who for a period of not less than two years has been in responsible charge of the Statistical or Actuarial Department of an insurance organization (other than life insurance) or has had such other practical experience in insurance (other than life insurance) as, in the opinion of the Council, renders him qualified for Associateship.

Any person who shall have qualified for Associateship may become a Fellow on passing such final examination as the Council may prescribe. Otherwise, no one shall be admitted as a Fellow unless recommended by a duly called meeting of the Council with not more than three negative votes, followed by a three-fourths ballot of the Fellows present and voting at a meeting of the Society.

Article IV.—*Officers and Council.*

The officers of the Society shall be a President, two Vice-Presidents, a Secretary-Treasurer, an Editor, a Librarian, and a General Chairman of the Examination Committee. The Council shall be composed of the active officers, nine other Fellows and, during the four years following the expiration of their terms of office, the ex-Presidents and ex-Vice-Presidents. The Council shall fill vacancies occasioned by death or resignation of any officer or other member of the Council, such appointees to serve until the next annual meeting of the Society.

Article V.—*Election of Officers and Council.*

The President, Vice-Presidents, and the Secretary-Treasurer shall be elected by a majority ballot at the annual meeting for the term of one year and three

members of the Council shall, in a similar manner, be annually elected to serve for three years. The President and Vice-Presidents shall not be eligible for the same office for more than two consecutive years nor shall any retiring member of the Council be eligible for re-election at the same meeting.

The Editor, the Librarian and the General Chairman of the Examination Committee shall be elected annually by the Council at the Council meeting preceding the annual meeting of the Society. They shall be subject to confirmation by majority ballot of the Society at the annual meeting.

The terms of the officers shall begin at the close of the meeting at which they are elected except that the retiring Editor shall retain the powers and duties of office so long as may be necessary to complete the then current issue of *Proceedings*.

ARTICLE VI.—*Duties of Officers and Council.*

The duties of the officers shall be such as usually appertain to their respective offices or may be specified in the by-laws. The duties of the Council shall be to pass upon candidates for membership, to decide upon papers offered for reading at the meetings, to supervise the examination of candidates and prescribe fees therefor, to call meetings, and in general, through the appointment of committees and otherwise, to manage the affairs of the Society.

ARTICLE VII.—*Meetings.*

There shall be an annual meeting of the Society on such date in the month of November as may be fixed by the Council in each year, but other meetings may be called by the Council from time to time and shall be called by the President at any time upon the written request of ten Fellows. At least two weeks notice of all meetings shall be given by the Secretary.

ARTICLE VIII.—*Quorum.*

Seven members of the Council shall constitute a quorum. Twenty Fellows of the Society shall constitute a quorum.

ARTICLE IX.—*Expulsion or Suspension of Members.*

Except for non-payment of dues, no member of the Society shall be expelled or suspended save upon action by the Council with not more than three negative votes followed by a three-fourths ballot of the Fellows present and voting at a meeting of the Society.

ARTICLE X.—*Amendments.*

This constitution may be amended by an affirmative vote of two-thirds of the Fellows present at any meeting held at least one month after notice of such proposed amendment shall have been sent to each Fellow by the Secretary.

BY-LAWS

(As Amended November 19, 1954)

Article I.— *Order of Business.*

At a meeting of the Society the following order of business shall be observed unless the Society votes otherwise for the time being:

1. Calling of the roll.
2. Address or remarks by the President.
3. Minutes of the last meeting.
4. Report by the Council on business transacted by it since the last meeting of the Society.
5. New Membership.
6. Reports of officers and committees.
7. Election of officers and Council (at annual meetings only).
8. Unfinished business.
9. New business.
10. Reading of papers.
11. Discussion of papers.

Article II.—*Council Meetings.*

Meetings of the Council shall be called whenever the President or three members of the Council so request, but not without sending notice to each member of the Council seven or more days before the time appointed. Such notice shall state the objects intended to be brought before the meeting, and should other matter be passed upon, any member of the Council shall have the right to re-open the question at the next meeting.

Article III.—*Duties of Officers.*

The President, or, in his absence, one of the Vice-Presidents, shall preside at meetings of the Society and of the Council. At the Society meetings the presiding officer shall vote only in case of a tie, but at the Council meetings he may vote in all cases.

The Secretary-Treasurer shall keep a full and accurate record of the proceedings at the meetings of the Society and of the Council, send out calls for the said meetings, and, with the approval of the President and Council, carry on the correspondence of the Society. Subject to the direction of the Council, he shall have immediate charge of the office and archives of the Society.

The Secretary-Treasurer shall also send out calls for annual dues and acknowledge receipt of same; pay all bills approved by the President for expenditures authorized by the Council of the Society; keep a detailed account of all receipts and expenditures, and present an abstract of the same at the annual meetings, after it has been audited by a committee appointed by the President.

The Editor shall, under the general supervision of the Council, have charge of all matters connected with editing and printing the Society's publications. The *Proceedings* shall contain only the proceedings of the meetings, original papers or reviews written by members, discussions on said papers and other matter expressly authorized by the Council.

The Librarian shall, under the general supervision of the Council, have charge of the books, pamphlets, manuscripts and other literary or scientific material collected by the Society.

The General Chairman of the Examination Committee, shall, under the general supervision of the Council, have charge of the examination system and of the examinations held by the Society for the admission to the grades of Associate and of Fellow.

ARTICLE IV.—*Dues.*

The Council shall fix the annual dues for Fellows and Associates. Effective November 19, 1954, the payment of dues will be waived in the case of any Fellow or Associate who attains the age of 70 years or who, having been a member for at least 20 years, attains the age of 65 years and notifies the Secretary-Treasurer in writing that he has retired from active work. Fellows and Associates who have become totally disabled while members may upon approval of the Council be exempted from the payment of dues during the period of disability.

It shall be the duty of the Secretary-Treasurer to notify by mail any Fellow or Associate whose dues may be six months in arrears, and to accompany such notice by a copy of this article. If such Fellow or Associate shall fail to pay his dues within three months from the date of mailing such notice, his name shall be stricken from the rolls, and he shall thereupon cease to be a Fellow or Associate of the Society. He may, however, be reinstated by vote of the Council upon payment of arrears in dues, which shall in no event exceed two years.

ARTICLE V.—*Designation by Initials.*

Fellows of the Society are authorized to append to their names the initials F.C.A.S.; and Associates are authorized to append to their names the initials A.C.A.S.

ARTICLE VI.—*Amendments.*

These by-laws may be amended by an affirmative vote of two-thirds of the Fellows present at any meeting held at least one month after notice of the proposed amendment shall have been sent to each Fellow by the Secretary.

GUIDES TO PROFESSIONAL CONDUCT

In order to assist the Council of the Society in resolving questions that might be raised as to the professional conduct of members, and more importantly to guide members of the Society when they encounter questions of professional conduct, the following "Guides to Professional Conduct" have been prepared by order of the Council. The actuary has professional responsibilities to society at large, to his client or employer, and to his professional associates. As is true of codes of ethics generally, these guides deal with precepts and principles only. They are not precise rules and are subject to interpretations in relation to the variety of circumstances that occur in practice.

Any member wishing advice on the application of these guides to a particular set of facts is urged to present his case to the Council of the Society. The Council has the power to consider and take action with respect to questions that may be raised as to the professional conduct of members. Any disciplinary action by the Council must be in accord with Article IX of the Constitution.

The Council assumes that every member of the Society earnestly desires to serve his client or employer properly, to protect the public, and to maintain the prestige of the Society and its members. Accordingly, the Council sets forth the following principles by which, in its opinion, every member should be guided in his practice of the actuarial profession.

1. The member will promote a wider understanding of the significance of membership in the Society and will maintain the high standards of the Society by avoiding even the appearance of any questionable practice.

2. The member will conduct his professional competition on a high plane. He will avoid unjustifiable or improper criticism of others and will recognize that there is substantial room for honest differences of opinion on many matters.

3. The member will act in professional matters for each client or employer with scrupulous attention to the trust and confidence that the relationship implies and will have due regard for the confidential nature of his work.

4. The member will bear in mind that the actuary acts as an expert when he gives professional advice, and he will give such advice only when he is qualified to do so.

5. The member will not provide actuarial service for, or associate professionally with, any person or organization if he has reason to believe that the results of such service or association are likely to be used in a manner inimical to the public interest or the interests of the actuarial profession or to evade the law.

6. The member will submit unqualifiedly an actuarial calculation, certificate, or report only if he knows it to be based on sufficiently reliable data and on actuarial assumptions and methods that, in his judgment, are consistent with the sound principles expounded in the course of study of the Society, or in recognized texts, sources or precedents relevant to the subject at hand.

7. The member will recommend for the use of his client or employer, premium rates, rating plans, dividends or other related actuarial functions only if, in his opinion, they are based on adequate and appropriate assumptions and methods.

8. The member will not make or sponsor any actuarial calculation, certificate, statement, report, or comparison, or give any testimony or interview on such matters, which he has reason to believe is false, materially incomplete, or misleading.

9. Where appropriate for the objective use of a certificate or report, or in any event on the request of his employer or client, the member will include a statement of the principal actuarial assumptions and the general methods adopted for his computations.

10. The member will recognize his ethical responsibilities to the person or organization whose actions may be influenced by his professional opinions or findings. When it is not feasible for the member to render his opinions or findings direct to such person or organization, he will act in such manner as to leave no doubt that the member is the source of the opinions or findings and to indicate clearly the personal availability of the member to provide supplemental advice and explanation.

11. The member will not serve more than one client or employer where a conflict of his professional interest may be involved unless there be a full disclosure to all parties concerned, and such parties request and acquiesce in the engagement of his services.

12. The member will sign actuarial recommendations, certificates, and reports if he be acting as an employe, only over a title conferred by his employer if any title is used. Nevertheless, in any capacity, the member may append to his signature the designation: "Fellow of the Casualty Actuarial Society" or "FCAS," or "Associate of the Casualty Actuarial Society" or "ACAS," as the case may be. The member will not use as a signature title the designation "Member of the Casualty Actuarial Society". The member will use a designation dependent upon elective or appointive qualification within the Society such as "President," or "Member of the Council," only when he is acting in such capacity on behalf of the Society.

13. The member will recognize his personal responsibilities under these guides whether he acts as an individual or through a partnership or his employer.

November 20, 1959.

GUIDES FOR THE SUBMISSION OF PAPERS

Method of Review. All papers are reviewed by the Committee on Review of Papers, which is appointed by the President. The Committee consists of three members, plus the Editor of the *Proceedings,* who is ex-officio. Unanimous vote of the regular Committee is necessary for acceptance of a paper, except that if one member votes for rejection and the Committee is not able to resolve the deadlock, the paper will be reviewed by the Editor and accepted if he approves.

Scope and Standards.—1. Broad latitude will be allowed in the choice of a subject, provided that it is one of interest to property and casualty actuaries. However, it must clearly be suitable for inclusion in the *Proceedings.*

2. The paper must contain original ideas or new material of reasonable value, unless it has a definite educational value for other reasons.

3. When a paper includes material that the Committee finds itself not qualified to review, the Committee will seek advice or opinion from other members of the Society or recognized experts outside of the Society.

4. Disagreement by the Committee with opinions of the author will not be a bar to the acceptance of an otherwise suitable paper. Where, however, a paper is believed by the Committee to be fallacious in logic or misleading in matters of fact, it may be rejected. Acceptance of a paper will not preclude members of the Committee from presenting reviews.

5. The paper should evidence care in preparation. A reasonable minimum standard will be required as to form, clarity, and literary quality. Where a paper, otherwise acceptable, does not meet these standards, the Committee may return it to the author and invite resubmission after editing or rewriting. The Committee may also make suggestions to the author as to possible improvements in an accepted paper.

6. Papers should be kept within the general limits of length indicated by past acceptances, ordinarily about twenty printed pages.

7. The Committee will impose generally higher standards upon papers submitted in lieu of examination than they will upon other papers.. For further information please refer to the Year Book, Rules Regarding Examinations for Admission, paragraphs 6 and 7.

Procedures and Regulations.—1. Papers may be submitted only by Fellows or Associates of the Casualty Actuarial Society, except that papers may also be submitted by non-members of the Society upon invitation of the President, and by students of the Society and others in accordance with paragraphs 6 and 7 of the Rules Regarding Examinations for Admission. A member may collaborate in joint authorship with a non-member who possesses particular qualifications in respect to the subject of a paper.

2. Papers should be submitted to the Secretary-Treasurer of the Society

in quadruplicate. The Secretary-Treasurer is authorized to return to the author copies of a paper that in his opinion are not legible.

3. The name of the author should not appear on the copies of the paper submitted to the Secretary-Treasurer but should be included in the covering letter.

4. In submitting a paper, the author must submit, on a separate sheet, the information specified below:

(a) Name of paper.

(b) Has the paper been published elsewhere, in whole or in part, in identical or similar form?

(c) Is the paper being simultaneously submitted elsewhere, or will it be so submitted before decision by the Committee on Review of Papers?

(d) In the case of co-authorship with a non-member, to what extent has the Society member contributed?

(e) If the paper contains factual data from some organization, has this organization given the author permission to publish it?

5. The paper should be typed double-spaced on letter-size stationery, using only one side of each sheet. Tables and footnotes may be single-spaced. Pages should be numbered.

6. Major captions should be centered and typed in capitals; sub-captions should appear in the left-hand margin in italics (single underscore). In technical papers, paragraphs may be numbered to simplify reference thereto; paragraphs in non-technical papers should not be numbered.

7. In preparing tables for inclusion in a paper, every effort should be made to have the headings clear, concise, and complete. So far as possible, tables should be arranged so that they can be printed on a single page of the *Proceedings* without undue reduction in size of type.

8. All mathematical formulas and symbols should be entered by hand in ink rather than typewritten. Particular care should be exercised that they be legible, especially as to subscripts and superscripts, and that there is no possibility of confusion between, for instance, dx and d_x; $\times$ (the sign for multiplication) and x; a and α (alpha). It is advisable to use the exclamation point (!) to indicate factorials in binomial expansions. Where necessary, instructions to the printer may be inserted in pencil on the manuscript. The revised International Actuarial Notation should be used when life contingency symbols are applicable. This code is described in the *Proceedings,* Vol. XXVI, page 123.

9. References to books and periodicals, and proceedings of professional societies, should be sufficiently complete to permit obtaining a copy of the source without additional research.

10. If the manuscript has been prepared carefully in accordance with the above suggestions, there should be only a few minor corrections necessary.

The paper as originally submitted should not be considered simply as a draft to which extensive alterations can be made. The paper as finally accepted by the Committee on Review of Papers may be made available to other members of the Society or to the insurance press.

11. Authors will be notified of the acceptance or rejection of their papers by the Secretary-Treasurer. If a paper is rejected, original and copies will be returned. The Committee does not promise a decision on a paper submitted less than forty-five days prior to the meeting for which the paper has been prepared.

12. Authors of accepted papers are requested to notify the Secretary-Treasurer whether or not they can supply additional copies for use at meetings or for further distribution prior to publication. (Photographic reproduction is less expensive than printing and insures accuracy.)

13. Except on recommendation of the Committee, no accepted paper will be read in its entirety at a meeting of the Society. The author will be expected to prepare a two- or three-minute abstract of his paper for oral presentation, stating the purposes of the paper and its conclusions.

14. The Editor of the *Proceedings,* in consultation with the author, may edit the paper at time of publication.

December 19, 1960.

RULES REGARDING EXAMINATIONS FOR ADMISSION TO THE CASUALTY ACTUARIAL SOCIETY

1. Dates of Examination.

Examinations will be held on two successive days during the second or third week of the month of May each year in such cities as will be convenient for three or more candidates. The exact dates will be set by the Secretary-Treasurer.

2. Filing of Application.

Application for admission to examinations should be made on the Society's blank form, which may be obtained from the Secretary-Treasurer. No applications will be considered unless received before the first day of March preceding the dates of examination. Applications should definitely state for what parts the candidate will appear.

3. Associateship and Fellowship Examinations.

There are four parts of the examinations which the candidate must pass in order to become an Associate of the Casualty Actuarial Society. These consist of six actual examinations:

Part I		3 hours
Part II	Section (a)	1½ hours
Part II	Section (b)	1½ hours
Part III	Section (a)	1½ hours
Part III	Section (b)	1½ hours
Part IV	Sections (a) and (b)	3 hours

A candidate may write any one or more of the six examinations and will receive credit for those passed.

There are four examinations which a candidate must also pass to become a Fellow of the Casualty Actuarial Society. Each Fellowship Part consists of two sections, but is a single 3 hour examination. A candidate may present himself for one or more of the Fellowship examinations either if he has previously passed the Associateship examinations or if he concurrently presents himself for and submits papers for all unpassed Associateship examinations. Subject to the foregoing requirements, a candidate will be given credit for any examination which he may pass.

4. Fees.

The examination fee for the Associateship examination in $3.00 for a section, $6.00 for one complete part; subject to a minimum of $6.00 for each year in which the candidate presents himself. The examination fee for the Fellowship examinations is $10.00 for each part.

5. Credit for Examination Parts under Former Syllabus.

A candidate who has passed, or been credited with, one or more of the Associateship or Fellowship examinations under the 1955 Syllabus will receive credit for the corresponding examinations of the 1960 Syllabus in accordance with the following table:

Parts Passed or Credited Under 1955 Syllabus	*Parts Credited Under 1960 Syllabus*
Associateship, Part I (a)	Associateship, Part II (b)
" " I (b)	" " II (a)
" " II (a)	" " III (a)
" " II (b)	" " III (b)
" " III	Fellowship, " I
" " IV	Associateship, " IV
Fellowship, Part I	Fellowship, " II
" " II	" " III
" " III	" " IV (a)
" " IV	" " IV (b)

Partial examinations will be given to those candidates requiring them in accordance with the foregoing credits.

Students who passed Associateship Parts I (a), I (b) and II (a) of the 1955 Syllabus prior to the 1960 examinations will generally be excused the Associateship Part I (General Mathematics) of the 1960 Syllabus, and will be eligible for admission to Associateship when they have completed or been credited with Associateship Parts II, III and IV and Fellowship Part I of the 1960 Syllabus. However, these students may elect to write Associateship Part I (General Mathematics) and thus become eligible for admission to Associateship when they have completed or been credited with Associateship Parts I, II, III and IV of the 1960 Syllabus.

6. Waiver of Examinations for Fellowship:

The examinations for Fellowship will be waived under Article III of the Constitution in part or in whole for those candidates who meet the qualifications and requirements set forth below.

1. WAIVER OF FELLOWSHIP PARTS III AND IV

(a) The candidate shall present himself in the same year for Fellowship Parts I and II, or shall have previously passed Parts I and II.

(b) The candidate shall present an original thesis on an approved subject relating to insurance (other than life insurance). Such thesis must show evidence of ability for original research

and the solution of advanced insurance problems comparable with that required to pass Fellowship Parts III and IV. The thesis shall be of a character which would qualify it for printing in the *Proceedings.*

(c) Candidates electing this alternative should communicate with the Secretary-Treasurer and obtain through him approval of the Committee on Review of Papers of the subject of the thesis and also of the thesis. In communicating with the Secretary-Treasurer, the candidate should state, in addition to the subject of the thesis, the main divisions of the subject and the general method of treatment, the approximate number of words and the approximate proportion to be devoted to data of an historical nature. All theses shall be in the hands of the Secretary-Treasurer before the examinations are held in May of the year in which they are to be considered. No examination fee will be required in connection with the presentation of a thesis.

2. FULL WAIVER

(a) The candidate shall have completed twenty years as an Associate member of this Society.

(b) The candidate shall present an original thesis on an approved subject relating to insurance (other than life insurance). The thesis shall be of a character which would qualify it for printing in the *Proceedings.*

(c) Candidates electing this alternative should communicate with the Secretary-Treasurer and obtain through him approval by the Committee on Review of Papers of the subject of the thesis and also of the thesis. No examination fee will be required in connection with the presentation of a thesis.

7. Waiver of Examinations for Associateship.

The examinations for Associateship will be waived under Article III of the Constitution in part or in whole for those candidates who meet the qualifications and requirements set forth below.

1. PARTIAL WAIVER

Waiver of the following Associate examinations will be allowed for a candidate who has passed the corresponding examinations of the Society of Actuaries:

Casualty Actuarial Society	*Society of Actuaries*
Part I	Part 2
Part II	Part 3
Part III (a)	Part 4

2. FULL WAIVER

(a) The candidate shall be at least thirty-five years of age.

(b) The candidate shall have at least ten years' experience in actuarial or statistical work in insurance (other than life insurance) or in a phase of such insurance which requires a working knowledge of actuarial or statistical procedure or in the teaching of the principles of insurance (other than life insurance) in colleges or universities.

(c) For the two years preceding date of application, the candidate shall have been in responsible charge of the actuarial or statistical department of an insurance organization (other than a life insurance organization) or shall have occupied an executive position in connection with the phase of insurance (other than life insurance) in which he is engaged, or, if engaged in teaching, shall have attained the status of a professor.

(d) The candidate shall have submitted a thesis approved by the Committee on Review of Papers. Such thesis must show evidence of analytical ability and knowledge of insurance (other than life insurance) sufficient to justify waiver of examinations.

(e) Refer to Paragraph 1 (c) of Rule 6 for details of submission.

LIBRARY

All students registered for the examinations of the Casualty Actuarial Society and all members of the Casualty Actuarial Society have access to all the library facilities of the Insurance Society of New York and of the Casualty Actuarial Society. These two libraries, with combined operations, are located at 107 William Street, New York 38, New York.

Registered students may have access to the library by receiving from the Society's Secretary-Treasurer the necessary credentials. Books may be withdrawn from the library for a period of one month without charge. The Insurance Society is responsible for postage and insurance charges for sending books to out of town borrowers, and borrowers are responsible for the safe return of the books.

Address requests for books to:

Librarian
Insurance Society of New York
107 William Street
New York 38, New York

INDEX TO PROCEEDINGS

The fourth index will be found in Volume XL of the *Proceedings*.

SYLLABUS OF EXAMINATIONS

(Effective with 1960 Examinations)

ASSOCIATESHIP

Part	*Section*	*Subject*
I		General Mathematics.
II	(a)	Probability.
	(b)	Statistics.
III	(a)	Elementary Life Insurance Mathematics.
	(b)	General Principles of Insurance; Insurance Economics and Investments.
IV	(a)	Insurance Coverages and Policy Forms.
	(b)	General Principles of Rate-Making.

FELLOWSHIP

I	(a)	Insurance Law; Supervision, Regulation and Taxation.
	(b)	Statutory Insurances.
II	(a)	Premium, Loss and Expense Reserves.
	(b)	Insurance Accounting and Expense Analysis.
III	(a)	Individual Risk Rating.
	(b)	Problems in Underwriting and Administration.
IV	(a)	Insurance Statistics and Machine Methods.
	(b)	Advanced Problems in Rate-Making.

INTERNATIONAL CONGRESSES OF ACTUARIES

The first International Congress of Actuaries was held in 1895 in Brussels. Since that time numerous congresses have been held, and many actuaries from the United States and Canada have been benefited by attendance at the congresses and by the printed Proceedings, in which numerous valuable articles have appeared.

Continuity in the arrangement for periodic congresses and for the intervening support and management of the central office located in Brussels is achieved by the maintenance of a Permanent Committee of international membership. According to the revised regulations adopted by the New York Congress in 1957, the objects of the Permanent Committee are:

1. To promote or conduct work and research of interest in the science or practice of the Actuary. For this purpose sections formed by a number of members for study of special problems may be recognized. Each section will have its own regulations, previously approved by the Council; it will elect its Committee, except for the member appointed by the Council on the Committee.
2. To publish periodically a Bulletin: (a) bringing together technical, legislative, statistical, and juridical information relating to actuarial science; (b) reviewing publications and works which appear in various countries, bearing upon actuarial matters.
3. To co-operate with the Organizing Committees in preparing the work of International Congresses, and in the publication of their Proceedings.

The XVIth International Congress was held in Brussels in 1960. The next Congress will be in 1964, probably in London.

ASTIN SECTION

ASTIN (Actuarial Studies in Non-Life Insurance) is the first section of the Permanent Committee to be formed under the modification of the rules approved at the XVth International Congress in New York and is for the study of the application of modern statistical and mathematical methods in the field of non-life insurance. It has grown from the desire expressed by many members of the XIVth Congress held in Madrid to provide for an effective interchange of ideas on an international basis.

It has as its object the promotion of actuarial research in general insurance and will establish contact between actuaries, groups of actuaries, and other suitably qualified persons interested in this field.

This section will, from time to time, publish papers on topics related to its objects and will also publish a bulletin containing notes of general interest to members. Conferences will be held about every three years.

With these purposes in mind the Permanent Committee wishes to enlist members as broadly as possible. Membership in the Permanent Committee and in the ASTIN Section is open to members of the Casualty Actuarial Society. The annual dues for membership are 100 Belgian francs for the Permanent Committee and an additional 200 Belgian francs for the ASTIN Section. It is necessary at present for members to pay $2.50 for the Permanent Committee and an additional $5.00 for the ASTIN Section in order that dues may be met and to provide a small margin for the expenses of collection and transmission of funds as well as to meet small miscellaneous expenses.

The principal activity of ASTIN in 1961 was the Rättvik Colloquium organized by the Swedish Actuarial Society and held at the Hotel Persborg on Lake Siljan near Rättvik in the Dalecarlia section of Sweden, June 14-18. Delegates from Belgium, Denmark, Finland, France, Germany, Great Britain, Holland, Israel, Italy, Norway, Poland, Sweden, Switzerland and the United States were in attendance.

The full text of all papers will be published and distributed to ASTIN members, and brief reports of the discussions will be published in the ASTIN BULLETIN. The general categories of the papers and the groupings for discussion were: (1) Statistical Distribution of Claims by Amounts; (2) Theory of Risk, Fundamental Mathematics and Applications; (3) Motor Insurance; and (4) Reserves.

The languages of the colloquium were English and French, but the organizing committee had made arrangements for the speeches to be immediately translated into "the other language".

The ASTIN Section of the International Congress of Actuaries has made significant growth in the last ten years. Total membership in 1961 was 423, of which 115 were from Canada and the United States. The growth and influence of ASTIN as an international group has paralleled that of the Casualty Actuarial Society in the United States and Canada, and for the same economic reasons. The increased standard of living and economic activity in Western Europe and North America have increased the need for and influence of actuaries in casualty, fire, and accident insurance on both sides of the Atlantic.

Inquiries regarding membership in the Permanent Committee and in the ASTIN Section should be directed to Albert Z. Skelding, Secretary-Treasurer, Casualty Actuarial Society, 200 East 42nd Street, New York 17, N. Y.

The officers of ASTIN are:

Chairman..... Mr. Marcel Henry (France)
Vice-Chairman & Secretary.... Mr. R. E. Beard (England)
Treasurer..... Mr. N. E. Masterson (U.S.A.)
Editor..... Dr. Hans Ammeter (Switzerland)

Mr. L. H. Longley-Cook is the United States member of the Editorial Committee.

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FUTURE MEETINGS OF THE CASUALTY ACTUARIAL SOCIETY

1962 Spring Meeting — May 21, 22, 23
Hotel Griswold
Groton, Connecticut

1962 Annual Meeting — November 14, 15, 16
Hotel Warwick
Philadelphia, Pennsylvania

1963 Spring Meeting — May (Tentative)
Concord Hotel
Lake Kiamesha, New York

1963 Annual Meeting — November 13, 14, 15
Statler Hilton Hotel
Boston, Massachusetts

1962 EXAMINATIONS

May 17 and 18