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**CASUALTY
ACTUARIAL SOCIETY**

SYLLABUS OF EXAMINATIONS



**RULES REGARDING EXAMINATIONS FOR ADMISSION
RECOMMENDATIONS FOR STUDY**

**Thirty-First Edition
1986**

College of Ins. - 962-4111

CASUALTY ACTUARIAL SOCIETY

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RULES REGARDING EXAMINATIONS FOR ADMISSION

1. Dates of Examinations

Part	Date of 1986 Examinations
1.....	morning of May 20, November 18
2.....	afternoon of May 20, November 18
3.....	morning of May 16, November 14
4.....	morning of May 7
5.....	morning of November 6
6.....	morning of May 9
7.....	morning of November 7
8.....	afternoon of May 6
9.....	morning of November 5
10.....	afternoon of May 8

It is customary to hold the examinations in such cities as will be convenient. The Secretary will announce the exact times and locations at which the examinations will be given.

Individual consideration will be given to providing special arrangements for persons with demonstrable physical impairments which would impose a severe handicap if examinations were taken under normal conditions. Advance notice that special arrangements will be needed must be given to the Office of the Society at the time of making application to write an examination.

2. Filing of Application

a. Parts 1-3

A candidate who wishes to take one or more of Parts 1, 2 and 3 must file an application form which may be obtained from the office of the Casualty Actuarial Society. For these Parts, application forms and the appropriate examination fee, in check, draft, or money order made payable to the Society of Actuaries, must be sent to:

Society of Actuaries
500 Park Blvd.
Itasca, IL 60143

The applications for Parts 1-3 must be received by the Society of Actuaries by March 20 for the May examinations and by September 20 for the November examinations.

b. Parts 4-10

The first time a candidate makes application to take one or more of Parts 4-10, an application obtained from the office of the Casualty Actuarial Society

must be filed. Subsequent requests to take other examinations can be accomplished by simply writing to the office of the Casualty Actuarial Society, stating the Part or Parts for which the candidate is applying.

Each request along with the appropriate examination fee, in check, draft, or money order payable to the Casualty Actuarial Society must be sent to:

Casualty Actuarial Society
One Penn Plaza
250 West 34th Street
New York, New York 10119

The application for Parts 4-10 must be received by the Secretary by March 20 for the May examinations and by September 20 for the November examinations.

3. Joint Administration

Part 1, the General Mathematics examination, Part 2, the Probability and Statistics examination, and Part 3, the Applied Statistical Analysis, Operations Research and Numerical Analysis examination, are jointly administered by the Casualty Actuarial Society and The Society of Actuaries.

The CAS is a joint sponsor of the prizes awarded for the highest scores on Part 1.

4. Associateship and Fellowship Examinations

Successful completion of, or credit for, Parts 1 through 7 is required to fulfill the examination requirements for Associateship.

Successful completion of, or credit for, all ten examination Parts is required to fulfill the examination requirements for Fellowship.

5. Fees

The examination fee schedule for 1986 at time of publication is as follows:

Parts 1-2 (non-refundable).....	\$30.00 for each part
Part 3.....	\$60.00
Parts 4-10.....	\$90.00 for each part

Candidates writing any of Parts 1-3 overseas or at a specially arranged center must pay an additional \$30.00 fee per examination session (May or November).

Please note that all fees are payable in U.S. funds by check, draft, or money order.

6. Late Registration, Refunds, and Transfers of Fees

Parts 1-3. If the application and regular fee are not received on or before March 20 for the May examinations, or September 20 for the November examinations, the candidate may be permitted to write the examination by the payment of a late registration fee of \$30.00 for each part in addition to the regular fee for that part. Late

registrations will not be accepted from candidates writing outside North America. However, under no circumstances will any applications be accepted after April 20 for the May examinations or after October 20 for the November examinations. Also, a registered candidate may request a change of examination center, but the candidate must pay a change-of-center fee of \$10.00 for each part. In such cases, every effort will be made to have the candidate's records and supplies on hand at the appropriate examination center in time for the examination. If this effort fails, it must be understood that the Society or jointly administering or sponsoring organizations will not be held responsible; in the case of a late registration, both the late registration fee and the regular fee will be refunded, while in the case of a request for change in examination center, any change-of-center fee will be refunded. If the candidate's notice and fees, or request for change of examination center, are received so late that it is manifestly not feasible to arrange for the candidate to write the examination, the fees will be refunded immediately. The organizations are not responsible for difficulties caused by delays in postal service, or for the consequences of failing to receive correspondence because of inadequate postage.

A candidate who has filed an application for Part 3 and does not write the examination should request a refund of the examination fee. This request must reach the Society not later than June 30 for the May examinations or Dec. 31 for the November examinations. Later requests will not be considered. A fee of \$30 per examination will be assessed for all refunds. Only examination fees for Part 3 can be refunded. Late registration fees and change-of-center fees are not refundable.

Parts 4-10. Examination fees are payable each time the candidate registers for an examination. Check, draft or money order in U.S. funds payable to the order of the Casualty Actuarial Society must be received by the Office of the Casualty Actuarial Society by March 20 for the May examinations or by September 20 for November examinations. Late registration will be accepted through April 20 and October 20 if accompanied by a \$50.00 late registration fee for each Part. Change-of-center fees will be \$15.00.

The same administrative conditions will apply for changes of examination center and for late registration as for the first three exams, with the organization to be contacted being the Casualty Actuarial Society.

A candidate who has filed an application and finds that it will not be possible to take the examination should request a refund of the examination fee. This request must reach the Office of the Casualty Actuarial Society not later than April 20 for the May examinations, or October 20 for the November examinations. Later requests will not be considered. A fee of \$15.00 per examination will be assessed for all refunds. The fee of a candidate who is unavoidably absent from an examination will, upon written request within 30 days following the date of such examination, be transferred to any examination given in the next thirteen months. A fee which has been so transferred is not refundable. There will be a \$15.00 fee for such transfer, payment for which should accompany the request for transfer. Candidates must register for the examination to be taken even if the fee is being transferred from a prior exam period.

7. Waiver of Examinations for Associateship

It is the policy of the Casualty Actuarial Society not to grant waiver of all or any portion of its examination requirements, either for work experience, contribution to the actuarial literature, or academic courses of study. Individuals who claim competence in the areas covered by the examinations should not have difficulty demonstrating their competence through the examination process.

Waiver of individual examination requirements will be granted by the Board of Directors of the CAS in instances where an applicant has passed or received credit for examinations sponsored by another recognized actuarial organization covering equivalent material in both subject and depth. The granting of waivers by the Board will be based on the recommendation of the Vice President-Membership. His or her recommendation will be guided by the policy established by the Education Policy Committee.

The Education Policy Committee has established the specific program outlined below, covering the most common requests for waiver of examination requirements.

1. Waiver of examination Part 1, 2, or 3 will be allowed for a candidate who has passed or been credited with the corresponding examinations sponsored by the Society of Actuaries prior to the joint administration of those examinations.
2. Candidates who take the Advanced Mathematics Test of the Graduate Record Examinations may apply for credit for Part 1. Credit will be granted if the candidate's score on the test is equivalent, as determined by the CAS, to a passing score on Part 1.
3. The CAS also specifically recognizes the examinations sponsored by the British Institute of Actuaries. Credit will be granted for examinations passed or waived in accordance with the following table:

<u>CAS</u>	<u>Institute Exam Equivalent</u>	
	<u>Current Syllabus</u>	<u>Prior Syllabus</u>
Part 1	Associateship Status	I-1
Part 2	A-1 and A-5	I-2 and I-5
Part 3	Associateship Status	I-1 and I-3

The Casualty Actuarial Society will grant credit either for exams passed by the Institute or waived by the Institute, except that credit will not be granted for exams waived by the Institute on account of academic records achieved in North American universities.

In these instances, candidates requesting a waiver of an examination requirement should present their request to the Vice President-Membership with appropriate evidence that demonstrates the passing of (or score on) the examinations for which a waiver is requested. Such request should also include an application for membership if one has not already been filed. The Vice President-Membership will review all applications and recommend action to the Board of Directors.

In instances other than those specifically delineated above, candidates should present their request to the Vice President-Membership and include with their applications evidence that demonstrates the asserted equivalence of the examinations passed to those for which a waiver is requested via a list of topics covered, or other relevant material. If such evidence is not included, the Vice President-Membership will request it from the candidate.

In such instances the Vice President-Membership will forward the request to the Education Policy Committee. The Education Policy Committee will then review the request to determine whether the waiver program should be expanded to include the examinations embodied in the candidate's request.

8. Conduct of Examinations

The examinations are exclusively in writing. Except as is noted in the following paragraphs, no books, papers, typewriters, slide rules, or electronic or mechanical aids to computation of any kind may be brought into the examination room by candidates, nor may any candidate communicate with or obtain any assistance from any other candidate during the examination.

Electronic calculators will be allowed in the examination room for Parts 1-10. For Parts 4-10, electronic calculators, which are to be supplied by the candidate, must meet the following standards to be acceptable:

1. portable
2. battery operated during examination
3. must not be programmable; and
4. must not emit distracting noises

For Parts 1-3, the only acceptable calculator is that sold by the Society of Actuaries. This should be purchased from the Society of Actuaries in advance of the examination, as none will be available for purchase at the time of the examination.

It is the candidate's responsibility to see that the calculator used during the examination meets the applicable standards and is in good working order.

Parts 1, 2, and 3 consist entirely of multiple-choice questions. On these examinations each multiple choice problem presented includes five answer choices identified by the letters A, B, C, D, and E, only one of which is correct. A separate answer sheet provides a row of six ovals for each problem. The first five of these, identified with the letters A, B, C, D, and E, correspond to the five answer choices. The sixth oval (described below) is marked "Omit". After deciding which answer is correct, the candidate should blacken the oval which has the same letter as this answer.

Since the answer sheets are scored by optical scanning equipment, it is important that there be only one oval blackened for each question. If the candidate decides not to respond to a question for which an oval has already been blackened, the answer oval should be erased, and the "Omit" oval should then be blackened. This oval is located to the right of the answer Oval "E". This procedure assures that the scoring equipment will score the question as an omitted question and not be confused by an incompletely erased answer oval. It is *not* necessary to blacken the "Omit" oval if no answer oval has been blackened. This is because the scoring equipment also scores a question as an omitted question if there are no ovals blackened in the row. Please note that the "Omit" oval appears on the answer sheets for Parts 1-3 only.

9. Grading of Examinations

a) Multiple-Choice and True-False Questions

Scoring of the multiple choice examinations will be done in such a way that there is no advantage or disadvantage to be anticipated from guessing answers in a purely random fashion as compared with omitting the answers entirely.

Parts 1-3. There will be one-fifth point added for each multiple-choice question left blank.

Parts 4-10. There will be no addition for multiple-choice questions left blank, but one-quarter point will be deducted for each incorrect answer. On true-false questions, one point will be deducted for each incorrect answer.

b) Determination of the Pass Mark

The final decision as to where the pass mark shall be set is arrived at by consultation among the Officers of the Examination Committee and the Part Committee. In determining the pass mark, consideration is given both to the performance level of candidates' answers and to the comparative difficulty of the examination, in relation to that of previous examinations. Appropriate recognition is given to any peculiarities that may appear in connection with the answers to any question on an examination despite all the care taken in setting the examination questions.

c) Candidates' Requests for Information

Any candidate for Parts 4-10 can get an analysis of his or her test paper by writing to the CAS office before the deadline. The normal deadline will be August 15 on May exams and February 15 on November exams. The requests will be batched. The batched requests will go to the Examination Committee about two to four weeks after the deadline. Candidates should receive an analysis normally within two months after the deadline.

The analysis will give an outline of the subject areas in which the student was strong or weak as well as the specific question numbers (on essays) on which he or she scored well, poorly, or in-between. The Examination Committee feels that this kind of information can be developed within a reasonable amount

of time and without undue effort. It should provide the educational guidance that most candidates desire.

The Examination Committee is also prepared to do an administrative check for any candidate who appeals a score, to be sure that he or she has been given the proper grade. It will also entertain any inquiries regarding the accuracy or ambiguity of specific exam questions.

Several weeks after receiving their notification of grade, failing candidates for Part 1 to 3 will receive, an analysis listing their percentile rank by topic. This will enable the candidate to identify areas requiring additional study.

10. Confidentiality of Examination Records

The fact that a candidate has passed a particular examination is considered public knowledge. Any further information as to examinations taken by candidates and grades received by candidates is available only to the candidates themselves and to committee chairmen as required for their committee purposes, unless the candidate requests in writing that such information be provided to someone else.

11. Disciplinary Action

Candidates for the Casualty Actuarial Society's examinations are expected to follow the rules and procedures included in the "Instructions to Candidates" printed on their examination books and announced by the supervisors at the examination locations. These standards may seem stricter than those which candidates are accustomed to in other examination environments. The Casualty Actuarial Society maintains these strict standards because the examinations are such a significant part of a candidate's career. Therefore, equitable administration of the examinations and enforcement of the highest standards of conduct cannot be emphasized too strongly.

Candidates should understand that the Casualty Actuarial Society will pursue any evidence of a candidate not adhering to the spirit of the examination rules and will respond to violations with appropriate disciplinary action.

LIBRARY

All candidates registered for the examinations of the Casualty Actuarial Society and all members of the Casualty Actuarial Society have access to all the library facilities. The CAS Library is located at One Penn Plaza, 250 West 34th Street, New York, New York 10119, Phone: (212) 560-1018—(212) 560-1019.

Books and manuals may be withdrawn from the Library for a period of one month without charge. In general, not more than two references may be in the hands of a borrower at one time.

Address requests for books to:

Vice President-Administration
CAS Library Service
One Penn Plaza
250 West 34th Street
New York, New York 10119

Phone: (212) 560-1018
(212) 560-1019

PROCEEDINGS AND OTHER PUBLICATIONS OF THE SOCIETY

The prices of past editions of the *Proceedings* and other publications of the Society and a list of those editions still in print are set out in the Yearbook of the Society.

Those wishing to purchase these publications should write the Secretary:

Vice President-Administration
Casualty Actuarial Society
One Penn Plaza
250 West 34th Street
New York, New York 10119

Phone: (212) 560-1018
(212) 560-1019

AMERICAN ACADEMY OF ACTUARIES

Satisfactory completion of specified examinations of the Casualty Actuarial Society will satisfy the educational requirements of the American Academy of Actuaries. For further information contact the Academy at 500 Park Boulevard, Itasca, Illinois 60143.

GRE Score 750

1986 SYLLABUS OF EXAMINATIONS

<u>Part</u>	<u>Time Allowed</u>	<u>Subjects</u>
<i>Associateship Examinations</i>		
1*	3 hours	General Mathematics
2*	3 hours	Probability and Statistics
3*	4 hours	Applied Statistical Analysis, Operations Research and Numerical Analysis
4	4 hours	Mathematics of Compound Interest, Life and Casualty Contingencies, Credibility Theory and Loss Distributions
5	3 hours	Principles of Economics; Theory of Risk and Insurance; Policy Forms and Coverages; Underwriting, Marketing and Claim Function
6	4 hours	Principles of Ratemaking and Data for Ratemaking
7	4 hours	Premium, Loss, and Expense Reserves; Insurance Accounting, Expense Analysis, and Published Financial Information
<i>Fellowship Examinations</i>		
8	3 hours	Insurance Law, Supervision and Regulation, and Statutory Insurance
9	4 hours	Advanced Ratemaking and Individual Risk Rating
10	4 hours	Financial Operations of Insurance Companies, Reinsurance and Excess Rating, Forecasting, and Current Events and Issues

*Jointly administered with the Society of Actuaries

NOTE

Part 4 jointly administered with SOA:
11/79, 5+11/80, 5+11/81, 5/82

RECOMMENDATIONS FOR STUDY

The objective of the Casualty Actuarial Society's education and examination process is to assist the candidate in professionally preparing for an actuarial career of managing the varied corporate responsibilities assigned to an Actuary in the casualty insurance field. The Recommendations for Study present the study material that a casualty actuarial candidate should understand thoroughly, and be able to apply professionally to actual casualty insurance situations. The examination process is designed to assure that each successful casualty actuarial candidate attains a satisfactory level of competence in the subject matter.

The examinations for admission to the two grades of membership in the Society are designed to establish the qualifications of candidates. The following Recommendations for Study are provided as a guide for the candidates in their preparation for the examinations. It should be realized that although the examination questions will be largely based upon the textual material cited, they will not necessarily be drawn directly therefrom. The examinations will test not only the candidate's knowledge of the subject matter, but also the candidate's ability to apply that knowledge. Finally, in the development of the syllabus readings and the examination questions, it is assumed that the candidate is familiar with the material covered in earlier parts. Therefore, it is recommended that the candidate take the parts in numerical order.

In their study for the mathematical sections of the Associateship Examinations, candidates are advised to work out as many examples as possible in order to acquire facility in the application of the mathematical principles and methods to specific problems. The questions on the examinations for Parts 1, 2, and 3 are all of the multiple choice type.

In preparing for Parts 7 through 10, the candidate should become familiar with current developments by reading regularly at least two general insurance periodicals.

The references to papers in the *Proceedings* of the Casualty Actuarial Society (PCAS) are considered to include all discussions of these papers, though the page references cited refer to the papers only. In the case of readings from out-of-print *Proceedings*, the candidate is responsible only for those discussions reprinted in the CAS Booklets referred to below.

A more detailed reference of the texts cited will be found in the Index To Readings at the end of these Recommendations. The reading materials suggested in these Recommendations are designed to acquaint the candidate with the respective subjects and should not be interpreted as representing views endorsed by the Casualty Actuarial Society. **If a new edition or printing of any text becomes available, the student should WRITE — NOT PHONE — the CAS office for instructions regarding its acceptability and the appropriate chapters/pages in the new edition which correspond to the printed study requirements.**

A dagger (†) beside a reading indicates that it is either an addition to the recommended readings or that there has been a material change to a previously included reading.

Study notes and study kits have been prepared in connection with some examinations and can be obtained from the Society's office at the following costs (payable in U.S. Funds):

Study Kit	Cost
Part 4	\$20.00
Part 6	25.00
Part 7	3.00
Part 9a	3.00
Part 10	7.00
Study Note	
Part 5	\$3.00
Parts 9b & 10	3.00

It should be noted that Study Kits and Study Notes are not simply aids, but contain additional readings that are part of the exam syllabus.

Readings from out-of-print *Proceedings* of the Casualty Actuarial Society (PCAS) are available from the Society's office as follows:

Part Booklet	Cost
Part 6	\$5.00
Part 7 & 9a	5.00
Part 8	5.00
Part 9b	7.00

The Call Paper and Discussion Paper Program booklets are available from the Society's office at a cost of \$15.00 each as shown below

<u>Program Year</u>	<u>Exam Part(s)</u>
1980	9 and 10
1981	7 and 10
1982	10

Sample examination questions for Parts 1 & 2 and copies of Parts 5-10 examinations for recent years may be obtained from the Casualty Actuarial Society office. Illustrative answers for essay questions on Parts 4-10 are available upon request. Also available without charge is a note entitled "Hints on Study and Exam Techniques."

In referring to a published prior examination, students should keep in mind that the questions are based on the Course of Reading in effect for that particular examination and may not in all instances reflect the current Course of Reading. Students may also expect future examinations to vary somewhat as to the proportion of question style and subjects. New forms of questions may appear from time to time, and the total number of questions may be increased or decreased.

Other material available for a charge from the Casualty Actuarial Society office:

Part 5

Excerpts from the following manuals:

Insurance Services Office:

Personal Automobile Manual. General Rules 1-13 \$3.00

Homeowners 76 Policy Program Manual. General Rules. pp. GR1-~~3~~ 3.00

Commercial Lines Manual. Common General Rules. pp. CGR1-2. General Liability. pp. GL1-15 3.00

National Council on Compensation Insurance:

Basic Manual for Worker's Compensation and Employers' Liability Insurance. General Rules. pp. R1-R34. 3.00

Part 6

Excerpts from the following plans:

Insurance Services Office. *Automobile Statistical Plan* 3.00

Insurance Services Office. *Commercial Statistical Plan* 3.00

Insurance Services Office. *Personal Lines Statistical Plan for Homeowners Policies, Mobile-homes Policies, Comprehensive Dwelling Policies, Dwelling Policies* 3.00

National Council on Compensation Insurance
Unit Statistical Plan 7.00

Longley-Cook, L. H. *An Introduction to Credibility Theory*. 1962. 3.00

Part 8

"Post-Assessment Property and Liability Insurance
Guaranty Fund" 3.00

Excerpt from the *Report of the National Commission
for the Review of Antitrust Laws and Procedures* 3.00

"NAIC Financial Condition Examiners' Handbook — Introduction" 3.00

Part 9

Insurance Services Office:

General Liability Experience and Schedule Rating Plans 3.00

*Retrospective Rating Plan for
Automobile, General Liability, Glass and Theft* 3.00

<i>Composite Rating Plan (Automobile, General Liability, Glass and Theft)</i>	3.00
<i>Commercial Fire Rating Schedule (Summary)</i>	3.00
National Council on Compensation Insurance <i>Retrospective Rating Plan</i>	7.00
<i>Experience Rating Plan</i>	3.00

ASSOCIATESHIP EXAMINATIONS

PART 1

GENERAL MATHEMATICS

This Examination Part is jointly administered by the Casualty Actuarial Society and the Society of Actuaries.

The three-hour multiple-choice examination is based on material usually covered in undergraduate mathematics courses through the differential and integral calculus and a first course in linear algebra. The general scope of the examination is indicated by the following topics:

- Real and complex numbers;
- Elementary set theory, including unions, intersections, and complements;
- Functions, equations and inequalities;
- Analytic geometry of two and three dimensions;
- Standard algebraic and transcendental functions, including polynomial, rational, trigonometric, logarithmic, and exponential functions;
- Limits, continuity, differentiability, and integrability;
- Derivatives, integrals, and partial derivatives;
- The fundamental theorem of integral calculus;
- Applications of derivatives and integrals, including multiple integrals;
- Finite and infinite sequences and series, including the Taylor series expansion;
- The mean value theorem;
- Linear equations, vector spaces and generating sets;
- Bases, dimensions, and subspaces;
- Scalar products, linear transformations, and kernel and image space;
- Matrices, determinants, eigenvectors and eigenvalues.

Candidates who have not had mathematics courses covering these topics may be helped by any of the four texts covering calculus and analytic geometry and either of the two texts covering linear algebra listed below. These may be considered representative of the many texts used in colleges and universities in the United States and Canada which adequately cover the material upon which the candidate may be examined. Earlier or later editions of the texts listed below contain essentially the same information, and should be adequate for review purposes.

†Thomas, G. B. (Jr.) and Finney, R.L. *Calculus and Analytic Geometry*. (Sixth Edition).
Johnson, R. E., Kiokemeister, R. L. and Wolk, E. S. *Calculus with Analytic Geometry*. (Sixth Edition).

Protter, M. H. and Morrey, C. B. (Jr.) *College Calculus with Analytic Geometry*. (Third Edition).

Purcell, E. J. *Calculus with Analytic Geometry*. (Third Edition)
Bradley, Gerald L. *A Primer for Linear Algebra*. Chapters 1-6.

†Kolman, B., *Introductory Linear Algebra With Applications*. (Third Edition).

An additional reference for those who may want further practice in solving linear algebra problems is *Linear Algebra* by Seymour Lipschutz (Schaum's Outline Series, McGraw-Hill).

PART 2

PROBABILITY AND STATISTICS

This Examination Part is jointly administered by the Casualty Actuarial Society and the Society of Actuaries.

The three-hour multiple-choice examination is based on material usually covered in undergraduate courses in mathematical probability and statistics. It can be taken by college students who have had a thorough course in these subjects or by persons who have done concentrated reading in these fields. The general scope of the examination is indicated by the following topics, which are among those proposed for a one-year college course in probability and statistics by the Committee on the Undergraduate Program in Mathematics (CUPM) of the Mathematical Association of America:

Sample spaces;
Axioms and elementary theorems of probability;
Independence, conditional probability, and Bayes' theorem;
Permutations and combinations;
Random variables;
Binomial, Poisson, normal, chi-square, t, F, and other probability distributions;
Expectation, mean, variance, and moment generating functions of probability distributions;
Multivariate distributions;
Transformations of random variables;
Conditional and marginal distributions;
Central limit theorem;
Point estimation, including maximum likelihood estimation and the application of criteria such as consistency, unbiasedness, and minimum variance;
Tests of statistical hypotheses, including power functions, Type I and Type II errors, Neyman-Pearson lemma, and likelihood ratio tests;
Applications of sampling distributions to confidence intervals and to tests for means and variances;
Regression and correlation;
Method of Least Squares;
Interpretation of experimental results;
Bayesian estimation.

The CUPM has reported that statistics courses can be implemented in a variety of ways, and can include different topics with different emphases on topics. That widely divergent approaches are acceptable is illustrated by the many texts appropriate for a one-year college course. Among such texts, the following are representative of those which cover most of the above topics and which provide the mathematical background required for this examination.

1. Hogg, R. V. and Craig, A. T. *Introduction to Mathematical Statistics*. (Fourth Edition).
2. Hoel, P. G., Port, S. C. and Stone, C. J. *Introduction to Probability Theory and Introduction to Statistical Theory*.
3. Mood, A. M., Graybill, F. A., and Boes, D. C. *Introduction to the Theory of Statistics*. (Third Edition).
4. DeGroot, Morris H. *Probability and Statistics*.

Candidates who have mastered the text material and can work the problems in any one of these references should be adequately prepared to handle the mathematical material in this examination.

The following page references to the representative texts listed above are provided to assist candidates in locating some of the appropriate background material for a few selected topics that are included in this examination:

Moment generating functions of probability distributions:

1. pp. 50-57, 91-92, 101, 105-107, 110-111, 119-120 and 164-169.
2. pp. 197-200 (Volume I).
3. pp. 78-81 and 538-543.
4. pp. 162-167, 201, 208-209, 214-215, 219 and 237-238.

Applications of chi-square distribution (chi-square tests):

1. pp. 269-283 and 312-313.
2. pp. 91-99 (Volume II).
3. pp. 440-461.
4. pp. 438-461.

Regression and correlation:

1. pp. 73-78, 117-120 and 296-303.
2. pp. 99-100 (Volume I), 33, 111-119 and 148-153 (Volume II).
3. pp. 155-159, 161, 167-169 and 482-502.
4. pp. 172-182 and 507-535.

Bayesian estimation:

1. pp. 227-233.
2. pp. 36-42 (Volume II).
3. pp. 339-350 and 396-398.
4. pp. 275-283.

An additional reference, for candidates who may wish further practice in solving problems, is Spiegel, M. R., *Theory and Problems of Statistics* (Schaum's Outline Series, McGraw-Hill). A second additional reference, for candidates who may wish to acquire further insight into the underlying nature of statistics and exposure to statistical applications is Tanur, Mosteller, et al, *Statistics: A Guide to the Unknown*. (Holden-Day), available in paperback form.

It will be assumed that the candidate is familiar with the ordinary deck of fifty-two playing cards and the ordinary six-faced dice.

PART 3

This Examination Part is jointly administered by the Casualty Actuarial Society and the Society of Actuaries.

The four-hour multiple-choice examination covers the three separate subjects of applied statistical analysis, operations research, and numerical analysis. Minimum standards will be imposed for each section of this examination. The use of these standards is intended to ensure that each candidate has a reasonably sufficient working knowledge of each subject covered on the examination. The minimum standard for each subject is lower than the passing percentage for the entire examination, and is normally equal to 35% of the total points available for that subject. Different minimum standards may be imposed when appropriate, such as after the introduction of a new text or a new topic, or when a subject is particularly important. If a candidate fails to meet the minimum standard for a particular section of an examination, yet would have otherwise passed the examination as a whole, that candidate will receive a score of 5*, which is a failing score. The examination is based on the material found in the textbooks listed below.

For many candidates, Part 3 is the first actuarial examination for which they will be preparing without the benefit of a formal course in the subject material. These candidates will find it helpful to maintain contact with other Part 3 candidates and to take advantage of opportunities to discuss with others questions that are considered difficult. Candidates should not hesitate to consult members of the profession in their own organizations or elsewhere who are knowledgeable on these subjects.

Solutions to selected exercises from *Intermediate Business Statistics* and the two Society of Actuaries study notes are available from the Society of Actuaries at a combined cost of \$5.

(a) APPLIED STATISTICAL ANALYSIS

The general scope of the applied statistical analysis section of the examination is indicated by the following topics:

Analysis of variance; Regression analysis; Time series analysis.

Miller, R. and Wichern, D. *Intermediate Business Statistics*. 1977. Chapter 4 (Up to Tukey's Test on page 158), Chapters 5-8 (Except Section 5.10), Chapters 9-11 (Except for supplements). Chapters 1-3 provide a good review of Part 2 concepts; however they will not be tested directly.

(b) OPERATIONS RESEARCH

The general scope of the operations research section of the examination is indicated by the following topics:

Linear programming; Dynamic programming; Queuing theory; Project scheduling; Integer programming; Decision Analysis; Simulation.

Hillier, F. S. and Lieberman, G. J. *Operations Research* (Third Edition). Chapters 1-3, 6 (Section 6.6 only), 7, 10 (10.1-10.6 up to but not including the Basic Model with a Finite Queue on p. 424), 18 (Section 18.1 only).

Study notes published by the Society of Actuaries:

An Introduction to Stochastic Simulation (Code: 30-31-84)

Decision Analysis (Chapter 4 of *A Study Manual for Operations Research* by Narragon) (Code: 30-32-84)

The emphasis is primarily on problem-solving and secondarily on theoretical considerations. Recourse is made, as needed, to methods from the calculus and classical algebra in order to present a broad perspective of both the practical and the theoretical aspects of this subject.

(c) NUMERICAL ANALYSIS

This subject encompasses various techniques for handling numerical data. Although many of the principles dealt with lend themselves readily to computer procedures and methods, knowledge of such procedures or methods is neither presupposed nor required for the examination.

The general scope of the numerical analysis section of the examination is indicated by the following topics as covered in the recommended text:

Iteration; Interpolation; Numerical Integration; Linear Systems.

†Burden, R. L., Faires, J. D., and Reynolds, A. C. *Numerical Analysis* (Third Edition). 1985, Chapters 1 (1.1*-1.3), 2 (2.1-2.5), 3 (3.1-3.4 and 3.6**), 4 (4.3-4.6), 6 (6.1-6.7), and 7 (7.1 only). (If studying from Second Edition, omit Sections 1.3, 2.5 and 6.7).

*Knowledge of this section will be assumed as background material for questions on Part 3; however, questions will not be directly based on this section.

**As related background material for Cubic Splines, the student should read pages 137 and 138 up to the paragraph following table 4.1. However, Part 3 questions will not be based on these pages. (Corresponding pages for Second Edition are 125 and 126).

PART 4

Prior to commencing study for this Part, the candidate should read the "Recommendations for Study" section, pages 11 to 14, for study suggestions and guidance in obtaining the Part 4 study kit, out of print readings, past examinations, and other information important to sitting for this examination. References are listed in the suggested order for study.

Items marked with an asterisk (*) are contained in the 1986 study kit, which is available from the CAS office at a cost of \$20.00.

(a) MATHEMATICS OF COMPOUND INTEREST

This section represents approximately 25% of the examination. Key topics include:

Measurement of interest, including accumulated and present value factors; annuities certain; amortization schedules and sinking funds; and bonds and related securities.

✓ †Kellison, S. G. *The Theory of Interest*. 1970 Edition or 1975 reprint of 1970 Edition. (Excluding Sections 4.7, 4.8, 5.6, 6 (6.8-6.10), and all of Chapter 7).

(b) LIFE AND CASUALTY CONTINGENCIES

This section represents approximately 25% of the examination.

✓ * †Jordan, C. W. *Life Contingencies*. 1967. (Second Edition). Society of Actuaries. Chapters 1-4 (all sections except 2.6, 3.5 and 4.2), 5 (5.1-5.3), 6 (6.1), 8 (8.1-8.3), 9 (9.1-9.3) and 14 (14.1-14.2).

In addition, the sections on notation and the problems at the end of the above chapters should also be reviewed.

*Ferguson, R. E. "Actuarial Note on Workmen's Compensation Loss Reserves." *PCAS LVIII*, 1971. Discussions by various authors, *PCAS LIX*, 1972. pp. 118-122.

(c) CREDIBILITY THEORY

This section represents approximately 25% of the examination.

✓ †Hossack, I. B., Pollard, J.H., Zehnwirth, B. *Introductory Statistics with Applications in General Insurance*. 1983. Chapters 4 (all sections), 8 (excluding 8.7).

†*Van Slyke, O. E. *An Overview of Credibility*. 1984. Casualty Actuarial Society. Section 1 (pp 1-16).

†*Herzog, T. N. Casualty Actuarial Society Part 4 Study Note: *An Introduction to Bayesian Credibility and Related Topics*, 1985. Casualty Actuarial Society.

†*Venter, G.G. *Limited Fluctuation Credibility with the Normal Power Approximation*. 1985. Casualty Actuarial Society.

* Library has 1975 + 1982 Editions.

(d) LOSS DISTRIBUTIONS

This section represents approximately 25% of the examination.

Many actuarial problems involve the analysis of incurred losses for an insured event. Often it is impossible to determine the exact distributions of certain losses. Thus in practice, the objective may be to find reasonable and usable approximations to those distributions. The loss distributions text describes some of the methods for doing this. Chapter 2 and the appendix of this text describe a variety of mathematical distributions which may be helpful in this process. Through study of the required sections below, the candidate is expected to become familiar with some uses of these distributions. The candidate will not be tested directly on the distributions themselves; rather the emphasis will be on using these distributions in a problem solving way. Solutions to selected exercises from the text are available at no charge from the CAS office. In order to promote the proper emphasis on the preparation for this exam, the Appendix of *Loss Distribution* (pp. 217-32) will be provided to students at the time of the examination.

†Hossack, I. B., Pollard, J.H., Zehnwirth, B. *Introductory Statistics with Applications in General Insurance*. 1983. Chapters 5 (all sections) and 6 (6.1-6.4).

†Hogg, R. V. and Klugman, S.A. *Loss Distributions*. 1984. Chapters 3 (3.1-3.4,3.6), 4 (4.1,4.2), 5 (5.2).

PART 5

Prior to commencing study for this Part, the candidate should read the "Recommendations for Study" section, pages 11 to 14, for study suggestions and guidance in obtaining study notes, out-of-print readings, past examinations, and other information important to sitting for this examination.

Note: *Sharing the Risk* by Marks and Craigie contains a good basic introduction to insurance. Although this reference is not part of the required readings for Part 5, the candidate may find it useful to review this material as background for this examination. This reading is available from the Insurance Information Institute at a cost of \$3.95.

Section (a) of this examination deals with the basic principles of economics and Section (b) with the theory of risk and insurance. Section (c) covers the insurance product, namely policy forms and coverages. Underwriting and marketing and claims function are covered in Section (d).

In studying the references it is recommended that they be read in the order listed.

(a) PRINCIPLES OF ECONOMICS

The candidate will need to have a knowledge of the principles of economics at the college level. The candidate should be familiar with the various key concepts and basic principles of economics included in the recommended reading and be able to explain and apply them.

†Samuelson, P. A. and Nordhaus, W.D. *Economics* (12th Edition). 1985. Chapters 5-10, 12-19, 21-24, and 30; exclude appendices except for chapters 18, 19, 22, and 30. (While the candidate will not be tested on chapter 1-4 and 20, the candidate may find it useful to review these chapters as background for this examination.)

(b) THEORY OF RISK AND INSURANCE

The candidate should know what risk is, the kinds of risk, and the ways in which they can be handled, with particular emphasis on the relation to insurance.

✓ Williams, C. A., Head, G. L., Horn, R. C., and Glendenning, G. W. *Principles of Risk Management and Insurance*. Second Edition, 1981. American Institute for Property and Liability Underwriters. Vol. I. pp. 1-35, 97-151 and 223-277.

Study Note (Available from the CAS office at a cost of \$3.00 per copy.) (Same as 1985)

✓ Houston, D. B. "Risk, Insurance, and Sampling." *The Journal of Risk and Insurance*. Vol. XXXI, No. 4, 1964. p. 511.

✓ †Hossack, I. B., Pollard, J.H. Zehnwirth, B. *Introductory Statistics with Applications in General Insurance*. 1983. Chapter 11.

✓ Lange, J. T. "Application of a Mathematical Concept of Risk to Property-Liability Insurance Ratemaking." *The Journal of Risk and Insurance*. Volume XXXVI, No. 4, 1969. p. 383.

(c) POLICY FORMS AND COVERAGES

The insurance policy is the contract describing the services and protection which the insurance company is providing to the insured. It is, in effect, the only "product" which the insurance buyer receives until the time a loss occurs. The candidate should know the policy provisions and the bases of exposure used in the respective lines of insurance, with emphasis on basic coverages and features common to all lines as well as those peculiar to specific lines or types.

✓ Williams, C. A., Head, G. L., Horn, R. C., and Glendenning, G. W. *Principles of Risk Management and Insurance*. (Second Edition). 1981. American Institute for Property and Liability Underwriters. Vol. II. pp. 49-64, and Chapter 14.

✓ Wood, G. L., Lilly, C. C., Malecki, D. S. and Rosenbloom, J. S. *Personal Risk Management and Insurance*. (Third Edition). 1984. American Institute for Property

and Liability Underwriters. Vol. I. pp. 28-35, 41-110, 163-217, 235-258, 262-274, and 281-292. Vol. II pp. 1-30, and 45-65.

✓ Malecki, D. S., Donaldson, J. H. and Horn, R. C. Commercial Liability Risk Management and Insurance. 1978. American Institute for Property and Liability Underwriters. Vol. I. (While the candidate will not be tested on Chapter 1, the candidate may find it useful to review this chapter as background for this examination.) pp. 61-118, 159-281, and 363-449. Vol. II. pp. 1-68, 122-127, and 157-182.

✓ Rodda, W. H., Trieschmann, J. S., Wiening, E. A., and Hedges, R. A. Commercial Property Risk Management and Insurance. (Second Edition). 1983. American Institute for Property and Liability Underwriters. Vol. I. pp. 1-27, 125-130, 179-186, 235-237, and 255-278. Vol. II. pp. 23-48, 101-108, 122-127, 141-148, 153-159, 166-171, and 233-244.

Policy provisions change from time to time so that it is essential to supplement the cited texts by study of the contracts currently in use. The candidate will be held responsible for knowledge of the following policy forms (not the associated endorsements): Personal Auto, Homeowners, Workers' Compensation. Current insurance contracts will be considered to be those in the Alliance of American Insurers' *Study Kit of Policies, Forms and Endorsements—Casualty, Fire, Marine and Life*. 1985 or a possible 1986 Edition. A review of the National Underwriter Company's *The Fire, Casualty and Surety Bulletins*, current edition, may be helpful to the candidate in preparing for this section although examination questions will not be derived from this source.

The manual sections listed should be studied as illustrative of the part played by manuals in the forms and coverages area.

Certain of the references encompass material beyond the scope of this subsection, that is, the determination of manual or class rates and individual risk rating plans. The examination for this section will not reflect such material.

Excerpts from the following manuals:

Insurance Services Office:

Personal Automobile Manual. General Rules 1-13.

Homeowners 76 Policy Program Manual. General Rules. pp. GR1-6.

Commercial Lines Manual. Common General Rules. pp. CGR1-2. General Liability. pp. GL1-15.

National Council on Compensation Insurance:

Basic Manual of Worker's Compensation and Employers' Liability Insurance. General Rules. pp. R1-R34.

NOTE: The four manuals listed above should not be requested from either ISO or the NCCI. If a candidate does not have access to this material, excerpts are available from the CAS office which include the pages listed for each manual. The excerpt for each manual is \$3.00 per copy.

(d) UNDERWRITING, MARKETING AND CLAIM FUNCTION

Underwriting is a key function in the insurance business with unique qualities which make it critical to the success of the endeavor. Actuaries will often be working closely with underwriters in their day-to-day operations. The candidate should know what the underwriting function is—its basic purpose, principles and activities.

Product design and product modification are areas in an insurance company's operations in which an actuary may become involved with the marketing function of an insurance company as it relates to pricing, market research, and marketing philosophy. The candidate should be well versed in the responsibilities of the marketing function as well as the basic differences among different marketing systems for insurance products.

The settlement of claims determines losses which are the key component for insurance ratemaking and reserving. The actuary should know how claims are settled, relevant policy provisions and how loss reserves are established.

✓ Webb, B. L., Launie, J. J., Rokes, W. P. and Baglini, N. A. Insurance Company Operations. (Third Edition). 1984. American Institute for Property and Liability Underwriters. Vol. I. Chapters 1-6. Vol. II. pp.225-238, 243-264, and 271-282.

PART 6

Prior to commencing study for this Part, the candidate should read the "Recommendations for Study" section, pages 11 to 14, for study suggestions and guidance in obtaining the study kit, out-of-print readings, past examinations, and other information important to sitting for this examination.

Note: *Sharing the Risk* by Marks and Craigie contains a basic introduction to insurance. Although this reference is not part of the required readings for Part 6, the candidate may find it useful to review this material as background for this examination. This reading is available from the Insurance Information Institute at a cost of \$3.95.

References are listed in the suggested order for study. The "Study Kit on Rate-making Developments", listed for both Parts (a) and (b), should be studied in conjunction with several of the individual readings included in the Syllabus. For example, the Fire and Extended Coverage ratemaking sections should be read along with the Hurley paper, and the section on statistical plans should be studied before reading the individual plans.

(a) PRINCIPLES OF RATEMAKING

Section (a) contains readings which describe ratemaking concepts in broad, general principles as well as in specific detail for many lines of insurance. Certain general

subjects of particular importance, such as credibility theory, classification and individual risk ratemaking, trend and loss development factors, and liability increased limits ratemaking are addressed in separate papers.

A candidate for this examination should have a thorough understanding of the general, basic principles of ratemaking such that he or she can analyze data given, select an appropriate ratemaking technique and develop a solution to a numerical problem. In addition, the candidate should be familiar with the ratemaking techniques presented in the readings, being able to compare and discuss why certain procedures are applicable to individual lines of insurance, as well as to work numerical problems.

The candidate should also be prepared to discuss specialized concepts in ratemaking, such as trend and loss development, and consider their relationship to changes in the economic environment.

The candidate is not responsible for current, specific developments in ratemaking procedures. However, a study kit is provided which contains portions of recent rate filings along with pertinent explanatory memoranda. This information is provided so the candidate will be aware of certain current techniques not covered in the various readings. The candidate will be responsible for an understanding of the types of techniques, their application, and how they relate to changes in the economic and social environment.

The following list of topics is typical of those a candidate should be prepared to discuss:

1. The selection and evaluation of ratemaking technique corresponding to the characteristics of a given line of insurance.
 - a. pure premium versus loss ratio,
 - b. calendar year versus accident year versus policy year,
 - c. credibility, and
 - d. territorial and classification relativities.
2. Methods for trending and projecting losses and premiums (when appropriate).
 - a. internal versus external indices,
 - b. relation to loss development,
 - c. claim cost projection versus current cost index approach, and
 - d. impact of deductibles, coinsurance and insurance to value programs.
3. The candidate should also be prepared to discuss and apply ratemaking principles to problems which may not have generally recognized solutions.

✓ Webb, B. L., Launie, J. J., Rokes, W. P., and Baglini, N. A. Insurance Company Operations. (Third Edition). 1984. American Institute for Property and Liability Underwriters. Vol. II. Chapters 9 and 10.

✓ Kulp, C. A. and Hall, J. W. Casualty Insurance. 1968. Chapter 22.

Dorweiler, P. "Notes on Exposures and Premium Bases." *PCAS XVI*, 1929. p. 319 or *PCAS LVIII*, 1971. p. 59.

Miller, D. L. and Davis, G. E. "A Refined Model for Premium Adjustment." *PCAS LXIII*, 1976. p. 117.

Longley-Cook, L. H. An Introduction to Credibility Theory. 1962. (Available from CAS office at cost of \$3.00)

Kallop, R. "A Current Look at Workers' Compensation Ratemaking." *PCAS LXII*, 1975. p. 62.

Harwayne, F. "Use of National Experience Indications in Workers' Compensation Classification Ratemaking." *PCAS LXIV*, 1977. p. 74. (Appendix excluded).

†Fratello, B. "The Workmen's Compensation Injury Table and Standard Wage Distribution Table—Their Development and Use in Workmen's Compensation Ratemaking." *PCAS XLII*, 1955. pp. 171-202 (only).

Stern, P. K. "Ratemaking Procedures for Automobile Liability Insurance." *PCAS LII*, 1965. p. 139.

Miller, M. J. "Private Passenger Automobile Insurance Ratemaking—A Calendar Year Approach." *PCAS LXVI*, 1979. p. 1.

Lange, J. T. "General Liability Insurance Ratemaking." *PCAS LIII*, 1966. p. 26.

McManus, M. F. "General Liability Ratemaking: An Update." *PCAS LXVII*, 1980. p. 144.

Newman, S. H. "Burglary Insurance Ratemaking." *PCAS LIII*, 1966. p. 312.

Brannigan, J. F. "Current Ratemaking Procedures in Boiler and Machinery Insurance." *PCAS LIII*, 1966. p. 248.

✓ Backman, J. Surety Rate Making. 1948. Chapters 8, 12, 13.

Hurley, R. L. "Commercial Fire Insurance Ratemaking Procedures." *PCAS LX*, 1973. p. 208.

Walters, M. A. "Homeowners Insurance Ratemaking." *PCAS LXI*, 1974. p. 15.

Cook, C. F. "Trend and Loss Development Factors." *PCAS LVIII*, 1970. p. 1.

✓ Head, G. L. Insurance to Value. 1971. Chapters 1, 2, 6-8, and Appendices 1-4.

Lange, J. T. "The Interpretation of Liability Increased Limits Statistics." *PCAS LVI*, 1969. p. 163.

✓ Aiff, G. N. "Liability Experience Rating: Concepts and Structure" CPCU Journal, March 1979, Society of Chartered Property and Liability Underwriters. Volume 32, No. 1. p. 44.

✓ MacIntyre, D. M. Voluntary Health Insurance and Rate Making. 1962. Chapter 3.

✓ Eilers, R. D. and Crowe, R. M., Eds. Group Insurance Handbook. 1965. Part IV, Chapter 22.

†1986 Study Kit on Ratemaking Developments. (Available from the CAS office at a cost of \$25.00. An update of the 1985 Kit is available for \$7.00)

(b) DATA FOR RATEMAKING

Section (b) includes readings which cover the planning and use of internal statistical material, the compilation and presentation of insurance statistics for statistical and ratemaking purposes, and the sources and uses of external statistics, particularly as they may be required in insurance administration and ratemaking.

The candidate should be familiar with the data captured in the individual statistical plans, being able to compare the different plans, noting limitations and possible areas of improvement. The relationship to the various ratemaking techniques should be noted.

✓ Kimball, S. L. and Denenberg, H. S., Eds. *Insurance, Government and Social Policy*. 1969. Chapter 13. (Not including Appendix.)

Masterson, N. E. "Economic Factors in Liability and Property Insurance Claim Costs, 1935-1967." *PCAS LV*, 1968. p. 61.

Insurance Services Office. *Automobile Statistical Plan*.

Insurance Services Office. *Commercial Statistical Plan*.

Insurance Services Office. *Personal Lines Statistical Plan for Homeowners Policies, Mobilehomes Policies, Comprehensive Dwelling Policies, Dwelling Policies*.

National Council on Compensation Insurance. *Workmen's Compensation Unit Statistical Plan Manual*. October 1984. Parts I—VII and XI.

NOTE: The statistical plans listed above should not be ordered directly from ISO or NCCI. Instead, if a candidate needs a copy of the plans, an excerpt of each plan is available from the CAS. Each excerpt includes the pages referenced in the study note on statistical plans included in the study kit.

Study Kit on Ratemaking Developments. (This is the same study kit as required for Part (a)).

PART 7

Prior to commencing study for this Part, the candidate should read the "Recommendations for Study" section, pages 11 to 14, for study suggestions and guidance in obtaining study notes, out-of-print readings, past examinations, and other information important to sitting for this examination.

Section (a) deals with the analytical techniques which an actuary may employ to develop premium, loss and expense reserves. Section (b) of this examination deals with the form, content and interpretation of the two major reports an insurance company makes to regulatory authorities and with sources of comparative data. The candidate should be familiar with current developments in the above areas.

(a) PREMIUM, LOSS AND EXPENSE RESERVES

An actuary may be expected to design and test reserving methods, and complete Schedules O and P of the Annual Statement. The candidate should be prepared to discuss such topics as:

1. The selection and evaluation of a loss reserving method appropriate to a given line of insurance:
 - a. For known claims
 - b. For IBNR claims
 - c. For all incurred claims
2. Testing of adequacy of previous loss and loss expense reserve levels.
3. Evaluating the adequacy of current loss and loss expense reserve levels.
4. The identification of, and correction for, effects on loss reserves stemming from:
 - a. Changes in the loss climate
 - b. Changes in a company's handling of claims
 - c. Data Problems
5. Special reserving problems in a line arising from:
 - a. Catastrophe losses
 - b. Reopened claims
 - c. Policies on a claims-made rather than occurrence basis
 - d. Fidelity and Surety IBNR
 - e. Credit insurance
6. The unearned premium reserve:
 - a. Improving its accuracy
 - b. The reserve for retrospective returns
 - c. Policies on a claims-made basis
 - d. Deposit premium policies
7. Allocated loss expense reserves.
8. Unallocated loss expense reserves.
9. Statutory Annual Statement reserves.

The candidate should be prepared to compare and evaluate the procedures discussed and the arguments advanced in the readings. The answers provided by the candidate will be graded based on their applicability to the specific problem presented and the professional competence evidenced by the answer. While the readings for this part provide the basic factual information necessary, practical experience has often proven helpful in successfully completing the examination.

Readings

1986 Study Kit of Current Articles (same as Part 7b and same as 1985). Available from the CAS office at a cost of \$3.00.

Those pages and schedules of the Association form of the 1985 Annual Statement Blank for Fire and Casualty Companies which relate to reserves.

†Strain, R. W. Property-Liability Insurance Accounting. (Third Edition.) 1984. Chapter 5.

†Salzmann, R.E. Estimated Liabilities for Losses and Loss Adjustment Expenses. 1984. Chapters 1-8 and 11.

Committee on Loss Reserves. "Statement of Principles Regarding Property and Casualty Loss and Loss Adjustment Expense Liabilities." *PCAS LXV*, 1978. p. 74.

Skurnick, D. "A Survey of Loss Reserving Methods". *PCAS LX*, 1973. p. 16.

Fisher, W. H. and Lange, J. T. "Loss Reserve Testing: A Report Year Approach", *PCAS LX*, 1973. p. 189.

Bornhuetter, R. L. and Ferguson, R. E. "The Actuary and IBNR". *PCAS LIX*, 1972. p. 181.

Berry, C. H. "A Method For Setting Retro Reserves." *PCAS LXVII*, 1980. p. 226.

Balcarek, R. J. "Reserves for Reopened Claims on Workmen's Compensation". *PCAS XLVIII*, 1961. p. 1.

Resony, A. V. "Allocated Loss Expense Reserves". *PCAS LIX*, 1972. p. 141.

Kittel, J. "Unallocated Loss Adjustment Expense Reserves in an Inflationary Economic Environment." *Inflation Implications For Property-Casualty Insurance*, 1981. Casualty Actuarial Society Discussion Paper Program. p. 311. (Available from the CAS office at a cost of \$15.00.)

Fisher, W. H. and Lester, E. P. "Loss Reserve Testing in a Changing Environment". *PCAS LXII*, 1975. p. 154.

McClenahan, C. L. "A Mathematical Model for Loss Reserve Analysis". *PCAS LXII*, 1975. p. 134. (The candidate will not be held responsible for notation or the development of the formulas in this paper.)

Berquist, J. R. and Sherman, R. E. "Loss Reserve Adequacy Testing: A Comprehensive, Systematic Approach." *PCAS LXIV*, 1977. p. 123.

Khury, C. K. "Loss Reserves: Performance Standards." *PCAS LXVII*, 1980. p. 1. (The candidate will not be responsible for notation or development of the formulas in this paper.)

(b) INSURANCE ACCOUNTING, EXPENSE ANALYSIS, AND PUBLISHED FINANCIAL INFORMATION

The candidate should obtain a general knowledge of insurance accounting, including its terminology and practice. A suggested basic accounting reference for candidates is the American Institute for Property and Liability Underwriters' CPCU 8 text, *Introduction to Accounting*, by A. Thompson Montgomery. A suggested basic overview of insurance accounting is *Basic Concepts of Accounting and Taxation of Property/Casualty Companies*, a monograph by the Insurance Information Institute.

The candidate should have detailed familiarity with the contents, purpose, and recent changes in the Annual Statement Blank and the Insurance Expense Exhibit. This includes a knowledge of the methods of preparation and interrelationships of the various exhibits, schedules, and parts comprising these reports. Instructions for preparation of the Annual Statements are available from the NAIC. Examination questions regarding preparation of the Annual Statement will not require the candidate to purchase the instructions. A suggested reference for a summary of recent changes to the Annual Statement is *Changes to the Annual Statement for 1982, 1983, 1984 and 1985, Fire & Casualty*, by Albert McKinney (Insurance Systems Publications). The candidate should understand the details of and reasons for the differences between the accounting methods employed under statutory and GAAP accounting. The candidate should also understand the differences between the statistics included in these reports and those used for ratemaking and the various types of experience analysis. The candidate should be able to interpret and evaluate data from the reports, identify potential distortions in the data, and suggest possible means of adjusting for any distortions.

Readings

✓ National Association of Insurance Commissioners. *Proceedings*. Blanks Committee (A1) Reports for 1981 and the Financial Condition (EX4) Subcommittee Blanks Task Force for 1982 through Volume I 1986, as applicable to the Fire and Casualty Blank.

(1) *Insurance Accounting*

1986 Study Kit of Current Articles (same as Part 7a and same as 1985 Kit). Available from CAS office at a cost of \$3.00.

* Association Form of 1985 Annual Statement Blank for Fire and Casualty Companies (both individual and consolidated basis).

✓ Strain, R. W. *Property-Liability Insurance Accounting*. 1984. Chapters 1, 2, 3, 6, 7, 8, 10, 11, 12, 14, 15, and Appendices.

Committee on Annual Statement. "Report on the Annual Statement." *PCAS LII*, 1965. p. 244.

✓ American Institute of Certified Public Accountants. *Audits of Fire and Casualty Insurance Companies*. Chapter 9.

Balcarek, R. J. "Effect of Loss Reserve Margins in Calendar Year Results." *PCAS LIII*, 1966. p. 1.

Otteson, P. M. "Some Observations Concerning Fire and Casualty Insurance Company Financial Statements." *PCAS LII*, 1965. p. 215.

Pruitt, D. M. "Uniform Accounting—A Study of Regulation." *PCAS XXXVI*, 1949. p. 22.

* Contact publisher.

Insurance Accounting and Statistical Association. *Proceedings*.

<u>Year</u>	<u>Page</u>	<u>Article</u>
1965	269	Interpretation and Analysis of Insurance Financial Statements.
1967	695	Analysis of Financial Conditions. (Four Articles).
1969	630	Thoughts About Annual Statement Reporting.
1970	687	Managerial Versus Statutory Accounting.

(2) *Expense Analysis*

* 1985 Insurance Expense Exhibit.

✓ Strain, R. W. *Property-Liability Insurance Accounting*. 1984. Chapter 9.

✓ New York State Regulations. Title 11, Parts 105 through 109 (Regulation 30). (Available from CAS Library.)

✓ Insurance, Accounting and Statistical Association. *Proceedings*.

<u>Year</u>	<u>Page</u>	<u>Article</u>
1963	273	Review of Uniform Accounting Instructions and Methods Used by Country Mutual in Allocating Expenses.
1971	475	Allocation of Investment Income to Underwriting.
1971	614	Investment Income Allocation.
1979	290	Uniform Classification of Expenses for Property and Liability Insurance Companies

Morison, G. D. "The 1965 Study of Expenses by Size of Risk." *PCAS LIII*, 1966. p. 61.

(3) *Published Financial Information*

The candidate should be familiar with the sources of published insurance statistics in order to know where to obtain such information when the need arises. The following annual publications constitute a representative list of such sources:

* Best, A.M., Co., Inc.

Best's Insurance Reports—Property/Casualty

Best's Reproductions of Convention Statements—Property/Casualty

Best's Aggregates and Averages—Property/Casualty

Best's Executive Data Service

Best's Key Rating Guide—Property/Casualty

* The National Underwriter

Argus F.C.&S. Chart

Argus Chart of Health Insurance

* New York Insurance Department. *Loss and Expense Ratios* (compiled from Insurance Expense Exhibits).

* New York Insurance Department. *Statistical Tables from Annual Statements*.

* Contact publishers

FELLOWSHIP EXAMINATIONS

PART 8

Prior to commencing study for this Part, the candidate should read the "Recommendations for Study" section, pages 11 to 14, for study suggestions and guidance in obtaining study notes, out-of-print readings, past examinations, and other information important to sitting for this examination.

(a) INSURANCE LAW, SUPERVISION AND REGULATION

Insurance Supervision and Regulation are subjects which are not strictly actuarial in nature, but which affect many areas of the actuary's work. The candidate should understand the role of the insurance business as a supplier of an essential service. As a result of the essential and highly technical nature of insurance, a system of regulatory controls has been established to require the industry to demonstrate that it is providing fair and reliable service.

Since no prior legal knowledge is assumed, the first section of readings includes several general texts on business and tort law. This material should provide background and a basic understanding of contract and tort law.

Each state's Insurance Law provides the basis for insurance regulation. The *New York Insurance Law* is included as a typical law which has evolved over time. In both the background material and in the law itself, the candidate should concentrate on those concepts of law which relate to the insurance contract, to the conduct of the business of insurance, and to the way insurance is marketed.

The candidate should be familiar with the major changes in rate regulation and the various approaches currently in use. The candidate should consider how well each style of rate regulation meets the basic objectives of regulation: insurer solvency, availability of insurance, and fair treatment of policyholders and claimants.

Judicial decisions interpreting the law are also an important component of insurance regulation. Several readings summarize significant cases which served to develop legal precedents.

In recent years, several reports have been issued examining the role of the states in insurance regulation. Excerpts from these reports are included on the syllabus so that the candidate can understand the unique nature of a state regulatory system, insurance's antitrust immunity and proposals for change in this immunity.

The candidate is expected to be able to discuss current developments relating to the topics of insurance law, supervision, and regulation.

(1) *Background Law and Insurance*

Note: Chapters 23 and 24 of Samuelson and Nordhaus's economics text contain a discussion of antitrust law, imperfect competition and regulation. Although this ref-

erence is not part of the required readings for Part 8, the candidate may find it useful to review the material as background for this examination.

✓ Barnes, A. J. *Self Review in Business Law*. 1979. Chapters 11 and 25. (Same as 1978)

✓ Lorimer, J. J., Perlet, H. F., Kempin, F. G., and Hodosh, F. R. *The Legal Environment of Insurance*. (Second Edition). 1981. American Institute for Property & Liability Underwriters. Vol. II. Chapters 11 and 12.

✓ †Keeton, R. "The Impact on Insurance of Trends in Tort Law" in *Issues in Insurance*. (Third Edition). 1984. Vol. I. American Institute for Property & Liability Underwriters.

✓ Kimball, S. L. and Denenberg, H. S., Eds. *Insurance, Government, and Social Policy*. 1969. Ch. 1-4, and 8.

✓ Anderson, D. R. "Limits on Liability: The Price-Anderson Act Versus Other Laws." *The Journal of Risk and Insurance*. Vol. XLV, No. 4. 1978. pp. 651-674.

✓ †New York (State) Laws, Statutes, etc. *New York Insurance Law*. Articles 1-3, 23, 24, 26, 31 and 34.

The candidate is responsible only for the sections of the law as stated. If studying from publications such as the Consolidated Laws Service, which cite case histories as well as the law itself, the candidate is not responsible for the case histories although they may be helpful in gaining an understanding of the law. Candidates will not be tested on those sections of the New York Laws dealing exclusively with life insurance and/or annuities.

(2) *Supervision and Regulation*

✓ Mertz, A. C. *The First Twenty Years*.

✓ Mintel, J. *Insurance Rate Litigation*. 1983. Chapters 1, 5, 8, 10, 11, 13, and 14. (Candidates will not be tested on details of cases mentioned only briefly, but will be responsible for knowledge of cases treated in some depth).

✓ Kimball, S. L. and Denenberg, H. S. Eds. *Insurance, Government and Social Policy*. 1969. Chapters 9-11.

✓ Bureau of Insurance, Richmond, Virginia. *Competition in the Property and Casualty Insurance Industry*. January, 1978. (Available from the CAS library).

Excerpt from the *Report of the National Commission for the Review of Antitrust Laws and Procedures*.

Report of Economic Advisory Panel—"Competition and Regulation in the Property/Casualty Insurance Industry." (Available from the CAS Office at a cost of \$3.00.)

✓ "Issues and Needed Improvements in State Regulation of the Insurance Business" — Report to the Congress of the United States by the Comptroller General, October

1979—Ch. 6—"Regulation of Automobile Risk Classification." pp. 102-142. (Available from U.S. General Accounting Office)

✓ *The Insurance Industry, Part III*. "Government Presence in the Insurance Industry"—The Select Committee on Company Law—Chapters 9-11 (Available from Insurer's Advisory Org., Toronto, Canada at a cost of \$5.00.)

✓ Williams, C. A. "Regulating Property and Liability Insurance Rates Through Excess Profits Statutes," *Journal of Risk and Insurance*, September 1983. pp. 445-471.

"NAIC Financial Condition Examiners' Handbook—Introduction" pp. 9-39 (Available only from the CAS office at a cost of \$3.00)

Post-Assessment Property and Liability Insurance Guaranty Fund—NAIC Model Act—(available from CAS office at a cost of \$3.00).

✓ *National Association of Insurance Commissioners, Proceedings, Volume II, 1980*. "Report of the Advisory Committee on Competitive Rating to the National Association of Insurance Commissioners." Chapters III-VI and Comments (candidates will not be responsible for the language of the model rating law itself nor the alternative model laws submitted in the report).

(b) STATUTORY INSURANCE

This section of this examination part involves a study of insurance coverages mandated by statute or required by regulation. In reviewing the recommended readings the candidate should be aware of the modifications of the tort law system with the introduction of various "First Party" compensation systems. In addition the candidate should be aware of the relationship of Financial Responsibility laws and various mechanisms for involuntary markets; e.g., assigned risk plans.

The workers' compensation and employer's liability systems are briefly introduced. The large variety of individually tailored state laws in workers' compensation makes this area particularly difficult to master, but the candidate should understand the basic concepts and structure common to the diverse state statutes.

Finally, social insurance plans are presented. The candidate is expected to be familiar with the basic principles and concepts underlying the Social Security system in the United States and with the general actuarial principles involved in the valuation of the system. One is not expected to have detailed knowledge of the current level of benefits or the formulas used to calculate such benefits.

Disability insurance is also treated as social insurance and, therefore, should be approached by the candidate in a manner similar to the Social Security programs.

Again, the candidate is responsible for knowledge of current developments relating to statutory insurance.

(1) *Statutory Automobile Insurance*

✓ Department of Transportation. *Motor Vehicle Crash Losses and Their Compensation in the United States*. March 1971.

- * American Insurance Association *Summary of Selected State Laws and Regulations Relating to Automobile Insurance*. 1985 Edition.
 - a. No-Fault Benefits (pp. 1-11)
 - b. Add-On Benefits (pp. 12-15)
 - c. Compulsory Liability, Financial Responsibility, and Uninsured Motorists Laws (pp. 43-61)
 - d. Residual Market Plans (p. 65)

While the candidate is not expected to memorize the detail of this reading, he or she should be familiar with the contents thereof as well as able to recognize major variations in the laws between groups of states.

- ✓ Department of Transportation, *A Study of Assigned Risk Plans*. August, 1970. Chapters 1-3.
- ✓ Wood, G. L., Lilly, C. C., Malecki, D. S., and Rosenbloom, J. S. *Personal Risk Management and Insurance* (Third Edition). 1984. American Institute for Property and Liability Underwriters Vol. I, "Shared Markets for Automobile Insurance", pp. 145-152.
 - (2) *Workers' Compensation*
- ✓ Myers, R. J. *Social Security*. 1981. Chapter 14 (including appendices).
- ✓ American Insurance Association, "*Workers' Compensation Insurance Rate Regulation Study*," 1982. Summary, Part I (A, B, D, F, G), Part II (A, B, C, D), Part III (A, B)
- * Chamber of Commerce of the United States *Analysis of Workers' Compensation Laws*. 1985. While the candidate is not expected to memorize the detail of this reading, he or she should be familiar with the contents thereof and the coverages described.
- ✓ †NAIC Study Committee Report "Regulating Workers' Compensation Groups" in *Issues in Insurance*. (Third Edition). 1984. Vol. II. American Institute for Property and Liability Underwriters. Parts I-III and VI-IX.
 - (3) *Social Insurance and Allied Programs*
- ✓ Robertson, A. Haeworth *The Coming Revolution in Social Security*. 1981. Ch. 1-16, 20, and 24.
- ✓ †Myers, R. J. *Social Security*. 1981. Chapters 5, 13 and 15 (Including appendix to Chapter 13)
- ✓ New York (State) Department of Labor, *Studies in Disability Insurance*. (*Special Bulletin #224*) Out of print. (Available from CAS Library.)
- ✓ Wood, G. L., Lilly, C. C., Malecki, D. S., and Rosenbloom, J. S. *Personal Risk Management and Insurance*. (Third Edition). 1984. American Institute for Property and Liability Underwriters. Vol. I. "Residual Markets for Residential Property Insurance" pp. 217-232. (Candidate need not memorize details of Crime or Flood Policies).

* Contact publisher.

- ✓ †Greene, M. "Government Insurers" in *Issues in Insurance*. (Third Edition). 1984. Vol. I. American Institute for Property and Liability Underwriters.

Schwartz, M. J. "New York Statutory Disability Benefits Law, Coverage, Rates and Rating Plans." *PCAS XXXVII*, 1950. p. 57.

(c) NAIC

The National Association of Insurance Commissioners is the central body of all state regulation. The NAIC meets regularly to consider current issues of concern. Typically, a task force and an advisory committee are established to make recommendations to a full committee and to the NAIC itself. These recommendations often take the form of a model law to be enacted by each affected state. The following issues, in particular, should be reviewed by the candidate:

- a) Investment Income in Ratemaking
- b) Environmental Liability
- c) Workers' Compensation Issues (Asbestosis and Unlimited Payroll)

The 1983-1985 NAIC *Proceedings* should be researched for material on these issues. It is suggested that the individual become familiar with the introductory portion of the *Proceedings* book in order to understand the structure of the books and of the NAIC itself, find the required information and trace its development through the various committees to ultimate resolution.

PART 9

Prior to commencing study for this Part, the candidate should read the "Recommendations for Study" section, pages 11 to 14, for study suggestions and guidance in obtaining study notes, out-of-print readings, past examinations, and other information important to sitting for this examination.

(a) ADVANCED RATEMAKING

Candidates for this part are expected to have acquired considerable technical knowledge and practical experience in insurance ratemaking. In addition, they should keep in touch with current developments and problems in ratemaking. The examination will assume a working knowledge of basic ratemaking and will deal with advanced problems such as those covered in the papers listed below. The examination will not necessarily be limited to the excerpts expressed in the listed papers. The ability to apply ratemaking knowledge and experience may be tested through questions dealing with problems for which there are no generally recognized solutions. To some degree, they will deal with the types of practical problems which a fully qualified actuary working in ratemaking should be able to solve.

All the papers in this section should be read for illustrations of basic principles and theories, as well as any insights into advanced ratemaking problems and their solutions. In none of the papers is the derivation of formulas or equations to be

stressed, but some applications of those techniques may be required. Some papers are included primarily for their historical significance or to illustrate unique solutions to a ratemaking problem.

The readings on credibility on Part 9 are duplicated to a limited extent on Part 4. The Syllabus Committee feels strongly that credibility is a subject that every actuary needs to study. Therefore, both Parts will include credibility for the immediate future. The emphasis, however, will be different. Part 4 students will be expected to relate to credibility mathematically while Part 9 students will be expected to understand the insurance implications as well as the mathematics.

1986 Study Kit on Advanced Ratemaking — Same as 1985 Kit. (Available from CAS office at a cost of \$3.00). The information contained in this kit is to be considered as background material only and will not be tested directly.

Bailey, R. A. "Insurance Rates with Minimum Bias." *PCAS L*, 1963. p. 4.

Lange, J. T. "Implications of Sampling Theory for Package Policy Ratemaking." *PCAS LIII*, 1966. p. 285.

Finger, R. J. "A Note on Basic Limits Trend Factors." *PCAS LXIII*, 1976. p. 106. Please note that one of the reviews appears in 1981.

Bickerstaff, D. R. "Automobile Collision Deductibles and Repair Cost Groups: The Lognormal Model." *PCAS LIX*, 1972. p. 68.

Walters, M. A. "Risk Classification Standards." *PCAS LXVIII*, 1981. p. 1.

* American Academy of Actuaries Committee on Risk Classification "Risk Classification Statement of Principles." June, 1980.

Dropkin, L. B. "Some Considerations on Automobile Rating Systems Utilizing Individual Driving Records." *PCAS XLVI*, 1959. p. 165.

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

Mayerson, A. L. "A Bayesian View of Credibility," *PCAS LI*, 1964. p. 85.

Mayerson, A. L., Jones, D. A., and Bowers, N. L.(Jr.) "On the Credibility of the Pure Premium." *PCAS LV*, 1968. p. 175.

Hewitt, C. C. "Credibility for Severity." *PCAS LVII*, 1970. p. 148.

Philbrick, S. W. "An Examination of Credibility Concepts." *PCAS LXVIII*, 1981. p. 195.

Wade, R. C. "Expense Analysis in Ratemaking and Pricing." *PCAS LX*, 1973. p. 1.

Marker, J. O. and Mohl, F. J. "Rating Claims-Made Insurance Policies." *Pricing Property and Casualty Insurance Products*, 1980. Casualty Actuarial Society Discussion Paper Program. p. 265. (Available from the CAS office at a cost of \$15.00).

(b) INDIVIDUAL RISK RATING

One of the most important functions performed by an actuary is the rating of individual risks. Prior to Part 9, most of the readings were addressed to group or classification risk rating. This part provides detail readings on individual experience risk rating so that the candidate will be prepared to design and manage an individual risk rating system.

Individual risk rating consists of two principal sections:

- 1) Prospective rating which is more commonly known as Experience rating.
- 2) Retrospective rating.

The readings range from those which discuss the theoretical foundation of individual risk rating to those which discuss the application of various plans.

The candidate will be expected to have a good working knowledge of credibility, loss limitation, and rate modification concepts as they apply to prospective and retrospective rating, and loss distribution, insurance charge and excess loss charge concepts as they apply to retrospective rating. The candidate can be expected to apply these concepts in a creative and problem solving manner.

The candidate is also expected to be knowledgeable in the application of individual risk rating plans currently in use (excluding individual state pages) and should anticipate answering questions in the manner of an insurance consultant for an insured. Finally, the candidate should keep abreast of current developments and problems as they apply to individual risk rating.

Candidates unfamiliar with the general principles underlying individual risk rating plans should review Chapter 22 of the Kulp and Hall text, or the section on Merit Rating Plans in Chapter 10 of *Insurance Company Operations*, Volume II, from the American Institute for Property and Liability Underwriters before studying the required readings for this part. The candidate may gain a better understanding of the application of prospective and retrospective rating plans from John R. Stafford's books, *Workers' Compensation Experience Rating and Retrospective Rating*, but will not be held responsible for their contents. It is realized that parts of some technical articles cited in the recommended reading for this part are not current. However, the candidate should study all articles for their explanation of theory.

(1) Experience Rating

Snader, R. H., "Fundamentals of Individual Risk Rating and Related Topics": Part I of Study Note (This study note is available from CAS office at a cost of \$3.00. Since it represents a compilation of several articles, it should be read in conjunction with the other readings of this section.)

The candidate should study the following rating plans and the forms used in the application thereof:

National Council on Compensation Insurance:

Experience Rating Plan (Available from the CAS office at a cost of \$3.00 per copy).

Insurance Services Office: *Experience and Schedule Rating Plans* applicable to:
General Liability (Available from the CAS office at a cost of \$3.00 per copy).

✓ Surety Association of America:
Experience Rating Plan — Financial Institutions.

Dorweiler, P. "A Survey of Risk Credibility in Experience Rating." *PCAS XXI*, 1934.
p. 1 or *PCAS LVIII*, 1971. p. 90.

Perryman, F. S. "Experience Rating Plan Credibilities." *PCAS XXIV*, 1937. p. 60 or
PCAS LVIII, 1971. p. 143. The candidate is not responsible for Perryman's third
formula — designated (39) in the paper — and developments based on that formula.

Uhthoff, D. R. "The Compensation Experience Rating Plan — A Current Review." *PCAS XLVI*, 1959. p. 285.

(2) Retrospective Rating

Snader, R. H., "Fundamentals of Individual Risk Rating and Related Topics". Part
II of Study Note (see comments in Section (1)).

The candidate should study the following retrospective rating plans and the forms
used in the application thereof:

National Council on Compensation Insurance: (Available from the CAS office) **87.00**
Retrospective Rating Plan Manual for Workers Compensation and Employers Li-
ability Insurance

Insurance Services Office: (Available from the CAS office) **83.00**
Retrospective Rating Plan for Automobile, General Liability, Glass and Theft

Dorweiler, P. "On Graduating Excess Pure Premium Ratios." *PCAS XXVIII*, 1941.
p. 132.

Carlson, T. O. "An Actuarial Analysis of Retrospective Rating." *PCAS XXVIII*, 1941.
p. 283.

Meyers, G. "An Analysis of Retrospective Rating." *PCAS LXVII*, 1980. p. 110.

Valerius, N. M. "Risk Distributions Underlying Insurance Charges in the Retro-
spective Rating Plan." *PCAS XXIX*, 1942. p. 96.

Harwayne, F. "Accident Limitations for Retrospective Rating." *PCAS LXIII*, 1976.
p. 1.

Skurnick, D. "The California Table L." *PCAS LXI*, 1974. p. 117.

Hewitt, C. C. "Loss Ratio Distribution — A Model." *PCAS LIV*, 1967. p. 70.

(3) Miscellaneous Rating

The candidate should study the following rating plans and the forms used in the
application thereof:

Insurance Services Office:
Composite Rating Plan (Automobile, General Liability, Glass and Theft.)
(Available from CAS office at a cost of \$3.00 per copy).

Insurance Services Office:
Commercial Fire Rating Schedule. Copyright 1975. (Summary available from CAS
office at a cost of \$3.00 per copy.)

PART 10

Prior to commencing study for this Part, the candidate should read the "Rec-
ommendations for Study" section, pages 11 to 14, for study suggestions and guidance
in obtaining study notes, out-of-print readings, past examinations, and other infor-
mation important to sitting for this examination.

Part 10 represents the final step in the examination process and is designed to test
both the breadth and depth of the candidate's understanding of the insurance process.
The candidate is expected to have acquired considerable technical knowledge and
practical experience during preparation for the previous examinations.

The required reading material for this examination is divided into four sections,
each of which builds on information covered in previous examinations. Questions may
be asked which require use of material mastered in preparation for these previous
examinations.

(a) FINANCIAL OPERATIONS OF INSURANCE COMPANIES

This section explores the various relationships that exist between underwriting
results, investment income, and taxes that arise out of the underwriting process and
total operating income. The candidate is also expected to develop an appreciation of
the varying standards employed in measuring overall operations from the perspective
of the stockholder, the manager, the regulator and the policyholder. The candidate
should be prepared to compare and evaluate the procedures discussed and the argu-
ments advanced in the readings.

1986 Study Kit of Current Articles (Same as Part 10b Kit and same as 1985 Kit).
Available from the CAS office at a cost of \$7.00 per copy.

Herron, S. D., Jr., "Insurance Company Investments." *PCAS LII*, 1965. p. 238.

✓ National Association of Insurance Commissioners. *Measurement of Profitability and*
Treatment of Investment Income in Property and Liability Insurance. June, 1970.
1970 Proceedings of the NAIC, Vol. IIA. pp. 742-780, 809-817, and 845-893.

✓ Kimball, S. L. and Denenberg, H. S., Eds. *Insurance, Government and Social Policy.*
1969. Chapter 6.

✓ Strain, R. W., *Property—Liability Insurance Accounting.* 1984. Chapter 13.

Beckman, R. W., "Federal Income Taxes." *PCAS LVIII*, 1971. p. 1.

Ferrari, J. R., "The Relationship of Underwriting, Investments, Leverage, and Exposure to Total Return on Owners' Equity." *PCAS LV*, 1968. p. 295.

Butsic, R. P., "The Effect of Inflation on Losses and Premiums for Property-Liability Insurers." *Inflation Implications For Property-Casualty Insurance*, 1981 Casualty Actuarial Society Discussion Paper Program, p. 58. *\$15.00*

Ferrari, J. R., "A Theoretical Portfolio Selection Approach for Insuring Property and Liability Lines." *PCAS LIV*, 1967. p. 33.

✓ Brubaker, R. E., "A Constrained Profit Maximization Model for a Multi-Line Property/Liability Company." *Total Return Due a Property/Casualty Insurance Company*, 1979 Casualty Actuarial Society Call Paper Program, p. 28 (Candidate is not responsible for the detailed iterations in the exhibits.) *(One copy in library.)*

Bailey, R. A., "Underwriting Profit from Investments." *PCAS LIV*, 1967. p. 1.

Sturgis, R. W., "Actuarial Valuation of Property/Casualty Insurance Companies." *PCAS LXVIII*, 1981. p. 146.

✓ Mullins, D. W., Jr., "Does the Capital Asset Pricing Model Work?" *Harvard Business Review*, Vol. 60, No. 1, 1982. p. 105.

(b) REINSURANCE AND EXCESS RATING

This section deals with various techniques for risk sharing between an insurer and a reinsurer as well as between an insured and an insurer.

The candidate should have a general knowledge and understanding of:

1. The various types of reinsurance, the advantages and disadvantages of each type, the purpose of each type, and the effects of reinsurance transactions on the company operating results and other financial information, as well as methods employed to analyze costs.
2. Deductible and excess coverages, and the problems inherent in pricing these coverages for various lines.

1986 Study Kit of Current Article (Same as Part 10a Kit and same as 1985 Kit).
Available from the CAS office at a cost of \$7.00 per copy.

✓ Webb, B. L., Launie, J. J., Rokes, W. P. and Baglini, N. A., *Insurance Company Operations*. (Third Edition). 1984. American Institute for Property and Liability Underwriters, Vol. I. Chapters 7 and 8.

✓ Munich Reinsurance Company, *Reinsurance and Reassurance*, Vol. I-IV.

Ferguson, R. E., "Nonproportional Reinsurance and The Index Clause." *PCAS LXI*, 1974. p. 141.

✓ Stone, J. M., "A Theory of Capacity and the Insurance of Catastrophe Risks." *The Journal of Risk and Insurance*. Part I in Vol. XL No. 2 (June, 1973) p. 231 and Part II in Vol. XL No. 3 (September, 1973) p. 339.

Snader, R. H., "Fundamentals of Individual Risk Rating and Related Topics". Part III of Study Note. (Available from the CAS office at a cost of \$3.00.)

Miccolis, R. S., "On the Theory of Increased Limits and Excess of Loss Pricing." *PCAS LXIV*, 1977. p. 27.

Finger, R. J., "Estimating Pure Premiums by Layer." *PCAS LXIII*, 1976. p. 34.

Rosenberg, S. and Halpert, A., "Adjusting Size of Loss Distributions for Trend." *Inflation Implications For Property-Casualty Insurance*, 1981 Casualty Actuarial Society Discussion Paper Program, p. 458. (Available from the CAS office at a cost of \$15.00).

Ferguson, R. E., "Actuarial Note on Loss Rating." *PCAS LXV*, 1978. p. 50.

Patrik, G. S. and John, R. T., "Pricing Excess-of-Loss Casualty Working Cover Reinsurance Treaties." *Pricing Property and Casualty Insurance Products*, 1980 Casualty Actuarial Society Discussion Paper Program, p. 399. (The candidate is not responsible for reproducing the formulas in this paper.) (Available from the CAS office at a cost of \$15.00).

Livingston, R. P., "A Note on Evaluating Aggregate Retentions For Special Risks." *Pricing, Underwriting and Managing the Large Risk*, 1982 Casualty Actuarial Society Discussion Paper Program, p. 229. (Available from the CAS office at a cost of \$15.00).

(c) FORECASTING

An actuary may be expected to develop both short and long range forecasts, and to play a key role in the corporate planning process of an insurance company. This section is designed to familiarize the candidate with various techniques employed in forecasting and planning. It is intended to provide an understanding of the advantages and disadvantages of various forecasting methods, how to interpret statistical measures in evaluating various techniques, and the assumptions underlying each.

✓ †Wheelwright, S. C. and Makridakis, S., *Forecasting Methods for Management*. (Fourth Edition). 1985. Chapters 1-4, 6-9, 12 and 13.

Lommele, J. A. and Sturgis, R. W., "An Econometric Model of Workmen's Compensation." *PCAS LXI*, 1974. p. 170.

✓ McLagan, D. L., "A Non-Econometrician's Guide to Econometrics." *Business Economics*, Vol. VIII, No. 3, May, 1973. p. 38. (Available from CAS office at no charge).

(d) CURRENT EVENTS AND ISSUES

This section deals with industry topics of current interest with which the candidate should be familiar.

In preparing for this subject, the candidate is expected to be familiar with major issues reported in the general press and in trade journals. The candidate should be able to define the problem involved, and to discuss both sides of the issue.

The candidate's attention should be directed to the general trade press coverage of current events. In certain instances, however, more detailed knowledge may be required from specific related source documents in order to fully respond to a question.

INDEX TO READINGS

Readings are available through the library of the Casualty Actuarial Society. However, the following information is furnished for those who wish to purchase the references.

Part(s)

- 5 Alliance of American Insurers, 1501 Woodfield Road, Suite 400 W., Schaumburg, IL 60195-4980.
- 9 American Academy of Actuaries, 500 Park Blvd., Itasca, IL 60143.
- 7 American Institute of Certified Public Accounts. *Audits of Fire and Casualty Insurance Companies*. Chapter 9. American Institute of Certified Public Accountants, P. O. Box 1003, New York, NY 10108-1003.
- 5-10 American Institute for Property and Liability Underwriters. Providence and Sugartown Roads, Malvern, PA 19355. (215) 644-2100
- 8 American Insurance Association. *Summary of Selected State Laws and Regulations Relating to Automobile Insurance*. (1984 Edition). American Insurance Association, 85 John Street, New York, NY 10038. 669-0400
- 8 American Insurance Association, "Workers' Compensation Insurance Rate Regulation Study." A limited number of copies has been made available to C.A.S. students at a reduced price. Copies may be purchased in person at 85 John St., NYC (Fourth Floor) for \$5 -. By mail, the per-copy price is \$10, Written requests and checks payable to "American Insurance Assn." should be directed to: Publications Dept., American Ins. Assn., 85 John St., New York, NY 10038. (212) 669-0400
- 6 Backman, J. *Surety Rate-Making*. (1948). Surety Association of America, 100 Wood Ave., S. Iselin, NJ 08830.
- 8 Barnes, A. J. *Self Review in Business Law*. (1979). Richard D. Irwin, Inc., 1818 Ridge Road, Homewood, IL 60430.
- 7 Best, A. M., Company, Inc., Ambest Road, Oldwick, NJ 08858.
- 1 Bradley, Gerald L. *A Primer of Linear Algebra*. (1975). Prentice-Hall, Inc., Englewood Cliffs, NJ 07632.
- 3 Burden, R. L., Faires, J. D., and Reynolds, A. C. *Numerical Analysis*. (Third Edition). 1985. PWS Publishers, 20 Park Plaza, Boston, MA 02116.
- 8 Bureau of Insurance, Richmond, Virginia. *Competition in the Property and Casualty Insurance Industry*. January 1978. Bureau of Insurance, State Corporation Commission, Richmond, VA 23219.

Part(s)

- 4-10 Casualty Actuarial Society, One Penn Plaza, 250 West 34th Street, New York, NY 10119.
- 8 Chamber of Commerce of the United States, 1615 H. Street, N. W., Washington D.C. 20062.
- 2 De Groot, Morris H. *Probability and Statistics*. (1975). Addison-Wesley Publishing Co., Inc. Jacob Way, Reading, MA 01867.
- 8 Department of Transportation. *Motor Vehicle Crash Losses and Their Compensation in the United States*. March, 1971. GPO-1971-0-420-342, or *A Study of Assigned Risk Plans*. August, 1970. Superintendent of Documents, Government Printing Office, Washington, D.C. 20402.
- 6 Eilers, R. D. and Crowe, R. M., Eds. *Group Insurance Handbook*. (1965). Richard D. Irwin, Inc., 1818 Ridge Road, Homewood, IL 60430.
- 10 Harvard Business Review, Reprints, Soldiers Field, Boston, MA 02163.
- 6 Head, G. L. *Insurance to Value*. (1971). Richard D. Irwin, Inc., 1818 Ridge Road, Homewood, IL 60430.
- 3 Hillier, F. S. and Lieberman, G. J. *Operations Research*. (Third Edition). Holden-Day, 500 Sansome Street, San Francisco, CA 94111.
- 2 Hoel, P. G., Port, S. C., and Stone, C. J. *Introduction to Probability Theory and Introduction to Statistical Theory*. 1971 Text Edition. Houghton Mifflin Co., 2 Park Street, Boston, MA 02107 or 551 Fifth Avenue, New York, NY 10017.
- 2 Hogg, R. V. and Craig, A. T. *Introduction to Mathematical Statistics*. (Fourth Edition) 1978 Text Edition, Macmillan Publishing Company, Inc., 866 Third Avenue, New York, NY 10022.
- 4 Hogg, R. V. and Klugman, S. A., *Loss Distributions*. (1984). John Wiley ^{Eastern distributions?} Center and Sons, 1 Wiley Drive, Somerset, NJ 08873. (201) 469-4400
- 4,5 Hossack, I.B., Pollard, J.H., Zehnwrith, B. *Introductory Statistics with Applications in General Insurance*. 1983. Cambridge University Press, 510 North Avenue, New Rochelle NY 10801. (914) 235-0300
- 7 Insurance Accounting and Statistical Association, P. O. Box 8857, Durham, NC 27707.
- 5,6,7 Insurance Information Institute, 110 William St., New York, NY 10038.
- 5,6,9 Insurance Services Office, 160 Water Street, New York, NY 10038.
- 8 Insurers' Advisory Organization of Canada, 180 Dundas St. West, Toronto, Ontario, M5G 1Z9.

Part(s)

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