Exam 5

CASUALTY ACTUARIAL SOCIETY
AND THE
CANADIAN INSTITUTE OF ACTUARIES

Exam 5

Basic Techniques for Ratemaking and Estimating Claim Liabilities

October 26, 2015

4 HOURS

INSTRUCTIONS TO CANDIDATES

1. This 55.75 point examination consists of 25 problem and essay questions.

2. For the problem and essay questions, the number of points for each full question and part of a question is indicated at the beginning of the question or part. Answer these questions on the lined sheets provided in your Examination Envelope. Use dark pencil or ink. Do not use multiple colors or correction fluid/tape.

   - Write your Candidate ID number and the examination number, 5, at the top of each answer sheet. Do not use leading zeroes. Your name, or any other identifying mark, must not appear.
   - Do not answer more than one question on a single sheet of paper. Write only on the front lined side of the paper – **DO NOT WRITE ON THE BACK OF THE PAPER.** Be careful to give the number of the question you are answering on each sheet. If your response cannot be confined to one page, please use additional sheets of paper as necessary. Clearly mark the question number on each page of the response in addition to using a label such as "Page 1 of 2" on the first sheet of paper and then "Page 2 of 2" on the second sheet of paper.
   - The answer should be concise and confined to the question as posed. When a specific number of items is requested, do not offer more items than the number requested. For example, if three items are requested, only the first three responses will be graded.
   - In order to receive full credit or to maximize partial credit on mathematical and computational questions, you must clearly outline your approach in either verbal or mathematical form, showing calculations where necessary. Also, you must clearly specify any additional assumptions you have made to answer the question.

3. Do all problems until you reach the last page of the examination where "END OF EXAMINATION" is marked.

CONTINUE TO NEXT PAGE OF INSTRUCTIONS

4. Prior to the start of the exam you will have a **fifteen-minute reading period** in which you can silently read the questions and check the exam booklet for missing or defective pages. A chart indicating the point value for each question is attached to the back of the examination. Writing will NOT be permitted during this time and you will not be permitted to hold pens or pencils. You will also not be allowed to use calculators. The supervisor has additional exams for those candidates who have defective exam booklets.

   - Verify that you have received the reference materials:

     Insurance Services Office, Inc., Personal Automobile Manual (Effective 6-98), General Rules 1-6.

5. Your Examination Envelope is pre-labeled with your Candidate ID number, name, exam number and test center. Do not remove this label. Keep a record of your Candidate ID number for future inquiries regarding this exam.

6. Candidates must remain in the examination center until two hours after the start of the examination. The examination starts after the reading period is complete. You may leave the examination room to use the restroom with permission from the supervisor. To avoid excessive noise during the end of the examination, candidates may not leave the exam room during the last fifteen minutes of the examination.

7. At the end of the examination, place all answer sheets in the Examination Envelope. Please insert your answer sheets in your envelope in question number order. Insert a numbered page for each question, even if you have not attempted to answer that question. Nothing written in the examination booklet will be graded. Only the answer sheets will be graded. Also place any included reference materials in the Examination Envelope. BEFORE YOU TURN THE EXAMINATION ENVELOPE IN TO THE SUPERVISOR, BE SURE TO SIGN IT IN THE SPACE PROVIDED ABOVE THE CUT-OUT WINDOW.

8. If you have brought a self-addressed, stamped envelope, you may put the examination booklet and scrap paper inside and submit it separately to the supervisor. It will be mailed to you. Do not put the self-addressed stamped envelope inside the Examination Envelope. Interoffice mail is not acceptable.

   If you do not have a self-addressed, stamped envelope, please place the examination booklet in the Examination Envelope and seal the envelope. You may not take it with you. Do not put scrap paper in the Examination Envelope. The supervisor will collect your scrap paper.

   Candidates may obtain a copy of the examination from the CAS Web Site.

   All extra answer sheets, scrap paper, etc. must be returned to the supervisor for disposal.

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9. Candidates must not give or receive assistance of any kind during the examination. Any cheating, any attempt to cheat, assisting others to cheat, or participating therein, or other improper conduct will result in the Casualty Actuarial Society and the Canadian Institute of Actuaries disqualifying the candidate's paper, and such other disciplinary action as may be deemed appropriate within the guidelines of the CAS Policy on Examination Discipline.

10. The exam survey is available on the CAS Web Site in the "Admissions/Exams" section. Please submit your survey by November 14, 2015.

END OF INSTRUCTIONS

1. (2.75 points)

Given the following information:

Effective Date	Number of Autos Written on Effective Date
February 1, 2013	1,100
August 1, 2013	800
February 1, 2014	600
August 1, 2014	300

- All policies have six-month terms.
- The exposure base is earned car years.
- The premium per auto is $500 per six-month term for policies effective through August 31, 2014.
- A uniform rate change of -18% became effective September 1, 2014.

a. (0.75 point)

Calculate the written and earned exposures for calendar year 2014.

b. (2 points)

Calculate the earned premium at current rate level for calendar year 2014 using both the parallelogram method and extension of exposures method, and discuss which method is more appropriate for this situation.

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2. (1.5 points)

   a. (0.75 point)

      Based on two relevant criteria, propose and briefly justify an appropriate exposure base for a general liability policy for a restaurant.

   b. (0.75 point)

      Based on two relevant criteria, propose and briefly justify an appropriate exposure base for a hospital professional liability policy.

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3. (1.5 points)

A personal auto insurer has recently completed the acquisition of a smaller insurer in order to increase their market share in a state.

An actuary has calculated a rate level indication, using only the smaller insurer's historical data for that state.

a. (0.5 point)

Explain the general role of credibility in ratemaking.

b. (1 point)

Propose a complement of credibility for the analysis and evaluate it based on three desirable qualities.

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4. (2.25 points)

An actuary is calculating a rate change to be effective July 1, 2016. Given the following:

- Policies are written on a semi-annual basis.
- Rates are expected to be in effect for one year.
- The exposure base is non-inflationary.
- The annual frequency and severity exponential trend fits based on data for the 12 months ending each quarter evaluated through December 31, 2014 are as follows:

Number of Points	Frequency Exponential Fit	Severity Exponential Fit
20 point	-2.9%	3.4%
16 point	-3.2%	3.0%
12 point	-2.5%	2.8%
8 point	-0.5%	2.9%
6 point	3.0%	3.1%
4 point	2.8%	3.3%

Calculate a pure premium trend factor for accident year 2012, justifying the selected trends and methodology.

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5. (3 points)

An insurance company writes annual policies. The history of law and coverage changes affecting benefit levels is as follows:

Effective Date	Direct Impact of Benefit Change
February 15, 2014	+6.5%
October 1, 2014	+4.3%

a. (1.25 points)

Calculate the direct benefit change loss adjustment factor for fourth accident quarter 2014, assuming both changes only affect losses on policies written on or after the effective date of the change.

b. (1.25 points)

Calculate the direct benefit change loss adjustment factor for first policy quarter 2014, assuming both changes affect all claims that occur on or after the effective date of the change.

c. (0.5 point)

In doing a rate level calculation, the actuary for this insurance company has selected an annual loss trend based on unadjusted pure premium data from 2012 through 2014. Assess the appropriateness of this selection and suggest an adjustment, if necessary.

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6. (1 point)

Given the following information:

	Calendar Year 2014
Written premium	$560.00
Earned premium	$616.00
Commissions	$67.20
Taxes, licenses and fees	$19.60
General expenses	$73.92
LAE ratio (to loss)	8.2%
Combined ratio	100%

Calculate the 2014 operating expense ratio.

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7. (4.5 points)

Given the following ratemaking information for a catastrophe-prone homeowners book of business:

			Non-Catastrophe Data	
Calendar/ Accident Year	Earned Exposures (EE)	Amount of Insurance Years (AIY) ($000)	Indicated Ultimate Frequency Trended to 2014	Indicated Ultimate Loss & ALAE Severity ($) Trended to 2014
2008	914,600	230,400	4.57%	14,638
2009	928,300	240,800	4.16%	12,624
2010	942,200	251,600	4.39%	13,445
2011	956,300	262,900	4.12%	12,306
2012	970,600	274,700	3.44%	14,564
2013	985,200	287,100	3.11%	11,634
2014	1,000,000	300,000	3.32%	13,726

- All policies are annual.
- The new rates will be in effect for one year, beginning April 1, 2016.
- Projected average rate = $1,070.
- Annual frequency trend = 3%.
- Annual loss and ALAE severity trend = 4%.
- Annual AIY/EE ratio trend = 3%.
- 20-year average historical ratio of non-modeled catastrophe losses and ALAE to AIY = 0.08.
- Projected modeled average catastrophe loss and LAE = $68.36.
- Variable expense ratio = 18%.
- Fixed expense provision = $54.36.
- ULAE provision = 4% of loss and ALAE.
- Target underwriting profit provision = 6%.

a. (1.75 points)

Using a frequency-severity technique with trending, calculate the ultimate non-catastrophe loss and ALAE for accident years 2013 and 2014. Justify any selections.

b. (2.75 points)

Using the results from part a. above, calculate the indicated rate change using the pure premium method.

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8. (1 point)

A company has a combined ratio of 125% in the first year of writing policies.

Explain two reasons why the company could be profitable in the long run without increasing rates.

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9. (2.75 points)

Given the following information:

	Relativities
Territory A	0.60
Territory B	1.10
Smoke Detector	0.90
No Smoke Detector	1.00

	2014 Earned Exposures	
	Territory A	Territory B
Smoke Detector	750	600
No Smoke Detector	150	100

	Accident Year 2014 Incurred Loss and ALAE	
	Territory A	Territory B
Smoke Detector	$160,000	$260,000
No Smoke Detector	$40,000	$52,000

- Base rate = $550.
- All rates are effective January 1 of each year.
- Management has decided that the relativity of the highest-rated territory will not exceed 130% of the lowest-rated territory in any future rate level change.
- Assume data for 2014 is fully credible.

a. (2.25 points)

Considering management constraints, use the loss ratio method to calculate the territorial relativity changes for a revenue-neutral overall change.

b. (0.5 point)

Evaluate the impact that the relativity changes may have on this book of business in the short and long term.

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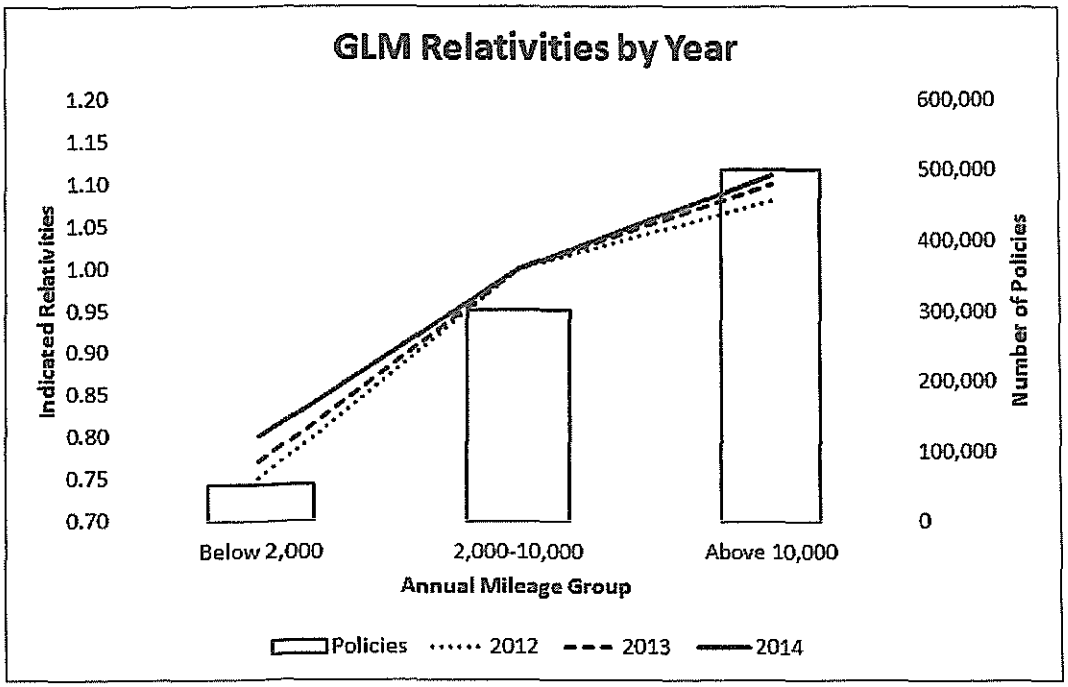
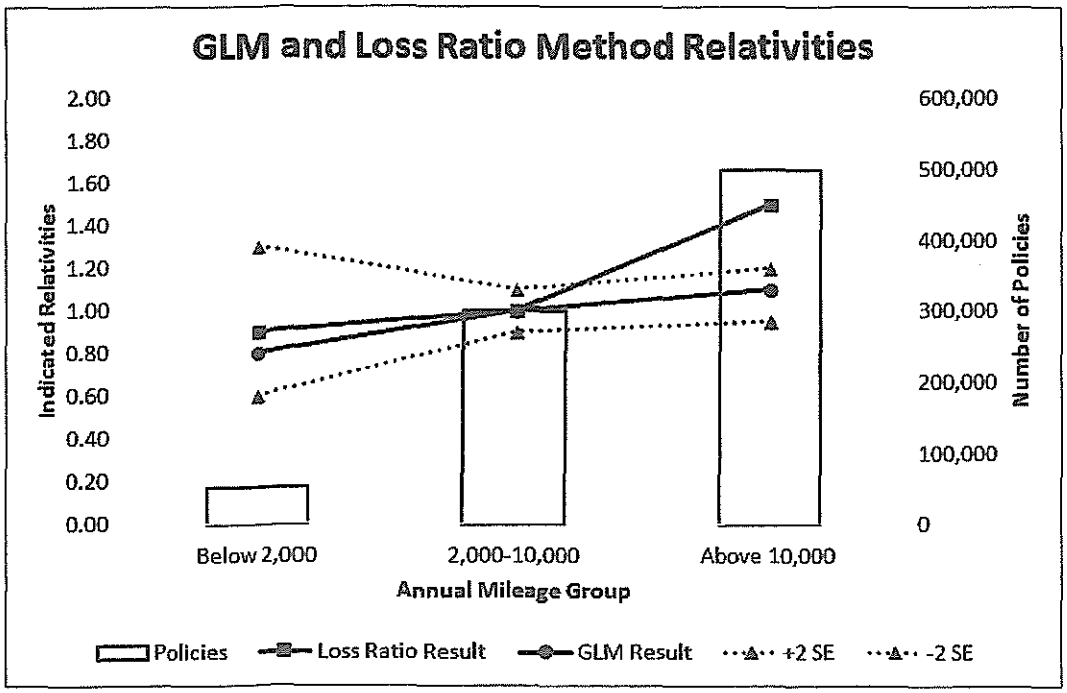
10. (2 points)

An automobile insurer has calculated indicated rating plan factors using both a loss ratio analysis and a generalized linear model (GLM). Data from years 2012-2014 was used in both analyses. Given the following output for the proposed Annual Mileage rating variable:





<QUESTION 10 CONTINUED ON NEXT PAGE>

10. (continued)

a. (1 point)

Using the data in each graph above, discuss whether annual mileage would be a good rating variable.

b. (0.5 point)

Taking into account two other criteria of a good rating variable, discuss whether annual mileage would be a good rating variable.

c. (0.5 point)

Recommend whether the insurer should add annual mileage to their rating plan.

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11. (4 points)

A homeowners insurance company uses only two rating variables, territory and amount of insurance. The company wishes to accomplish the following as part of an upcoming rate filing:

- Achieve an indicated average rate increase of +15%.
- Update class plan relativities based on indicated results.
- Adopt a minimum premium requirement of $800.
- Keep the same base classes.

The following information applies to the company's current book of business:

- Current base rate per exposure is $1,250.

Amount of Insurance	Current Relativity	Indicated Relativity
Less than $100,000	0.750	0.600
Greater than or Equal to $100,000	1.000	1.200

Territory	Current Relativity	Indicated Relativity
Territory 1	0.800	0.850
Territory 2	1.000	1.000

In-force Exposure Distribution		
Amount of Insurance	Territory 1	Territory 2
Less than $100,000	1,500	4,000
Greater than or Equal to $100,000	1,500	3,000

Using the extension of exposures method, calculate the base rate that satisfies all of the company's objectives.

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12. (2.5 points)

Given the following information about a property:

- Value of property = $750,000
- Required Coinsurance = 85%
- Amount of Insurance purchased = $600,000
- There is a 30% chance of total loss, given a claim.
- All other losses are uniformly distributed between $0 and $750,000.
- Frequency of loss = 2%

a. (1.25 points)

Draw a graph of the coinsurance penalty as a function of loss amount. Label and give values of all critical points.

b. (1.25 points)

Calculate the rate per $1000 of insurance to be charged for this property, assuming no coinsurance penalty is used.

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13. (1 point)

Below are the parameters for a retrospectively rated policy with an annual policy period:

Standard Premium	$813,546
Basic Premium	$343,137
Loss Conversion Factor	1.08
Tax Multiplier	1.03
Min Retro Premium Ratio	60%
Max Retro Premium Ratio	140%

Evaluation at Age	Limited Reported Losses
18 months	$115,000
30 months	$151,800

Calculate the retrospective premium at 18 months and 30 months.

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14. (1.5 points)

Given the following data for an insurer that writes auto coverage in two states:

Underwriting Year	State A Earned Premium ($000s)	State B Earned Premium ($000s)
2012	2,000	154,000
2013	9,000	152,000
2014	20,000	147,000

	Reported CDFs as of (months)			
State	12	24	36	48
A	2.43	1.58	1.14	1.00
B	2.47	1.55	1.17	1.00

- State A policy limit is $50,000
- State B policy limit is $25,000

a. (1 point)

Discuss an argument for and an argument against combining State A and State B when performing an unpaid claims analysis.

b. (0.5 point)

Discuss the expected change in severity from 2012 to 2014 when combining the experience from State A and State B.

CONTINUED ON NEXT PAGE

15. (1.25 points)

    a. (0.75 point)

    List three considerations when establishing a large claim threshold for the purpose of estimating unpaid claims.

    b. (0.5 point)

    Contrast the effect that large claims have on the development technique and the Bornhuetter-Ferguson technique for estimation of unpaid claims.

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16. (2.75 points)

Claim #1	
January 4, 2012	Accident occurs
May 1, 2012	Claim is reported and opened with initial case outstanding of $5,000
December 1, 2012	A payment of $2,000 is made and case outstanding is reduced to $4,000
January 15, 2013	Claim is closed with an additional payment of $8,000
June 1, 2013	A deductible amount of $1,000 is recovered on the claim

Claim #2	
December 1, 2012	Accident occurs
January 15, 2013	Claim is reported and opened with initial case outstanding of $1,000
January 31, 2014	Case outstanding is reduced to $500
February 20, 2014	Claim is closed with a total payment of $3,000

Claim #3	
November 1, 2013	Accident occurs
November 3, 2013	Claim is reported and opened with initial case outstanding of $10,000
January 30, 2014	Claim is closed without payment

Claim #4	
July 15, 2014	Accident occurs
July 17, 2014	Claim is reported and opened with initial case outstanding of $3,000

a. (1.75 points)

Using the claims data above, build the following cumulative development triangles with annual December 31 valuations:

i. Report year reported claims net of any recoveries
ii. Accident year paid claims net of any recoveries

b. (1 point)

Briefly discuss one advantage and one disadvantage of using each of the data aggregation methods in part a. above when performing an unpaid claim analysis.

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17. (2.25 points)

Given the following information:

Accident	Reported Claims ($000)			
Year	12 Months	24 Months	36 Months	48 Months
2011	722	844	897	942
2012	758	898	963	
2013	818	980		
2014	931			

Calendar Year	On-level Earned Premium ($000)
2011	1,300
2012	1,325
2013	1,350
2014	1,375

- Annual claims trend = 4%.
- Assume no development beyond 48 months.

a. (0.75 point)

Calculate the estimated ultimate claims for accident year 2014 using the reported development technique.

b. (1.5 points)

Calculate the estimated ultimate claims for accident year 2014 using the expected claims technique. Justify the expected loss ratio selection.

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18. (1.5 points)

Given the following data:

Calendar / Accident Year	Earned Premium ($000s)
2011	100
2012	150
2013	150
2014	200

Reported Claims ($000s)

Calendar / Accident Year	12 Months	24 Months	36 Months	48 Months
2011	26	40	48	51
2012	40	43	51	
2013	44	67		
2014	69			

- The a priori expected claim ratio for all accident years is 51%.
- There is no development after 48 months.

a. (1 point)

Calculate ultimate claims for accident year 2014 using the reported Bornhuetter-Ferguson technique. Justify all selections.

b. (0.5 point)

Discuss the applicability of the Bornhuetter-Ferguson technique when cumulative claim development factors are less than 1.00.

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19. (3.5 points)

An actuary has performed a reserve analysis on a line of business using four techniques. The data, techniques, and assumptions are as follows:

Accident Year	Reported Claims ($000) as of (months)				
	12	24	36	48	60
2010	5,000	8,500	11,000	11,500	11,500
2011	6,000	10,800	13,000	13,800	
2012	7,000	12,300	15,300		
2013	8,000	14,000			
2014	10,000				

Accident Year	Reported Claim Age to Age Factors				
	12-24	24-36	36-48	48-60	60-Ult
2010	1.70	1.29	1.05	1.00	
2011	1.80	1.20	1.06		
2012	1.76	1.24			
2013	1.75				
Selected	1.75	1.25	1.05	1.00	1.00
CDF to Ultimate	2.29	1.31	1.05	1.00	1.00

Accident Year	Paid Claims ($000) as of (months)				
	12	24	36	48	60
2010	1,100	4,500	8,100	10,000	11,000
2011	1,400	5,500	9,300	11,700	
2012	1,600	6,400	11,200		
2013	1,800	7,200			
2014	1,800				

Accident Year	Paid Claim Age to Age Factors				
	12-24	24-36	36-48	48-60	60-Ult
2010	4.09	1.80	1.23	1.10	
2011	3.93	1.69	1.26		
2012	4.00	1.75			
2013	4.00				
Selected	4.00	1.75	1.25	1.10	1.00
CDF to Ultimate	9.68	2.42	1.38	1.10	1.00

Accident Year	Ratio of Paid Claims to Reported Claims as of (months)				
	12	24	36	48	60
2010	22%	53%	74%	87%	96%
2011	23%	51%	72%	85%	
2012	23%	52%	73%		
2013	23%	51%			
2014	18%				

<QUESTION 19 CONTINUED ON NEXT PAGE>

19. (continued)

Accident Year	Earned Premium ($000)	Projected Ultimate Claims: Development Techniques Reported ($000)	Development Techniques Paid ($000)	Bornhuetter-Ferguson Techniques Reported ($000)	Bornhuetter-Ferguson Techniques Paid ($000)
2010	18,800	11,500	11,000	11,500	11,000
2011	23,200	13,800	12,870	13,800	13,071
2012	25,900	16,065	15,456	16,102	15,836
2013	31,700	18,340	17,424	18,876	19,291
2014	30,000	22,900	17,424	20,985	19,286

- Selected expected claim ratio used in Bornhuetter-Ferguson Techniques is 65%.
- Claims ratio trend is 0%.
- There is no reported development beyond 60 months.

a. (1 point)

Recommend two changes to the actuary's selected assumptions across the techniques and justify the changes.

b. (1.5 points)

For accident year 2014, calculate a revised estimate of ultimate claims for each of the four techniques based on the recommendations made in part a. above.

c. (1 point)

Assume the actuary selected ultimate claims as the average of the four techniques.

Accident Year	Selected Ultimate Claims ($000)
2010	11,250
2011	13,385
2012	15,865
2013	18,483
2014	20,149

Given the revised estimates calculated in part b. above, fully assess the reasonableness of the actuary's accident year 2014 selected ultimate claims estimate of $20,149,000.

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20. (2.25 points)

An actuary for a large general liability insurer uses a frequency-severity technique to determine the estimate of unpaid claims.

a. (0.5 point)

Discuss whether the frequency-severity technique is appropriate for determining an estimate of unpaid claims for general liability.

b. (1.25 points)

The insurer recently changed their offering from large deductible policies to small deductible policies. Discuss the impact of this change on the frequency-severity technique, including an assessment of the appropriateness of the technique.

c. (0.5 point)

Recommend and justify an improvement to the actuary's estimation of unpaid claims given the change in deductible offerings described in part b. above.

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21. (2 points)

Given the following information:

Cumulative Reported Claim Counts

Accident Year	12 Months	24 Months	36 Months
2012	500	750	1,000
2013	575	865	
2014	800		

Cumulative Closed Claim Counts

Accident Year	12 Months	24 Months	36 Months
2012	300	500	875
2013	350	800	
2014	750		

- Assume no reported development after 36 months.

a. (1.5 points)

Based on disposal rates, assess the appropriateness of using a Berquist-Sherman paid claims development adjustment.

b. (0.5 point)

Given the additional information below, discuss a possible distortion when using the Berquist-Sherman paid claim development adjustment.

Unadjusted Paid Claims Severity on Closed

Accident Year	12 Months	24 Months	36 Months
2012	$24,000	$34,667	$35,657
2013	$26,087	$28,142	
2014	$16,111		

- Assume no partial payments.

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22. (2 points)

An actuary is using the development technique based on accident year data to calculate ultimate claim estimates at 12 months maturity.

For each issue provided below, briefly discuss how it may impact the analysis and propose an appropriate response to mitigate the issue.

a. (0.5 point)

The actuary observes a long development pattern.

b. (0.5 point)

Tort reforms anticipated to decrease severity on all open and future claims were recently enacted.

c. (0.5 point)

In recent years, policies have been written with higher deductibles than in prior years.

d. (0.5 point)

The insurer has implemented a new claims system that allows faster processing of claims.

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23. (1.25 points)

An insurer has business reinsured through an excess of loss reinsurance arrangement and a stop loss limit reinsurance arrangement.

		Net of Excess of Loss Reinsurance			
			Claims as of December 31, 2014		
Policy Year	Gross Ultimate Claims Estimate ($000)	Net Ultimate Claims Estimate ($000)	Reported ($000)	Paid ($000)	Stop Loss Limit ($000)
2012	1,650	1,475	1,450	1,200	1,500
2013	1,800	1,750	1,600	1,200	1,500
2014	2,000	1,900	1,400	1,000	1,500

a. (0.75 point)

Calculate the IBNR for policy years 2012 through 2014 net of all reinsurance.

b. (0.5 point)

Calculate the unpaid claims for policy years 2012 through 2014 net of all reinsurance.

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24. (3.25 points)

Given the following data as of December 31, 2014:

Paid Claims Only ($000) as of (months)

Accident Year	12	24	36	48
2011	1,000	1,100	1,157	1,178
2012	1,500	1,650	1,733	
2013	2,000	2,200		
2014	2,500			

Paid ALAE ($000) as of (months)

Accident Year	12	24	36	48
2011	100	220	347	424
2012	150	330	520	
2013	200	440		
2014	375			

Accident Year	Selected Ultimate Claims Only ($000)
2011	1,178
2012	1,768
2013	2,356
2014	2,945

- Assume that no development occurs after 48 months.

a. (1.5 points)

Calculate ultimate ALAE using the multiplicative development technique applied to the ratio of paid ALAE-to-paid claims only for accident years 2012, 2013, and 2014.

b. (1.25 points)

Calculate ultimate ALAE using the additive alternative approach to the technique in part a. above for accident years 2012, 2013, and 2014.

c. (0.5 point)

Select and justify a reasonable estimate of ultimate ALAE for accident year 2014 based on the estimates calculated in parts a. and b. above.

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25. (2.5 points)

An actuary has performed the following unpaid claims analysis as of December 31, 2014:

Accident Year	Claims as of December 31, 2014 Reported ($000)	Claims as of December 31, 2014 Paid ($000)	Development Technique Ultimate Claims Reported ($000)	Development Technique Ultimate Claims Paid ($000)	Selected Ultimate Claims ($000)
2013	10,000	4,800	12,500	12,000	12,250
2014	7,500	2,200	15,000	11,000	13,000

a. (1 point)

For accident year 2014, determine the expected incremental reported and paid claims in calendar year 2015 based on the development techniques.

b. (1 point)

For accident year 2014, determine the expected reported and paid claims in calendar year 2015 based on the actuary's ultimate claim selections.

c. (0.5 point)

Assume for accident year 2014, the reported claims are $3,300,000 and the paid claims are $2,400,000 in calendar year 2015. Assess whether the actuary's estimate of the ultimate claims should change.

END OF EXAMINATION

Exam 5
Basic Techniques for Ratemaking and Estimating Claim Liabilities

POINT VALUE OF QUESTIONS

QUESTION	VALUE OF QUESTON	SUB-PART OF QUESTION (a)	(b)	(c)	(d)	(e)	(f)	(g)
1	2.75	0.75	2.00					
2	1.50	0.75	0.75					
3	1.50	0.50	1.00					
4	2.25	2.25						
5	3.00	1.25	1.25	0.50				
6	1.00	1.00						
7	4.50	1.75	2.75					
8	1.00	1.00						
9	2.75	2.25	0.50					
10	2.00	1.00	0.50	0.50				
11	4.00	4.00						
12	2.50	1.25	1.25					
13	1.00	1.00						
14	1.50	1.00	0.50					
15	1.25	0.75	0.50					
16	2.75	1.75	1.00					
17	2.25	0.75	1.50					
18	1.50	1.00	0.50					
19	3.50	1.00	1.50	1.00				
20	2.25	0.50	1.25	0.50				
21	2.00	1.50	0.50					
22	2.00	0.50	0.50	0.50	0.50			
23	1.25	0.75	0.50					
24	3.25	1.50	1.25	0.50				
25	2.50	1.00	1.00	0.50				
TOTAL	55.75							

EXAM 5 SAMPLE ANSWERS AND EXAMINER'S REPORT

GENERAL COMMENTS:

- Candidates should note that the instructions to the exam explicitly say to show all work; graders expect to see enough support on the candidate's answer sheet to follow the calculations performed. While the graders made every attempt to follow calculations that were not well documented, lack of documentation may result in the deduction of points where the calculations cannot be followed or are not sufficiently supported.
- Candidates should justify all selections when prompted to do so. For example, if the candidate selects an all year average and the candidate prompts a justification of all selections, a brief explanation should be provided for the reasoning behind this selection.
- Incorrect responses in one part of a question did not preclude candidates from receiving credit for correct work on subsequent parts of the question that depended upon that response.
- Candidates should try to be cognizant of the way an exam question is worded. They must look for key words such as "briefly" or "fully" within the problem. We refer candidates to the Future Fellows article from December 2009 entitled "The Importance of Adverbs" for additional information on this topic.
- Some candidates provided lengthy responses to a "briefly describe" question, which does not provide extra credit and only takes up additional time during the exam.
- Candidates should read each question carefully and answer the question as it is presented.

EXAM STATISTICS:

- Number of Candidates: 780
- Available Points: 55.75
- Passing Score: 38.25
- Number of Passing Candidates: 243
- Raw Pass Ratio: 31.15%
- Effective Pass Ratio: 33.38%

EXAM 5 SAMPLE ANSWERS AND EXAMINER'S REPORT

QUESTION: 1	
TOTAL POINT VALUE: 2.75	**LEARNING OBJECTIVE: A3**

SAMPLE ANSWERS

Part a: 0.75 point

Written CY 2014=(600+300)(.5)=450

Earned CY 2014=1/6(800)(.5)+600(.5)+5/6(300)(.5)=491.67

Part b: 2 points

Parallelogram method

A=4/12x8/12x.5=.111

2014 rate level=.111(1-.18)+(1-.111)=.98
on-level factor=(1-.18)/(.98)=.837
earned prem at current rate level=491.67x500x2x.837=411,528

Extension of exposure
earned prem at current rate level=491.67x(1-.18)x500x2=403,169

Extension of exposure is more appropriate because the parallelogram method assumes uniform writing throughout the year which is not satisfied here.

EXAMINER'S REPORT

Part a

Candidates were expected to know how to calculate written exposure and earned exposures for 6-month policies.

Candidates generally scored well on this part. The most common mistake was not taking half of the exposures to account for the 6-month term since exposure defined as one car-year.

Part b

Candidates were expected to calculate the 2014 earned premium at the current rate level using the parallelogram method. Some candidates had difficulty with this part. Common mistakes included not calculating the area associated with a particular rate level correctly and not annualizing the premium.

EXAM 5 SAMPLE ANSWERS AND EXAMINER'S REPORT

Candidates were expected to calculate the 2014 earned premium at the current rate level using the extension of exposure method. Candidates generally scored well on this part. One common mistake was not annualizing the premium.

Candidates were expected to select the extension of exposure method by knowing which assumption of the parallelogram method did not hold true. Many candidates performed well on this part. The most common error was identifying the method but not explaining why it was more appropriate.

EXAM 5 SAMPLE ANSWERS AND EXAMINER'S REPORT

QUESTION 2	
TOTAL POINT VALUE: 1.5	**LEARNING OBJECTIVE: A2**
SAMPLE ANSWERS	
Part a: 0.75 point	

Sample Answer 1

I propose using yearly revenue. This value should be directly proportional to expected loss and is practical since it's easy to obtain and verify as revenue for a business would be used in the company's financial statements.

Sample Answer 2

Sales is an appropriate exposure base for GL for a restaurant.
Practical – sales is an estimate that is tracked and filed with the IRS so it should be easy and inexpensive to obtain. This also prevents the insured from giving inaccurate estimate (moral hazard)
Historical precedence – sales is generally the industry standard for GL policies. If making a change to a new exposure base, there could be large premium swings for customers and large IT expenses so this may not be appropriate

Sample Answer 3

Payroll
Varies with the hazard – the larger the payroll would imply more employees for more business/customers and risk exposure
Verifiable – easy to obtain from company's payroll information

Part b: 0.75 point

Sample Answer 1

I propose using number of patients as an exposure base for a hospital's professional liability policy.
1. Number of patients is directly proportional to expected losses, as the greater number of patients seen by a hospital results in a greater amount of liability risk to the hospital.
2. Number of patients should also be easy to obtain and verify and hard to manipulate given the hospital should have a robust system to track patents checking in and out.

Sample Answer 2

Proposal: number of doctors and nurses on staff.
1. Based on proportionality to losses, this would be a good exposure base since more doctors or nurses on staff would be able to see and treat more patients, resulting in more exposure to potential liability claims.
2. Based on practicality, the number of doctors and nurses on staff is easy to obtain from the

hospital and to verify.

Sample Answer 3

Payroll for medical professionals
1. Practical - payroll is objective and easy to measure and verify.
2. Proportional to expected loss because higher payroll likely means more doctors/professionals which means increased chance of a loss.

Sample Answer 4

Exposure base: number of physician-years
This exposure base is directly proportional to expected loss because the more physicians working and employed, the more likely there will be loss. It is also a practical exposure base because the number of physicians is very easy to verify, it is well-defined and inexpensive to obtain this information.

Sample Answer 5

I would recommend using occupied beds as an exposure base for a hospital professional liability policy. Since this is an exposure base that is commonly used in the industry for this line of business, it would be "considerate of historical precedence" for many insurance companies and no expenses would be incurred due to making a change to the exposure base. It is also proportional to expected loss since your liability increases with every new patient.

Sample Answer 6

Hospital - use revenue as an exposure base.
1. Practical - hospital needs to report revenue for tax purposes and the cost of procedures are normally billed to patient insurance carriers, so data is available at least two ways.
2. Proportional to loss - higher revenue implies more patients and thus more opportunity for loss or higher risk procedures which also would have a higher chance of loss.

EXAMINER'S REPORT

Part a

Candidates are expected to know what an exposure base is and the three criteria for a good exposure base. To receive full credit, candidates must propose a valid exposure base specifically for a restaurant GL policy (not just GL policies in general) and provide justification based on two of the three criteria. If a candidate proposed payroll as the exposure base and used proportional to expected losses as a justification, then there must be a link that increased/decreased payroll is correlated with increased/decreased customers.

A common error was the proposal of square footage as an exposure base which received partial

credit if accompanied by valid justification. Even though square footage is used for some GL policies, it is not appropriate for restaurants. The exposure base should be responsive to any change in exposure to risk, and square footage is not response to exposure for restaurants. Another common error was the proposal of number of customers/meals as an exposure base which received partial credit if accompanied by valid justification. Use of number of customers/meals would not be practical.

Part b

Candidates were expected to demonstrate an understanding of exposure bases and the criteria used to assess their appropriateness, using two relevant criteria to justify their selection. To receive full credit, the recommended exposure base had to have a clear link to hospital professional liability (e.g., number of medical professionals, number of patients, number of occupied beds, etc.), and had to be briefly justified using two relevant criteria.

Many candidates did well on this part of the question, with over half receiving full credit. Candidates lost points where the recommended exposure base was either likely to be unresponsive to changes in underlying exposure (e.g., number of beds) or impractical to obtain and verify (e.g., hours worked). There also seemed to be confusion among a small subset of candidates around the meaning of physician-years, with many of those who proposed this as an exposure base identifying it as a measure of physician experience (i.e., years in practice) rather than number of physicians. No credit was awarded in these instances.

EXAM 5 SAMPLE ANSWERS AND EXAMINER'S REPORT

QUESTION 3	
TOTAL POINT VALUE: 1.5	**LEARNING OBJECTIVE: A4**

SAMPLE ANSWERS

Part a: 0.5 point

Sample Answer 1

The general role of credibility in ratemaking is to assess how much weight should be reasonably given to the actual data and how to determine a reasonable complement in order to ensure that rate changes are credible and due to signals rather than noise created from small amounts of data.

Sample Answer 2

Credibility complements are used in order to make indications more actuarially sound. If data is too sparse or erratic, it shouldn't be used by itself when creating the indication for your rate review. It protects the insurer (and insureds) from creating rates that are excessive or inadequate.

Part b: 1.0 point

The acquiring personal auto insurer could use its own indication in the state as the complement for the smaller insurer. Assuming the smaller insurer was not included in this indication, this complement would be independent. There is also a logical relationship between the small insurer's experience in the state and the acquiring insurer's experience in the same state. The complement may be biased, however, because the two companies pre-merger may have different underwriting guidelines, rates, so their expected loss ratios could be different.

EXAMINER'S REPORT

Candidates were expected to demonstrate a good understanding of credibility's role in ratemaking, recommend a complement of credibility and be able to evaluate the appropriateness of their complement based on at least 2 qualities.

Part a

Candidates were expected to demonstrate an understanding of credibility's role in ratemaking. Key observations were around the predictive power of data driven by volume and stability. Ideally, candidates also discussed bringing in a complement for data lacking credibility; however, candidates could also demonstrate an understanding of this concept by answering part b.

Common mistakes included being too vague explaining credibility. For example, saying credibility is the reliability/trustworthiness of data was not awarded full credit as reliability and trustworthiness are synonyms for credibility.

Part b

Candidates were expected to be able to propose an appropriate complement and evaluate the appropriateness of at least two qualities.

Some candidates proposed the complement "trended present rates" which the paper discusses is not appropriate when there is a larger group data from which to select a complement. Therefore, full credit was only awarded if candidates discussed the disadvantage/limitation of using trended present rates.

Another common mistake was listing qualities without discussion. These answers were awarded partial credit as a more thorough argument was expected.

QUESTION 4	
TOTAL POINT VALUE: 2.25	**LEARNING OBJECTIVE: A4**
SAMPLE ANSWERS	

2-Step Method:

Sample Answer 1

Frequency: 2 Step Trend – change in freq trend
Trend period: 7/1/12 to 7/1/14 (step 1), AAD AY12 to AAD for most recent avail data
➔ select 12pt freq trend: -2.5%
Trend period: 7/1/14 to 4/1/17 (step 2), AAD future period = 7/1/16 + 12mo/2 (to AWD) + 6mo/2 (to mid pt of policy)
➔ select 3% proj trend – freq looks stable 6pt onward
Severity: select 3.4% – looks stable, include as much data as possible

PP Trend Factor = (0.975)^2 x (1.03)^2.75 x (1.034)^4.75 = 1.2086

Sample Answer 2

The frequency trend has changed significantly. I will therefore use a different trend for different periods. I'll pick -2.5% to go from 2012 to 2014, and then (3+2.8)/2 = 2.9% to go from 2014 to prospective period.

Sev trend is stable, I will select all year avg = (3.4 + 3.0 + … + 3.3)/6 = 3.08%.

First step we go from AAD AY12 = 7/1/12 to AAD AY14 = 7/1/14
Trend = (1 – 0.025)^2 x (1 + 0.0308)^2 = 1.01 = A

Second step go from AAD of AY2014 = 7/1/14 to AAD of exp period = 3/31/17 = 2.75yrs
Trend = (1 + 0.029)^2.75 x (1 + 0.0308)^2.75 = 1.175904 = B

So overall trend is A x B = 1.188

1-Step Method:

Sample Answer 3

For frequency trend, I'm going to use 0%. There has been a large spike in frequency over the past two years, which could be the cause of changing legal environments. I don't expect this to continue indefinitely especially since there is a longer term decreasing trend. Without more information, I am most comfortable with 0%.

Severity: use 3.4% (20 point trend) – largest term trend we have and it's been pretty stable.

Trend dates: 7/1/2012 to 4/1/2017 (4.75 years).

7/1/2012 is avg acc date in 2012, 4/1/17 is avg acc date in future period (7/1/2016 + 6 months + 3 months, where 6 month = avg written date, and 3 month = avg acc date on 6-mth policy)

Trend factor: (1.00 x 1.034)^4.75 = 1.172

Sample Answer 4

For the severity trend, I will select a 3% trend because all of the indicated trend values seem to hover around this value (avg of trend is 3.08%).

For the frequency trend, I will select a trend factor of 1%. This is because the trend value from year end 2012 (8 point trend) is negative, but there appears to be a positive trend going into the future. As such I judgmentally selected a factor in between instead of doing a 2 step trend.

Trend from: 7/1/2012
Trend to : 4/1/2012
Trend length = 4.75 years

LC Trend Factor for AY12 = (1.01 x 1.03)^4.75 = 1.206

Sample Answer 5

We know policies are semi-annual and rates will be in effect 1 year. Given that info, the avg earned date of a policy in the effective policy period would be 9 months past the effective date of 7/1/16, which is 4/1/17. The amount of time the pure premium must be trended is from 7/1/12 to 4/1/17.

Looking at the severity exponential fits the data is steady from year to year, so I will select a straight average from all of the data points for the severity trend which is 3.1%.

Looking at the frequency exponential fits, we see a clear change in trend starting with the 8 point trend. The trend graph would look something like this

Since we are projecting the premium from 2012 to 2017. We may want to select a less positive trend from the 4 point or 6 point trend since the date is coming from a higher starting point. I also assume the premium will continue to trend up and not change its trend again. So I will select a premium trend of 1% for frequency.

The total pure premium trend is =(1.01 * 1.031)^ 4.75 = 1.212

EXAMINER'S REPORT

Candidates were expected to demonstrate their knowledge and understanding of loss trend as well as the approaches to determine trend.

To score full credit, candidates are expected recognize the shift in frequency trend and the

consistency in severity trend. Candidates are also expected to make appropriate trend selections and justify them, determine the trend period, and finally, calculate the pure premium trend factor for trending AY2012 loss data. A range of reasonable answers were accepted.

Overall, candidate scored well on trend selections and trend factor calculations but scored poorly on justifying their selections and trending methodology. Candidates who chose 2-step method generally answered well. Many 1-step candidates simply picked the most recent trends and ignored data credibility and the fact that the historical period 2012 – 2014 needs to be considered when trending AY 2012 data.

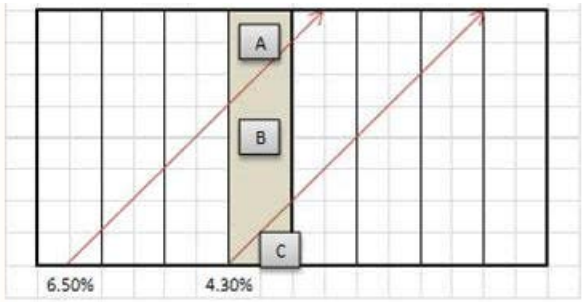
Other common mistakes included:

- Selecting frequency trend solely based on 4 and 6 point in 1-step trending
- Forgetting to provide justifications
- Describing that frequency was increasing where in fact, frequency was decreasing first then reversed to increasing in recent data
- Attempting to annualize trends when trends provided are already annual fits
- Determining incorrect trend periods
- Incorrectly handling semi-annual policies
- Using average written dates instead of average accident dates to determine trend period

EXAM 5 SAMPLE ANSWERS AND EXAMINER'S REPORT

QUESTION 5	
TOTAL POINT VALUE: 3.0	**LEARNING OBJECTIVE: A2**
SAMPLE ANSWERS	

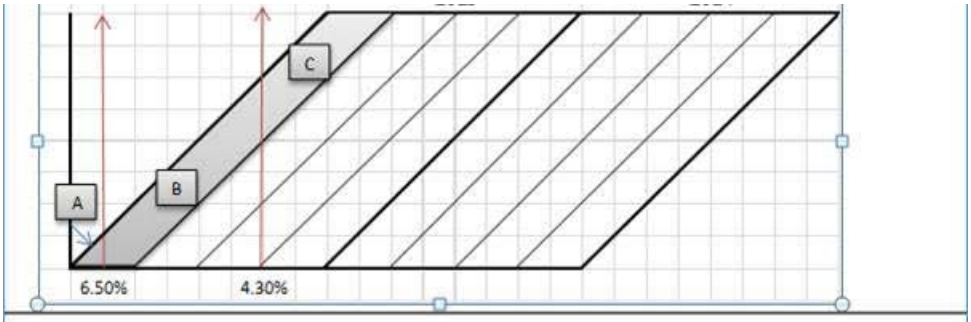
Part a: 1.25 points



Area of A = (0.125 + 3 * 0.125) / 2 * 0.25 = 0.0625
Area of B = 0.25 – A – C = 0.15625
Area of C = (0.25 * 0.25) / 2 = 0.03125

Adjustment = (1.065 * 1.043) / (1.00 * (0.0625/0.25) + 1.065 * (0.15625/0.25) + (1.065*1.043) * (0.3125/0.25))
= **1.0534**

Part b: 1.25 points



Area of A = (0.125 * 0.125) / 2 = 0.0078
Area of B = 0.25 – A – C = 0.1484
Area of C = (2 * 0.125 + 4 * 0.125) / 2 * 0.25 = 0.09375

Adjustment = (1.065 * 1.043) / (1.00 * (0.0078/0.25) + 1.065 * (0.1484/0.25) + (1.065*1.043) * (0.09375/0.25))
= **1.0284**

Part c: 0.50 points

Sample Answer 1

This is not appropriate as the loss trend will be distorted by the benefit level changes (in this case overstated). Use losses adjusted for benefit level changes instead to produce trends.

Sample Answer 2

Selection not appropriate – should adjust pure premium data for direct benefit changes, then select loss trend. Otherwise, would double-count effect of direct benefit changes.

Sample Answer 3

This will double-count the effect of the benefit change. The pure premium trend selected will also reflect the benefit change, so the trend selected will be too high. So it's not appropriate. Adjustment: adjust loss to the benefit level after these two benefit changes. Calculate the pure premium using losses after loss adjustment factor and select pure premium trend based on this data.

Sample Answer 4

The actuary should adjust for one-time changes such as law and coverage changes before calculating trend. If actuary does not adjust for one-time changes, they will be incorporated into the loss trend and be applied as a continuous change when they are not expected to continue.

Sample Answer 5

Annual loss trend will be overstated because it includes the underlying increases in benefit change. Actuary should restate pure premium to current benefit level before determining the annual loss trend.

EXAMINER'S REPORT

Part a

The candidate was expected to be able to:

- Correctly identify and work the problem on the accident quarter
- Correctly understand how the direct benefit changes impacted loss claims
- Calculate the proportion of the accident quarter at each benefit level
- Determine the adjustment factor, based on the current rate level and average rate level calculated on the accident quarter

A graph or diagram was not required for credit.

Common mistakes included:

- Incorrect application of accident vs. policy quarter and/or how the direct benefit changes impacted loss claims
- Incorrect calculation of weights due to geometrical errors
- Failing to adjust weights so that they were consistently on either an annual (% of total year) or quarterly (% of total quarter) basis
- Applying the problem to the wrong quarter or using the accident year rather than an accident quarter.
- Some candidates failed to apply a second benefit impact to either of the parts, failing to recognize that both benefit level changes impacted the accident quarter in question

Part b

The candidate was expected to be able to:

- Correctly identify and work the problem on the policy quarter
- Correctly understand how the direct benefit changes impacted loss claims
- Calculate the proportion of the policy quarter at each benefit level
- Determine the adjustment factor, based on the current rate level and average rate level calculated on the policy quarter

A graph or diagram was not required for credit.

Common mistakes included:

- Performing the problem on an accident quarter basis
- Calculating the benefit impact only on policies written on or after the effective date of the change.
- Incorrect calculation of weights due to geometrical errors
- Failing to adjust weights so that they were consistently on either an annual (% of total year) or quarterly (% of total quarter) basis
- Applying the problem to the wrong quarter or using the policy year rather than a policy quarter.
- Some candidates failed to apply a second benefit impact to either of the parts, failing to recognize that both benefit level changes impacted the policy quarter in question

Part c

The candidate was expected to be able to provide reasoning as to why the trend selection would be inappropriate and suggest a reasonable adjustment to the loss data to avoid this issue.

Common mistakes included:

- Inappropriately applying the concepts of the question to premium or exposure trending
- Failing to address both portions of the question, the assessment and the suggested adjustment
- Incomplete or vague assessments/adjustments. For example, simply stating that it was not appropriate was not enough for assessment credit. Similarly, saying that the losses should be adjusted was not specific enough to receive credit for that portion.

QUESTION 6	
TOTAL POINT VALUE: 1	**LEARNING OBJECTIVE: A4**
SAMPLE ANSWERS	

Sample Answer 1

Let's calculate U/W expense ratio
Commissions:67.20/560=0.12
Taxes, license, fee=19.6/560=0.035
General expenses=73.92/616=0.12
Now we need LAE/earned premium
Combined ratio=100%
100%=loss ratio (LAE included)+UW expenses/written premium
Assuming for combined ratio that all expenses/UW are incurred at the policy inception (so written premium)

100%=(loss ratio)(1+0.082)+(67.2+19.6+73.92)/560
Loss ratio=0.713/1.082=0.659
LAE/earned premium=(0.659)(0.082)=0.054
Operating expense ratio=LAE/earned premium+UW expense ratio=0.054+0.12+0.035+0.12=0.329

Sample Answer 2

Loss+LAE+UW+PROFIT=616
1.082(Loss)+67.20+19.60+73.92=616
455.28=1.082(Loss)
Loss=420.78

Operating expense ratio=(-420.78+616)/616=31.69%

Sample Answer 3

OP expense=UW exp+LAE
GOE divide by EP, others by WP
UW Exp Ratio=(67.2+19.6)/560+73.92/616=27.5%
100%=L/R*1.082+27.5%
L/R=67%
LAE=67%0.082=5.494%
2014 OP exp ratio=5.494%+27.5%=32.994% or 33%

Sample Answer 4

LAE/Loss=0.082
U/W ratio=73.92/616+(67.2+19.6)/560=0.275
Combine ratio=.275+Loss/616+LAE/616=1

Loss+LAE=446.6
Loss+.082loss=446.6
Loss=412.75
LAE=(412.75)(.082)=33.85
OER=LAE/EP+U/W ratio=33.85/616+.275
=.32995

Sample Answer 5

Combined ratio=Loss&LAE/Earned premium+(underwriting expenses)/written premium
100%=Loss*(1+8.2%)/616+(67.2+19.6+73.92)/560
Loss=405.92
2014 operating expense ratio=405*8.2%/616+(67.2+19.6+73.92)/560=34%

EXAMINER'S REPORT

The candidate was expected to be able to calculate underwriting expense ratio (UWER) using the provided information on underwriting expenses and premium, and to calculate the operational expense ratio (OER) using the UWER and the provided LAE-to-Loss ratio and combined ratio.

In general, the candidates did well on this question. Most calculated the UWER correctly, and either calculated the OER using the combined ratio minus the loss ratio or the underwriting expense ratio plus the LAE-to-EP ratio.

Common mistakes included:

- Calculating the UWER but calling it the OER
- Calculating the OER by adding the LAE-to-loss ratio to the UWER
- Multiplying the LAE-to-loss ratio by the loss and LAE-to-EP ratio to get the LAE-to-loss ratio, rather than multiplying it by only the loss ratio
- Dividing general expense by WP and commissions &/or TLF by WP, or dividing Loss &/or LAE by WP

QUESTION 7

TOTAL POINT VALUE: 4.5 | **LEARNING OBJECTIVE: A6, B3**

SAMPLE ANSWERS

Part a: 1.75 points

For frequency, since they are decreasing after being trended, I will select the latest 3 year average. It seems like there was a significant shift at this point that I expect to continue.
Freq. = (3.32%+3.11%+3.44%)/3 = 3.29%

Severity seems to be up and down, so I will select an all-year average to balance it out as there is no clear trend.

Avg. Severity selection = 13,277

	(1)	(2)	(3)=(1)*(2)* Earned Exposures
AY	Sev	Freq	Ult. Loss and ALAE
2013	13,277*(1.04^-1)=12,766	3.29%(1.03^-1)=3.19%	$401,208,316
2014	13,277	3.29%	$436,813,300

Part b: 2.75 points

	(4)	(5)=(3)/(4)*[(1.03)*(1.04)]^3.75 or 2.75
AY	EE	Loss & ALAE Pure Premium Trended
2013	985,200	527.06
2014	1,000,000	527.76
	Selected =	527.41

Indicated Rate = $\frac{527.4*(1.04) + 68.36 + 54.36 + (300M/1M)*(1.03)^{2.75}*.08*1.04}{1 - .18 - .06}$

= 918.80

Ind Rate Change = 918.80 / 1070 – 1 = -14.1%

EXAMINER'S REPORT

For this question, the candidate was expected to know the mechanics of a frequency-severity method to calculate an estimated loss and ALAE amount. Then they were expected to know the pure premium method to calculate an indicated rate change.

In general, many candidates mixed the answers for parts a. and b. together. Part a. asked the candidates to use a frequency-severity method to come up with an ultimate estimate for accident years 2013 and 2014. Part b. was intended to then carry that answer further and use it as an input to a projected future loss and LAE calculation. Often candidates projected their answer for part a. into 2016 or 2017 when it was not necessary to do so. Candidates struggled with the mechanics of the frequency-severity method in part a. Most candidates did know how to

at least set up the pure premium method for part b., while many struggled with the actual inputs used.

Part a

The candidate was expected to know a frequency-severity method that involved detrending frequency and severity figures given in the problem. To obtain full credit on this part, the candidate needed to explain how they chose their frequency and severity picks. There was a clear shift in frequencies indicating that a pick based on recent years should have been considered. Severities showed no clear pattern suggesting that a longer term average should be used.

For the 2014 picks, many candidates simply selected the 2014 frequency and severity given in the problem. While not an unreasonable pick, many candidates offered no rationale for their selections even though the question stated they must justify their selections.

Candidates then needed to de-trend those picks to 2013 levels. Candidates struggled with this part. Many picked the 2013 figures given in the problem with no de-trending or they made a frequency selection based on a 3 year average (such as 3.29%) but did not de-trend it for 2013.

The candidate needed to then take their selected (and detrended for 2013) picks and multiply them by the exposures to get a final answer. Some candidates confused the AIY figures given with the Earned Exposures.

Part b

The candidate was expected to take their answer from part a and use a pure premium method to come up with an indicated rate change.

This first required trending the non-cat losses to a future time period. Most candidates were able to correctly identify the trend figures needed and most trended the losses the appropriate number of years, though more than a handful did not trend the losses the correct number of years. Using these trended losses and the exposures, an initial projected pure premium was developed.

For the pure premium method, candidates also needed to account for ULAE, non-modeled cat provisions, modeled cat provisions, and a fixed and variable expense provision. One common mistake on this part was neglecting to include a ULAE provision.

For the non-modeled cat provision, the candidate had to project the AIY/EE forward and multiply it by a historical average. One common mistake on this part failing to trend the AIY/EE ratio to a future period.

The final part of this problem required candidates to put all of the pieces together and calculate a rate change. Candidates did generally well on this part, although one common mistake was to calculate an indicated rate instead of an indicated rate change.

EXAM 5 SAMPLE ANSWERS AND EXAMINER'S REPORT

QUESTION 8	
TOTAL POINT VALUE: 1	**LEARNING OBJECTIVES:** A3, A4, A5

SAMPLE ANSWERS

The following are acceptable sample answers (need two for full credit):

- The company may have a very profitable long-term investment strategy with returns that will more than offset underwriting loss
- Company has high expense in operations and marketing for the first 1st year writing business and then those expenses will go down in the later years and company can make profit later on
- It's possible that the company over reserved and there will be downward development
- The company could be using asset share pricing, where they consider the long term profitability of a policy by considering persistency. They may be able to write the policy at a loss at first, knowing that they will eventually make a profit if the policy renews and persists with the company Some of the underwriting expenses may be higher for new business than renewal business. For example, commission is usually higher for writing new business. Hence the underwriting expense could be reduced going forward
- Company might not yet have proper claims adjustment expertise in lines where it is writing. If it hires better claims adjusters, loss ratio (and thus combined ratio) could decrease in long run without increasing rates
- If the CR doesn't include salvage and subrogation and the SS is sufficient enough to offset the high CR than could be profitable
- High combined ratio could be a function of low premium volume since this is a stat up. As they grow, volatility will decrease and company could be profitable w/o increasing rates
- In general, new business loss ratios are much higher initially and will go down as some policyholders leave. This is because those frequent shoppers are usually those that are more risky, while those that stay tend to do better
- Some insureds tend to become more profitable as they age and stay with the insurer longer. For example, a 17-year old driver that is considered risky can become more profitable in the long run
- As the book grows, underwriting can get a better handle on which policies are good and bad risks and create U/W guidelines that filter out the bad risks

EXAMINER'S REPORT

Candidates were expected to know the definition of the combined ratio and the reasons why starting a company and/or a new book of business may have a high combined ratio.

Candidates did generally well on this question.

Common mistakes included:

- Giving two reasons that were fundamentally the same / only giving one reason
- Giving a reason for why the combined ratio may decrease but not giving sufficient detail explaining why the reason actually puts pressure on the combined ratio

- Using "asset share pricing" without adequately explaining this concept
- Stating that investment income was expected to decrease the combined ratio
- Using examples which include changing rate or are fundamentally the same as changing rates (price per exposure)

QUESTION 9	
TOTAL POINT VALUE: 2.75	**LEARNING OBJECTIVE: A9**
SAMPLE ANSWERS	
Part a: 2.25 points	

Sample Answer 1

Terr	Current Premium	Loss & ALAE	LR	Ind Rel Change	Indicated Rel	Adjusted Rel	Off-balanced Rel
A	272,250	200,000	0.7346	0.9462	.6*.9462=.5677	1	0.7236
B	387,200	312,000	0.8058	.8058/.7764=1.0379	1.1*1.0379=1.1417	1.3	0.9407
Total			0.7764				

1.1417/.5677=2.0111 > 1.3, so adjust rel.
Then off-balance factor =
(.6*.9*750+.6*1*150+1.1*.9*600+1.1*1*100)/(1*.9*750+1*1*150+1.3*.9*600+1.3*1*100)
=.7236

Sample Answer 2

Territory A Premium = 750*.6*.9*550+150*.6*1.00*550=272,250
Territory B Premium = 600*1.1*.9*550+100*1.1*1.00*550=387,200
Total Premium=659,450

	(1)	(2)	(3)	(4)
A	0.7346	0.9462	0.5677	0.7236
B	0.8058	1.0379	1.1417	0.9407
Total	0.7764			

(1)=LR=Loss/Prem
(2)=(1)/(1 Total)
(3)=Current Rel *(2)

1.1417/.5622=2.01
(4)=New Rel meeting Requirement
X*(.9*750+1*150)*550 + 1.3X*(.9*600+100)*550=659,450
453,750X+352,000(1.3X)=659,450
X=.7236

Sample Answer 3

Territory	Loss & ALAE	EP	LR	Relativity	Indicated Relativity
A	200,000	272,250	0.7346	0.946	0.5676
B	312,000	387,200	0.8058	1.038	1.1418
Total			0.7764		

Note that our indicated relativities don't satisfy the management request. Thus we'll cap Territory B relativity to 1.3*.5676=.7379. Now we just need to adjust the base rate to make this revenue-neutral:
Proposed premium= 659,450 =Base Rate*(.5676*(750*.9+150*1)+.7379*(600*.9+100*1))
Base Rate=$701.15, with relativities of .5676 for Territory A and .7379 for Territory B.

Sample Answer 4

Territory A Loss Ratio = 200000/((750*.9+150)*550*.6)=.7346
Territory B Loss Ratio = 312000/((600*.9+100)*550*1.1)=.8058
Overall Loss Ratio = 512000/(600*.9*1.1+100*1.1+750*.9*.6+150*.6)=.7764

Uncapped indicated relativity for territory A =.5677
Uncapped indicated relativity for territory B=1.1417
1.1417/.5677>1.3, so set territory B relativity to .78 (1.3x the current territory A relativity), and territory A relativity to .6.

Indicated Base Rate Change=
(600*.9*1.1+100*1.1+750*.9*.6+150*.6)/(600*.9*.78+100*.78+750*.9*.6+150*.6)-1 = 20.6%
Territory A Relativity Change = 0%
Territory B Relativity Change=.78/1.1-1 = -29.1%

Part b: .5 point

Sample Answer 1

Short term – As rates for Territory A increase and Territory B decrease, risks in A will leave the company. The company will attract more risks in Territory B since it is being subsidized by Territory A.

Long term – The company will write only in Territory B and rates will adjust to Territory B's level.

Sample Answer 2

Short term – Likely attract more unprofitable customers from Territory B as it is significantly underpriced and the company will lose/write fewer policies from the overpriced Territory A.

Long term – Loss ratio increases as the company experiences adverse selection.

Sample Answer 3

Short term – The company will still make money as it can cover the losses from Territory B with premium from Territory A.

Long term – The company will likely face adverse selection if a competitor is present.

Sample Answer 4

Short term – Territory A customers will be subsidizing Territory B customers.

Long term – Territory A customers will leave due to higher price and more Territory B customers will join the company due to lower price, leading to a deteriorating loss ratio.

Sample Answer 5

Short term – There aren't significant changes as it's a revenue neutral change.

Long term – Territory A policyholders are subsidizing Territory B so they're likely to non-renew. Territory B policyholders are paying less than they should so Territory B policyholders will buy from this insurer. As more Territory A policyholders leave and more Territory B policyholders come to the insurer, the insurer will be unprofitable.

Sample Answer 6

Short term – Territory A customers may change to a lower priced insurer and Territory B customers will switch to this insurer based on low rates.

Long term – This will continue to occur over the long term and eventually this insurer could become insolvent from inadequate pricing.

Sample Answer 7

Short term – The company will make a profit on Territory A policies and loss on Territory B policies.

Long term – The company will likely lose a larger portion of low risk policies from Territory A (which are overpriced) to competition and will keep underpriced Territory B policies. The company will need to raise rates to remain profitable.

Sample Answer 8

Short term – The relativity change will cause the insurer to write more policies in Territory B and fewer policies in Territory A due to adverse selection, but there can be financial balance in a short period.

Long term – The insurer's financial results will deteriorate due to the adverse selection.

Sample Answer 9

Short term – The change will be revenue neutral.

Long term – The company will lose business in Territory A (and gain business in Territory B) since it's overpriced and adverse selection will make the company unprofitable.

EXAMINER'S REPORT

Part a

Candidates were expected to know how to calculate rating differentials for territorial relativities and apply a cap to the relativities. To receive full credit, candidates needed to utilize the loss ratio method. Many candidates were able to correctly calculate the indicated relativities, but were unable to cap the relativities and apply a revenue-neutral offset factor.

Common mistakes included:

- Using a pure premium method to develop the indicated relativities, rather than the loss ratio method required by the question
- Incorrect calculation of premium by territory
- Incorrectly accounting for the maximum relativity difference
- Not applying the correct revenue-neutral off-balance factor

Part b

The candidate was expected to demonstrate an understanding of adverse selection and the conditions that may cause it. In order to receive full credit, candidates were required to evaluate the impact of the relativity changes on both Territory A and Territory B policyholders. The most common error made by candidates was failing to mention the impact on each territory. In addition, some candidates stated short term and long term effects that were not distinct and therefore only received partial credit.

QUESTION 10	
TOTAL POINT VALUE: 2.0	**LEARNING OBJECTIVE: A2**
SAMPLE ANSWERS	
Part a: 1.0 point	

Sample Answers for Graph 1

- The annual mileage is a good rating variable since there is a clear difference in the indicated relativity for each level (conveys the idea of "clear differentiation") or:
- The indicated relativities are CONSISTENT across all 3 years (conveys idea of "consistency" across years); this implies the rating variable is good

Sample Answers for Graph 2

- The +/- 2 standard error bars include the base relativity of 1.0 for each level, suggesting the 'mileage' variable may not be statistically significant and, therefore, not be a good rating variable
- The LR relativity is considerably above the indicated GLM relativity for the ">10,000" level, implying that "mileage" may be correlated with other exposure variables (the candidate may then argue the merits of this observation)

Sample Answers for Graph 1 or 2

- Since the first ("<2K") level contains far fewer policies than the other two levels, the actuary should consider combining it with the "2K-10K" level – and recasting the results with only two groups.

Part b: 0.5 point

Sample Answers (needed two arguments for full credit):

- Controllable: drivers have control over the number of miles driven in a year, so the 'mileage' variable is good with respect to this consideration
- Mileage is intuitive and proportional to expected loss
- Socially acceptable: This variable would not seem to violate any privacy concerns, so would be good from a social acceptability standpoint
- Subject to Manipulation: Drivers may lie about how many miles they drive, so this variable is subject to manipulation, an undesirable quality.
- No historical precedence – switching exposure bases could result in large premium swings
- Acceptable to regulators: This variable is widely used for personal auto and is largely considered to be acceptable to regulators, a good thing.

Note that this list is not exhaustive, and other reasonable answers were accepted provided they were adequately supported.

Part c: 0.50 point

Sample Answer 1

I would not recommend using the rating variable, as it does not appear to have statistical significance (graph 2), is expensive to verify and is subject to manipulation.

Sample Answer 2

I would include the rating variable given that graph 1 shows the levels to be clearly differentiated, "mileage" is easy to verify and proportional to loss, and does not violate any privacy concerns.

EXAMINER'S REPORT

Part a

Candidates were expected to have knowledge of strengths/weaknesses of rating variables and how the graphs may or may not reflect such strengths/weaknesses, as well as have an understanding of GLM output, including standard error considerations and comparison of GLM results to LR results.

In general, candidates scored well on this part. Common errors included:

- Misinterpreting the lines on graph 1 as "confidence intervals", when they are actually the results by year
- Making statements about either graph which are not relevant to the determination of whether the rating variable is "good/bad"
- Making unjustified conclusions about each level's credibility based on the relative number of exposures in each level

Part b

Candidates were expected to know desirable qualities of rating variables/exposures and whether "annual mileage" reflected these qualities.

In general, candidates scored well on this part. One common mistake was providing observations already made in part a. since the question asked for "two other criteria".

Part c

Candidates were expected to know how to make a final recommendation based on pros/cons of data analysis and operational/practical considerations.

In general, candidates scored well on this part. Common mistakes include providing explanations which were unclear or untrue (based on the graphical results) or which contradicted earlier statements made in parts a. or b.

QUESTION 11	
TOTAL POINT VALUE: 4	**LEARNING OBJECTIVES: A9, A10**

SAMPLE ANSWERS

Sample Answer 1

Increase avg premium 15%
Minimum premium $800
Current br 1250

Current average premium = 1250[1500(.75)(.8)+1500(1)(.8)+4000(.75)(1)+3000(1)(1)] / (1000 + 1500 + 4000 + 3000)
=$1012.50
Proposed avg premium = 1012.50(1.15) = 1164.375

Ignoring minimum premium for now

Proposed BR B
1164.375 = B[1500(.6/1.2)(.85)+1500(1.0)(.85)+4000(.6/1.2)(1.0)+3000(1.0)(1.0)]/10,000
1164.375 = B(.69125)
B = 1684.45

Minimum premium impact – only affects terr 1, <100k
Prior 1684.45(.5)(.85)(1500) = 1,073,835.90
Prop 800(1500) = 1,200,000
126,164.1

Off-balance factor = 1 + 126,164.1/(1164.375(10,000)) = 1.0108

New base rate 1684.45/1.0108 = $1666

Sample Answer 2

AOI	Terr	In-force exp	In-force Premium	Prop terr rel	Prop rebased	proposed premium prior to BR change
<100k	1	1500	1,125,000	0.85	.6/1.2 = .5	796,875
<100k	2	4000	3,750,000	1	0.5	4000*1250*1*1.5 = 2,500,000
>=100k	1	1500	1,500,000	0.85	1	1,593,750
>=100k	2	3000	3,750,000	1	1	3,750,000
		Total	10,125,000			8,640,625

% change before BR change = 8,640,625/10,125,000 – 1 = 1466
BR change to get +15% overall: 1.15/(1-.1466) – 1 = 34.76%
Proposed BR = 1250(1-.3476) = 1685

But this causes Terr 1 and AOI < 100 to be <800 minimum premium
1685*.85*.5 = 716

Proposed premium for AOI<100k, Terr 1 w/ 800 premium = 800*1500 = 1,200,000

This gives terr 1, AOI<100k a change of 1.2M/1.125M – 1 = 7.856
We need the rest of the proposed premium to equal 10,125,000(1.15) – 1,200,000 = 10,443,750 to achieve a 15% change.

So base rate change = 10,443,750 / (2.5M+1.593750M+3.75M) – 1 = 33.15%

Proposed base rate = (1.3315)(1250) = 1664

Sample Answer 3

AOI	Terr	In Force Exposure	AOI chg	terr chg	15% rate	New Ind Rate
<100k	1	1500	.5/.75 = .67	.85/.8 = 1.0625	1.15	610.94
>=100k	1	1500	1	1.0625	1.15	1221.875
<100k	2	4000	0.67	1	1.15	718.75
>=100k	2	3000	1	1	1.15	1937.5

Rebased AOI Ind = .5

AOI	Terr	Old Rates
<100k	1	750
>=100k	1	1000
<100k	2	937.5
>=100k	2	1250

Initial Proposed Chg before min prem
= [610.94(1500) + 718.75(4000) + 1221.875(1500) + 1437.5(3000)] / [750(1500) + 1000(1500) + 937.5(4000) + 3000(1250)]

=936,722.5 / 10,125,000
=.9814

At this level base rate = 1250(1.15) = 1437.5
But that's -1.859% chg overall
Adj to get 15%: 1.15/.9814 = 1.172
New base = 1684.75

AOI	Terr	New Adj Rate	Min Prem
<100k	1	715.897	800
>=100k	1	1432.0375	
<100k	2	842.375	
>=100k	2	1684.75	

Final chg = [800(1500) + 1432(1500) + 842(4000) + 1684(3000)] / 10,125,000
= 1.1624

Final Adj to BR = 1.15/1.1624
= .989

Final Base Rate = .989(1684.75)
= 1667

EXAMINER'S REPORT

Candidates were expected to be able to rebalance the new Amount of Insurance relativities to the base class. Candidates were expected to be able to calculate the current and proposed premiums and to correctly adjust the base rate for the proposed rate level change in addition to offsetting the base rate for the rating factor changes. Candidates needed to correctly identify that policies in Territory 1, AOI <$100,000 would be impacted by the implementation of the minimum premium. They needed to calculate the total proposed premium with and without the minimum premium and then to adjust the base rate for the difference.

Common mistakes included:

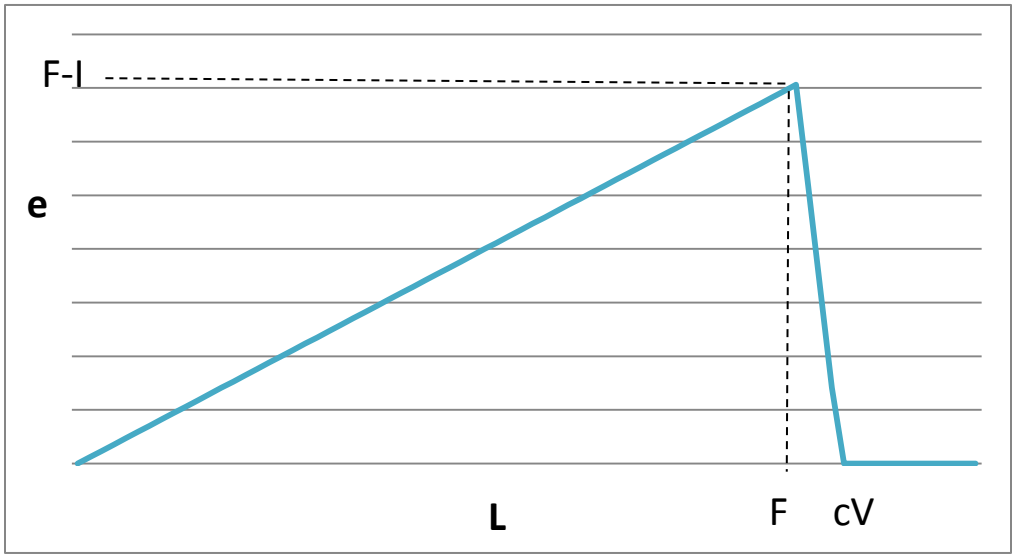
- Neglecting to rebalance the new Amount of Insurance relativities to the base class
- Correctly determining the impact of the rating factor changes but accounting for it incorrectly when adjusting the base rate
- Using the prior base rate to calculate the minimum premium impact

QUESTION 12	
TOTAL POINT VALUE: 2.5	**LEARNING OBJECTIVE:** A11
SAMPLE ANSWERS	
Part a: 1.25 points	

Sample Answer 1

Required AOI = (750k)(.85) = 637.5k
Actual AOI = 600k
Max = 600k (1 – 600/637.5) = 35,294

Sample Answer 2



Where:
L = loss
e = penalty = L - I
c = coinsurance requirement = 0.85
V = value of property = 750k
F = face value of policy = 600k
I = indemnity = max(L * F/cV, L)

Part b: 1.25 points

Sample Answer 1

80% of unif distr loss between 0-600k -> avg = 300k
20% of unif >600k
exp loss = (.02)(.3)(600k) + (.02)(.7)*[(.8)(300k) + (.2)(600k)]
= 8,640
Rate per $1000 = 8460/600 = 14.40

Sample Answer 2

Frequency = .02

Severity (uncapped)	Probability
0-600	600/750 * .7 = .56
600-750	1 - .3 - .56 = .14
750	.3

Avg severity = 300(.56) + 600(.14) + 600(.3) = 432 (000)
Pure Premium = .02 x 432 = 8640
Rate per $1000 = 8640 / (600000/1000) = $14.4

EXAMINER'S REPORT

Candidates were expected to know what the coinsurance penalty function looks like, how to calculate the maximum penalty and when it occurs, when the penalty drops to zero, and how to calculate rate given a piecewise loss distribution function.

Candidates generally did well on this question, particularly on part a.

Part a

Candidates were expected to know the maximum coinsurance penalty and at what loss value it occurs as well as the loss value at which the coinsurance penalty drops to zero.

For full credit candidates needed to draw and properly label axes, show and label the above points on the graph, and connect the points with a straight line.

Common errors included:

- Not labeling or mislabeling axes
- Incorrectly calculating or not labeling both X and Y values for points of maximum and zero penalty
- Drawing a graph that did not intersect the origin

Part b

Candidates were expected to know how to find limited average severity of both uniformly distributed and point mass probability losses at the given Amount of Insurance, how to combine point mass and uniformly distributed LAS to determine the total LAS, and how to incorporate frequency to determine Pure Premium.

Common errors included:

- Not capping losses, or not capping at the amount of insurance
- Ignoring some part of the loss distribution – either the point mass, or the portion of the uniform distribution above or below the AOI
- Not dividing by AOI/1000

EXAM 5 SAMPLE ANSWERS AND EXAMINER'S REPORT

QUESTION 13	
TOTAL POINT VALUE: 1	**LEARNING OBJECTIVE:** A11

SAMPLE ANSWERS

Standard Premium

Minimum = .6(813,546) = 488,127.6
Maximum = 1.4(813,546) = 1,138,946.4

Basic conversion factor

r = (b + c*A) * t subject to max and min

losses tax mult.

At 18 months:
r = (343,137 + 1.08(115,000)) * (1.03) = 481,357.11 → This is less than the minimum, so the minimum premium will be charged. 488,127.6

At 30 months:
r = (343,137 + 1.08(151,800)) * 1.03 = 522,293.43 → between min. and max., so this will be the premium

EXAMINER'S REPORT

The candidate was expected to calculate the retrospective premium at two evaluation points using the information given in the question. Calculation of the retrospective premium includes the correct calculation of converted losses at each evaluation. Furthermore, the candidate was expected to calculate and apply the minimum and maximum retrospective premiums.

In general, candidates performed well on the calculation components of the problem. Most identified and used the correct components of the retrospective premium formula.

Candidates commonly lost credit on the following items:

- Referencing but not deriving or stating minimum or maximum retrospective premiums.
- Incompletely determining the final retrospective premium by only stating that the preliminary premium is above the minimum premium or below the maximum premium.
- Incorrect preliminary retrospective premium formula.
- Incorrectly calculating converted losses at 30 months to be the sum of the limited losses at 18 and 30 months (and not stating the assumption that losses are incremental).
- Deriving minimum and maximum premium using basic premium instead of standard premium.

EXAM 5 SAMPLE ANSWERS AND EXAMINER'S REPORT

QUESTION 14	
TOTAL POINT VALUE: 1.5	**LEARNING OBJECTIVE: B1**

SAMPLE ANSWERS

Part a: 1 point

Sample Answer 1

Since Reported CDFs for A and B are pretty close to each other and State A EP is significantly lower than that of B, combining A and B would produce a reliable estimate than separating the two states.

Sample Answer 2

You want a stable mix of business, here we see that policy A have a different policy limit and increases a lot year over year in volume. B is neutral or decreasing. Because of that the combined mix of business is not stable.

Sample Answer 3

State A and State B are growing at different rates. Since State A is growing rapidly, the average accident date of State A's recent AYs' loss is later than historical and later than State B. Combining them will lead to an inaccurate result.

Part b: 0.5 point

The severity would be increasing because State A is growing and State B is shrinking, and because State A has a higher policy limit than State B.

EXAMINER'S REPORT

Part a

Candidates were expected to offer robust arguments for and against combining the two states' data, demonstrating an understanding of credibility, homogeneity, or impacts of the shifting mix between states.

Candidates receiving less than full credit typically offered incomplete discussions. Examples of incomplete discussions include simply listing one reason for or against combining without elaboration.

Part b

This part required candidates to speak to the observed trend in the combined states' severity due to a mix shift toward higher limits.

Some candidates recognized that combined severity would be higher than state B severity due to the higher limits in state A, but did not speak to the growth in state A. Others simply stated that the combined severity would be higher than state B on its own and lower than state A on its own, which did not directly answer the question.

QUESTION 15	
TOTAL POINT VALUE: 1.25	**LEARNING OBJECTIVE: A4, B3**

SAMPLE ANSWERS

Part a: 0.75 point

Sample Answers (three required for full credit)

- # of claims over threshold
- Size of claim relative to policy limits
- Size of claims relative to reinsurance limits
- Credibility of data above the threshold
- Credibility of large claims
- Percentile of loss distribution
- The large loss threshold may vary by line of business (for example, property vs. liability)
- Industry benchmark
- External data relevant to the large loss threshold
- Discussion with claims department on large claims
- Amount of total Losses. A large loss will have a much more severe effect on a book of business with a total of $10M total losses as compared to a book with $1B.
- Stability vs. Responsiveness of overall rate indication from year to year.
- % of policy limits. If your book of business is composed of different coverages or limits by policy.

Part b: 0.50 point

Sample Answer 1

Large claims will distort the development technique. If LDFs are computed using historical data without large claims, then the historical LDFs will be applied to large claims in immature accident years causing overstated unpaid claims.

The B-F method will be less impacted by large losses than the development technique since B-F uses a credibility weighting between the expected claim method and the development method. The expected claim method will not be impacted by large losses, therefore the impact to B-F unpaid claims will be lower than the development technique.

Sample Answer 2

Large claims could cause a leveraging effect to LDFs. This will result in high LDFs being applied and resulting in overstated unpaid claims.

The B-F unpaid claims will not be impacted because unpaid claims are based on an a priori estimate of ultimate claims.

Sample Answer 3

Development technique is more responsive to large claims as LDFs are based off historical data. Higher LDFs will apply to higher losses resulting in overstated unpaid claims.

Since the B-F method is a credibility weighting of the development technique and an a priori estimate, it will be impacted in the same direction as the development technique, but to a lesser extent.

EXAMINER'S REPORT

Part a

Candidates were expected to know three considerations when determining a large loss threshold. Most candidates received partial credit for this part.

Common answers that did not receive credit were more procedural rather than considerations, such as mentioning you need to trend or develop your losses. In addition, many responses were too general/not enough explanation, such as mentioning credibility of data, effect on ultimate losses, or when the data becomes erratic.

Part b

Candidates were expected to know that large losses would distort the development technique, while having less of an impact on Bornhuetter-Ferguson. A basic explanation on why each technique is affected was expected.

In general candidates did well, with the majority earning full credit on this part of the question. Common answers that did not receive full credit include:

- Answers that simply stated that a method would or would not be distorted without any further explanation.
- Not mentioning the credibility weighting of expected claims/a priori estimate for B-F.
- Not comparing or incorrectly comparing the relative effects on each method.
- Stating that unpaid claims would be understated without any justification (answers mentioning understatements were given full credit if the process was explained).
- Incorrectly listing/using the BF formula for unpaid/unreported claims.

QUESTION 16

TOTAL POINT VALUE: 2.75 | **LEARNING OBJECTIVE: B1**

SAMPLE ANSWERS

Part a: 1.75 points

(i). Report year reported claims net of any recoveries

RY	12	24	36
2012	6,000	9,000	9,000
2013	11,000	3,000	
2014	3,000		

(ii). Accident year paid claims net of any recoveries

AY	12	24	36
2012	2,000	9,000	12,000
2013	0	0	
2014	0		

Part b: 1.0 point

One of the items from each section was needed to obtain credit. Note that this list of sample answers is not exhaustive, and other reasonable answers were accepted provided they were adequately supported.

i.

Report Year Advantage

- Claim counts are fixed at the end of the year
- Useful when estimating unpaid claims for claims-made policies
- Only settlement lag, no report lag in estimates
- RY is appropriate when there's a change in social or legal climate that causes severity to be correlated with reported date more than accident date
- Easy to see changes in laws which will predominantly show up when a claim is reported
- More stable development patterns

Report Year Disadvantage

- Does not consider pure (total) IBNR (not useful when estimating IBNYR)
- The disadvantage is that there is no pure IBNR, so report year can be used to estimate IBNER but not IBNR
- Not as commonly used, less benchmark data available

ii.

Accident Year Advantage

- It is a common aggregation method with a lot of benchmarks available
- There are many industry factors compiled on AY so can help supplement analysis
- Easy to understand and collect data
- Data readily available sooner than policy year aggregation
- Useful if there is a change in the legal or economic environment
- Valuable when there's a major claim event (catastrophe, weather, or large loss events)

Accident Year Disadvantage

- Provides an imperfect match between losses and exposure/premium
- Includes claims from policies at different rate levels
- It may mask the changes in policy limits (deductibles) that could have an effect on development patterns
- If there has been a shift in mix of business, method won't be accurate and may correlate better to policy year

EXAMINER'S REPORT

Part a

Candidates were expected to correctly list the aggregated values in a triangle of all 4 claims for both report year reported claims and accident year paid claims

Common errors include forgetting to subtract recoveries, creating an accident year reported triangle (instead of paid), forgetting to put the 36 month evaluation where applicable, assigning individual claims to the wrong accident/report year, calculating incremental instead of cumulative data, and not correctly calculating the appropriate reported or paid amounts.

Candidates generally did well on this part, with many receiving full credit.

Part b

Candidates were expected to list an advantage and disadvantage of report and accident year data aggregation methods.

Candidates struggled with this part. Common errors included: Listing vague advantages/disadvantages that are true of all or most data aggregation methods, listing advantages/disadvantages of reported vs paid triangles, defining report or accident year (but listing no advantages or disadvantages), misunderstanding of report year methodology, and listing incomplete or inaccurate statements.

QUESTION 17

TOTAL POINT VALUE: 2.25 | **LEARNING OBJECTIVE: B2, B3**

SAMPLE ANSWERS

Part a: 0.75 point

Age-to-Age Factors				
Accident Year	12-24	24-36	36-48	
2011	1.169	1.063	1.050	
2012	1.185	1.072		
2013	1.198			
Derivation of Age-to-Ultimate Factors				
Accident Year	12-24	24-36	36-48	To Ult
Volume-weighted	1.185	1.068	1.050	
CDF	1.328	1.121	1.050	1.000

2014 Projected Ultimate = 931 x 1.328 = 1,237

Part b: 1.5 points

AY/CY	OLEP	Trended Ult. Loss	ECR
2011	1300	$942 \times 1 \times 1.04^3 = 1059.62$	81.5%
2012	1325	$963 \times 1.050 \times 1.04^2 = 1093.65$	82.5%
2013	1350	980 x 1.121 x 1.04 = 1142.52	84.6%

There is an increasing trend in the loss ratios. Therefore, I will select the average of the latest 2 years to be more responsive to the current condition while accounting for stability and credibility. (82.5% + 84.6%)/2 = 83.6%

Ultimate Claims = 0.836 * 1,375 = $1,149.50

EXAMINER'S REPORT

This question tested two common techniques. Candidates scored well on this problem.

Part a

The candidate was expected to know how to calculate age-to-age factors and make a selection for each age-to-age period. Candidates were then expected to use this to compute an age-to-ultimate factor and apply that to a provided reported loss to calculate an ultimate loss. Acceptable alternative answers included using a volume weighted average, a simple average of the factors, or a geometric average of the factors. Credit was also awarded if the candidate noted an increasing trend from accident year to accident year and selected an average using the latest two years or just the latest year.

Common errors involved calculation errors and over-complicating the question. For example, some candidates attempted a Berquist-Sherman technique to answer the question even though the question did not provide sufficient data for this method.

Part b

The candidate was expected to know the expected claim technique, select appropriate years to use in the estimate, and calculate an expected loss ratio. The candidate was then expected to apply this loss ratio to a provided earned premium in 2014 to get an ultimate loss amount for 2014. Alternative loss development factors were accepted provided they were calculated in part a.

To earn full credit, the candidate was also expected to justify the selection of expected loss ratio. Credit was awarded to any justification which the data supported.

Candidates generally performed well on this part. The most common mistakes included

- Failing to state an acceptable justification
- Incorporating 2014 into the estimate
- Failing to correctly incorporate the 4% claims trend
- Failing to correctly incorporate the loss development factors calculated in part a
- Calculation errors

QUESTION 18

TOTAL POINT VALUE: 1.5 | **LEARNING OBJECTIVE: B3**

SAMPLE ANSWERS

Part a: 1 point

Sample Answer 1

AY	12-24	24-36	36-48
2011	1.538	1.200	1.063
2012	1.075	1.186	
2013	1.523		

Justification

12-24	This factor looks very weird, going to assume abnormal and exclude
24-36	Straight average, 2yr data, can't tell anything

Selection	1.531	1.193	1.063
CDF	1.941	1.268	1.063

Ultimate 118,450 = 69,000 + .51 * 200,000 * (1 - 1/1.941)

Sample Answer 2

AY	12-24	24-36	36-48
2011	1.538	1.200	1.063
2012	1.075	1.186	
2013	1.523		

Justification

12-24	I don't like the way that AY12's 12-24 month LDF is so much smaller than the other two, but removing it would be throwing out 1/3 of a small data set. So I selected a straight average.
24-36	[none]

Selection	1.379	1.193	1.063
CDF	1.748	1.268	1.063

Ultimate 112,600 = 69,000 + .51 * 200,000 * (1 - 1/1.748)

Sample Answer 3

AY	12-24	24-36	36-48
2011	1.538	1.200	1.063
2012	1.075	1.186	
2013	1.523		

Justification

12-24 Excluding AY 2012 due to what appears to be an odd anomaly in the data. Very low reported losses compared to what we'd expect and low LDFs.

24-36 [implied from above exclusion]

Selection	1.531	1.200	1.063
CDF	1.952	1.276	1.063

Ultimate 118,720 = 69,000 + .51 * 200,000 * (1 - 1/1.951)

Part b: 0.5 point

Sample Answer 1

The BF Method can be thought of as a credibility weighting between the loss development method and expected claims method. When we have a CDF < 1 we obtain a value of Z = 1/CDF >1. This is unacceptable in theory. In practice it is common to limit LDFs to one and use the BF method.

Sample Answer 2

The BF technique is a credibility weighted average of the development technique and expected claims technique. If CDFs < 1 then the % Reported >1 which violates the first rule of credibility. You can still use the method as is, limit your CDFs to 1 or use a different method.

Sample Answer 3

It still can be applicable if you cap the CDFs at 1. Although less common and less intuitive you could use the BF method as is you would just have weird % reported and % paid. Another option is to use another method.

EXAMINER'S REPORT

Part a

The candidate was expected to know how to calculate ultimate losses using the BF method given a reported loss triangle, the earned premium for the year, and an expected loss ratio. The candidate was also asked to justify all selections, which in the context of this question, applies mainly to their selection of LDFs at each age.

To obtain full credit, candidates were expected to do the following:

- Calculate the loss development factor triangle
- Provide some reasonable justification for their LDF selections
- Calculate the CDF
- Apply the CDF using the BF method to calculate ultimate loss

The most common mistake candidates made was in their justification, either by just restating the method used or by omitting any kind of justification. Credit was given for a wide variety of answers as long as the justification supported the selection.

In general, candidates performed very well on this part of the question.

Part b

The majority of the candidates who answered this question performed well. The most common answer was discussing how the credibility weight interpretation of the BF method was no longer applicable and how this should be handled. Candidates could argue the BF method was no longer applicable, was applicable as is, or was applicable with adjustments provided the response was well supported.

A common mistake was mentioning that because LDFs <1 cause negative IBNR the BF method should not be used. This is not unique to the BF method and further discussion was needed for full credit.

QUESTION 19	
TOTAL POINT VALUE: 3.50	**LEARNING OBJECTIVE: B3, B8**

SAMPLE ANSWERS

Part a: 1 point

Sample Answer 1

1. I would assume the paid 60 to ult development is not 1.000 as the paid at 60 is 11,000 while reported at 60 is 11,500.
2. The expected claims ratio seems too high based on the historical data. Only AY 2014 has an ECR near 0.65. Lower the ECR.

Sample Answer 2

1. The paid claims to reported claims triangle shows a significant decrease in ratio at 12 months in AY 2014. This suggests possibly a slowdown in settlement rates or increase in case reserve adequacy. It seems more likely to be an increase in case reserve adequacy given that reported claims increased sharply in AY 2014. While paid claims remained at levels similar to prior years. Therefore, I would suggest adjusting for changes in case reserve adequacy.
2. Also the expected claims ratio of 65% for the B-F seems too high. In no year other than Rpt'd for AY '14 does the ultimate loss ratio from any of the methods reach 65%. A 60% ECR seems more reasonable.

Part b: 1.50 points

Sample Answer 1

1. I would select a paid tail factor of 11,500/11,000 = 1.045
2. Based on review of historical data select ECR of 60%

Rptd Dev Ultimate (000) = 22,900 (unchanged)
Paid Dev Ultimate (000) = 17,424 * 1.045 = 18,208
Rptd B-F Ult (000) = 10,000 + 30,000 * 0.60 * (1-1/2.29) = 20,140
Paid B-F Ult (000) = 1,800 + 30,000 * 0.60 * (1-1/(9.68*1.045)) = 18,021

Sample Answer 2

I am assuming that the AY '14 reported claims are increased due to an increase in case reserve adequacy of a factor of 10,000/8,000 = 1.25
Rptd Dev = 10,000 * 2.29 / 1.25 = 18,320
Pd Dev = 17,424 (unchanged)
Rptd BF = 10,000 + 30,000 * .6 * (1–1/(2.29/1.25)) = 18,175
Pd BF =1,800 + 30,000 * .6 * (1-1/9.68) = 17,940

Part c: 1 point

Sample Answer 1

This selection seems too high. It appears as though there is a large reported unpaid claim in AY 14 @ 12 or there is an increase in case res. adequacy. I'll assume this is due to an inc. in case res. adequacy which would mean the reported development method and the reported B-F method overstate ultimate claims. (B-F reported overstates by less than reported development) If this is the case I would rely on the paid development and paid B-F estimates of ultimate which are close to one another and appear stable despite highly leveraged age to ultimate factor @ 12-Ult.

Sample Answer 2

The estimate of 20,149 is too high since it exceeds all of the revised estimates in b of this question that take into account the changes in case reserve adequacy mentioned in a. A better estimate would be the average of the four methods' results in b which would be 17,965.

Sample Answer 3

A lot of reported loss in 2014 but stable paid claims since last several years at 12 age. Maybe a large loss In AY 2014. Therefore I wouldn't give any weight to likely overstated Rep. Dev. Method. Cumulative paid dev factor of 9.68 (or 10.1156) are leveraged. I would select revised BF of 20,140 in b to account for what seems to be a large reported claim in 2014. As a result, actuary's selection of 20,149 is reasonable.

EXAMINER'S REPORT

Overall, very few candidates received full credit. Most candidates who attempted the question received at least some partial credit.

Part a

Candidates were expected to recognize potential weaknesses in assumptions of the methods and to select and justify new assumptions that would improve the validity of the method's results.

Common errors included not providing justification for the newly selected assumptions, stating that claims ratio trend is increasing solely because AY 2014 is high, and stating that the B-F expected claims ratio should increase solely because AY 2014 is high at 12 months.

Part b

Candidates were expected to know how to update the four methods provided in the question given the assumption that the candidate made in part a.

Common errors included incorrect B-F formulas, calculation of IBNR instead of ultimates, and not

updating all methods for the changes in assumptions.

Part c

Candidates were expected to know how to compare the actuary's original estimate to that of the results of the methods in part b. Candidates were also expected to take note of the change in the ratio of paid to reported claims at 12 months and evaluate the validity of the methods.

Common errors included:

- Stating that the actuary's estimate was too high or too low without additional discussion. The question required the candidates to provide a full assessment of the reasonableness of the estimate.
- Not noticing the change in paid/reported claims ratio.
- Assessing the estimate from part b rather than the actuary's estimate.

QUESTION 20	
TOTAL POINT VALUE: 2.25	**LEARNING OBJECTIVE: B3**

SAMPLE ANSWERS

Part a: 0.5 point

Sample Answer 1

The F/S technique can certainly be used for GL since the true GL severities may not be known for a while, the historical severity is a good starting point. With good indications of frequency early on, the F/S technique allows for justifiable estimates of ultimate claims and unpaid claims.

Sample Answer 2

For a large GL insurer, a F/S technique could be appropriate since it is a long-tailed line and trends on severity could make it a better estimate. Also, these claims are usually a low frequency high severity type of business, thus it may make more sense to analyze frequency and severity separately.

Part b: 1.25 points

Sample Answer 1

This would increase our frequency of claims and decrease our average severity since we are adding a lot of small claims into our data. It would not be appropriate to analyze this data without first adjusting all prior data to be on the same basis as the current. Since this is not possible because our small claims have been censored by the large deductible, we cannot know our new average severity and new frequency.

Sample Answer 2

The average severity will increase since claims will be higher than before with a smaller deductible. Frequency will increase as well since former losses under the large deductible may be above the small deductible. The F/S technique would be appropriate if prior loss information below the deductible was available so that the historical data could be re-stated to the new deductible level.

Part c: 0.5 point

Sample Answer 1

Estimate unpaid claims using policy year instead of accident year to separate policies with smaller deductible and adjust prior policy years for the change in deductible.

Sample Answer 2

The use of expected claims or B-F method is preferable until more data with the small deductible option is collected since it does not rely solely on historical development patterns. The actuary can select an appropriate expected claim ratio based on judgement or industry data.

Sample Answer 3

An improvement would be to re-state historical data to new deductible level if prior claim data below the large deductible exists and then use the F/S method since applying the F/S method on the current data would yield incorrect estimates.

EXAMINER'S REPORT

Part a

Candidates were expected to know that the frequency-severity technique works well for long-tailed lines as well as the reasons why. They also needed to know GL is a long-tailed line.

Candidate results were mixed. Many candidates thought that the frequency-severity technique worked only for short-tail lines. However, the text states that frequency-severity is appropriate for all lines of business but is more often used for long-tail lines.

Those getting partial credit generally did not provide a full explanation of why the frequency-severity technique is appropriate for general liability.

Part b

Candidates were expected to know how and why the deductible change would individually impact frequency and severity. Candidates would also be expected to know that this would violate a key assumption of the frequency-severity technique unless an appropriate adjustment was made.

Candidates performed well on this part. Candidates receiving less than full credit did not fully explain why both frequency and severity would change.

Part c

Candidates were expected to recommend an improvement and explain why it would improve the estimate.

Candidates scored well on this part. The most common error was not justifying why their proposed recommendation was an improvement.

QUESTION 21

TOTAL POINT VALUE: 2.0 | **LEARNING OBJECTIVE: B5**

SAMPLE ANSWERS

Part a: 1.5 points

Cum. reported claim counts
AY 12-24 24-36 36-ult
2012 1.5 1.333
2013 1.504
Sel avg 1.502 1.333 1
Age to ult 2.002 1.333 1

AY Ult Counts
2012 1000 x 1 = 1000
2013 865 x 1.333 = 1153
2014 800 x 2.002 = 1602

AY Disposal Rates
12 24 36
2012 .3 .5 .875
2013 .304 .694
2014 .468

Since there is a jump in disposal rates for the latest diagonal, there seems to be an increase in settlement rates, so the Berquist-Sherman paid claims development adjustment would be appropriate.

Part b: 0.5 point

Severity decreasing for 2014 combined with closed counts/closure rates increase for 2014 violates the assumption of the paid Berquist Sherman that a higher % of closed counts corresponds to a higher % paid claims. The paid Berquist Sherman adj is inappropriate here and would distort development pattern. This could indicate instead a switch to closing small claims instead of large ones.

EXAMINER'S REPORT

Part a

Candidates were expected to know how to calculate disposal rates and understand when the Berquist Sherman method should be used. In order to receive full credit, candidates must accurately develop reported ultimates, including the calculation of LDFs, and correctly use the closed claims triangle and ultimate reported claims to calculate a disposal rate triangle. Candidates must then recognize the increase in disposal rates and state that the Berquist

Sherman method is appropriate given the increase.

Many candidates simply divided the closed triangle by the reported triangle to calculate disposal rates. This is not the recommended method of calculating disposal rates. Also, some candidates calculated ultimate claim counts using the closed claim triangle.

Part b

Candidates were expected to make the connection between the increase in disposal rates and decrease in paid severity on closed claims. In order to obtain full credit, candidates were expected to point out the severity change and the claims handling process that could have led to that change, and describe what assumption of the Berquist-Sherman method was violated.

Many candidates simply stated that severity had decreased without describing why that violated the Berquist Sherman method. This is important, as severity trends can be accounted for in the method, but a shift in claim handling cannot.

QUESTION 22	
TOTAL POINT VALUE: 2	**LEARNING OBJECTIVE: B3, B4, B5**
SAMPLE ANSWERS	
Part a: 0.5 point	
Sample Answer 1 Early maturities are highly leveraged. Use BF Method. Sample Answer 2 Claims at early maturities will be volatile, which can cause incorrect estimates. Expected claim method can be used instead.	
Part b: 0.5 point	
Sample Answer 1 Overstates estimation based on historical claims. Use report year data as it will address the issue. Sample Answer 2 It would cause lower true CDF than historical. To mitigate the issue use a F-S technique and modify the severity.	
Part c: 0.5 point(s)	
Sample Answer 1 Probably will be more development in later periods since it will take longer for losses to reach deductible, as well as large losses more likely settled later. Restate all claims at new deductible levels to mitigate effect. Sample Answer 2 Mix of business will change after the higher deductibles. On average, insurer will pay less and so development technique based on historical data will overestimate. Policy Year data should be used to neutralize or isolate the change.	
Part d: 0.5 point(s)	
Overstates estimation, CDF developed based on historical data will be higher than actual. Use B-S to account for change.	

EXAM 5 SAMPLE ANSWERS AND EXAMINER'S REPORT

EXAMINER'S REPORT

Part a

Candidates were expected to know how the development technique worked, that the development would be leveraged, and what alternative methods could be used to mitigate this.

Candidates generally scored well on this part. One common error was to say that development would understate as you wouldn't have enough data to estimate the tail, and you needed to use industry data or a curve to fit a tail. This answer was given partial credit if they included both the impact and response, but not full credit because it does miss a key component of the problems with the development technique (LDF would still be leveraged), and thus was not a complete answer.

Part b

Candidates were expected to know how tort reforms would impact development and what alternative methods could be used. They were also expected to know that decreasing severity would shorten development, factors based on history would overstate the analysis, and what alternative methods could be used to mitigate this.

Candidates struggled with this part. In particular, candidates generally had difficulty explaining how to adjust the reserve analysis in response to the change. Common errors include:

- Suggesting the use of the BF method, which would be inappropriate because the changing severity would also impact the % unreported
- Suggesting restating claims at lower severities; however, it's not clear how the tort reforms would impact individual claim development

Part c

Candidates were expected to know what impact a change to deductible would have on losses, reporting patterns, and how to mitigate it.

Candidates struggled with this part. In particular, candidates generally had difficulty articulating the impact the change would have on the reserve analysis.

Part d

Candidates were expected to understand that increase in settlement meant speed of up development and what impact that would have on our estimate, as well as how to respond to it. Candidates were expected to answer that the current approach would overstate estimates, and that the B-S method was most appropriate.

Candidates generally scored well on this part. One common mistake was to assume only paid-loss patterns would shift, but reported-loss patterns would be unaffected. This was not reasonable given the information in the problem as paid losses are a component of reported losses.

EXAM 5 SAMPLE ANSWERS AND EXAMINER'S REPORT

QUESTION 23

TOTAL POINT VALUE: 1.25 | **LEARNING OBJECTIVE: B6**

SAMPLE ANSWERS

Part a: 0.75 point

Yr	(1) Net Ult After Stop Loss (000)	(2) Rep After Stop (000)	(1) - (2) IBNR net of all reins
12	1,475	1,450	25,000
13	1,500	1,500	0
14	1,500	1,400	100,000
	min(net ult XOL, stop limit)	min (rep net XOL, stop)	total = 125,000

Part b: 0.5 point

Yr	(3) Net Ult After Stop Loss (000)	(4) Pd After Stop (000)	(3) - (4) Unpd net of all reins
12	1,475	1,200	275,000
13	1,500	1,200	300,000
14	1,500	1,000	500,000
		min (pd net XOL, stop)	total = 1,075,000

EXAMINER'S REPORT

Part a

The candidate was expected to know how to calculate IBNR while taking into account the reinsurance agreements.

Most candidate who answered this part scored well. A common mistake was to forget to apply the stop loss limit and ending up with a negative IBNR for 2013.

Part b

The candidate was expected to know how to calculate the unpaid claims while taking into the reinsurance agreements.

Candidate's performance was mixed on this part. A common mistake was using Net Ultimate Claims Estimate instead of the Net Ultimate Claims Cost (after applying the Stop Loss Limit) when calculating the Net Unpaid Claims.

QUESTION 24

TOTAL POINT VALUE: 3.25 | **LEARNING OBJECTIVE: B3, B8**

EXAM 5 SAMPLE ANSWERS AND EXAMINER'S REPORT

SAMPLE ANSWERS

Part a: 1.5 points

Sample Answer 1

Paid ALAE to Paid Loss Ratios (Paid ALAE / Paid Loss)
AY 12 24 36 48
2011 10.0% 20.0% 30.0% 36.0%
2012 10.0% 20.0% 30.0%
2013 10.0% 20.0%
2014 15.0%

Paid ALAE to Paid Loss Age-to-Age Factors
AY 12-24 24-36 36-48
2011 2.0 1.5 1.2
2012 2.0 1.5
2013 2.0

12 24 36 48
ATA: 2.0 1.5 1.2 1.0
ATU: 3.6 1.8 1.2 1.0

Estimated Ultimate ALAE/Loss Ratio
2012: 30.0% * 1.2 = 36.0%
2013: 20.0% * 1.8 = 36.0%
2014: 15.0% * 3.6 = 54.0%

Estimated Ultimate ALAE
2012: 1,768 * 36.0% = 636.50
2013: 2,356 * 36.0% = 848.20
2014: 2,945 * 54.0% = 1590.30

Sample Answer 2

Paid ALAE to Paid Loss Ratios (Paid ALAE / Paid Loss)
AY 12 24 36 48
2011 10.0% 20.0% 30.0% 36.0%
2012 10.0% 20.0% 30.0%
2013 10.0% 20.0%
2014 15.0%

Paid ALAE to Paid Loss Age-to-Age Factors
AY 12-24 24-36 36-48
2011 2.0 1.5 1.2
2012 2.0 1.5
2013 2.0

12 24 36 48 ATA: 2.0 1.5 1.2 1.0 ATU: 3.6 1.8 1.2 1.0 Estimated Ultimate ALAE/Loss Ratio 2012: 30.0% * 1.2 = 36.0% 2013: 20.0% * 1.8 = 36.0% 2014: 15.0% * 3.6 = 54.0% Since AY 14 ultimate ratio is much higher than historical, I will judgmentally select a more reasonable estimate of 36%. I assume 2014 is an outlier. Estimated Ultimate ALAE 2012: 1,768 * 36.0% = 636 2013: 2,356 * 36.0% = 848 2014: 2,945 * 36.0% = 1060
Part b: 1.25 points
Sample Answer 1 Additive Age-to-Age of ALAE to paid ratios AY 12-24 24-36 36-48 2011 10.0 10.0 6.0 2012 10.0 10.0 2013 10.0 12 24 36 48 ATA: 10.0 10.0 6.0 0.0 ATU: 20.6 10.6 6.0 0.0 Estimated Ultimate ALAE Ratio 2012: 30.0% + 6.0% = 36.0% 2013: 20.0% + 16.0% = 36.0% 2014: 15.0% +26.0% = 41.0% Estimated Ultimate ALAE 2012: 1,768 * 36.0% = 636.50 2013: 2,356 * 36.0% = 848.20 2014: 2,945 * 41.0% = 1,207.50 *Sample Answer 2* Additive Age-to-Age of ALAE to paid ratios

AY 12-24 24-36 36-48
2011 10.0 10.0 6.0
2012 10.0 10.0
2013 10.0

12 24 36 48
ATA: 10.0 10.0 6.0 0.0
ATU: 20.6 10.6 6.0 0.0

Estimated Ultimate ALAE Ratio
2012: 30.0% + 6.0% = 36.0%
2013: 20.0% + 16.0% = 36.0%
2014: 15.0% +26.0% = 41.0%
Since AY 14 ultimate ratio is much higher than historical, I will judgmentally select a more reasonable estimate of 36%. I assume 2014 is an outlier.

Estimated Ultimate ALAE
2012: 1,768 * 36.0% = 636
2013: 2,356 * 36.0% = 848
2014: 2,945 * 36.0% = 1,060

Part c: 0.5 point

Sample Answer 1

Select estimate of 1,207,450 based on additive approach. CDF for AY 14 in multiplicative approach (3.6) is highly leveraged. Additive estimate is more stable at earlier maturities.

Sample Answer 2

If the change [in AY 14's paid to paid ratio relative to historical ratios] is not due to changes in our claims settlement rate, the multiplicative approach will be more responsive. Thus, I will select answer a: 1,590,300 for AY 2014.

Sample Answer 3

Since 2014 has a high ratio at 12 months (15% compared to 10% all other years) and is immature, select the stable ALAE/claims ratio of 36% that 2012-2013 have in part b. 2014 ultimate ALAE = .36 * 2,945 = 1,060.

Sample Answer 4

I would select [the ALAE ratio of 36% for AY 14] by treating the spike in most recent paid to paids

as noise given its inconsistency with prior years.

Sample Answer 5

Select ALAE that would result from using an ALAE to loss ratio of (.54 + .36)/2 to balance responsiveness and stability.

EXAMINER'S REPORT

Part a

The candidate was expected to know how to use paid ALAE and paid loss triangles to calculate paid ALAE to paid loss ratio triangles.

The candidate was expected to know how to calculate multiplicative development factors from paid ALAE to paid loss triangles and apply those factors to determine ultimate ALAE to loss ratios by accident year.

The candidate was expected to know how to apply ultimate ALAE to loss ratios to ultimate loss to determine estimates of ultimate ALAE by Accident Year.

Common errors included calculating ultimate ALAE for only AY 2014, applying ultimate ALAE/loss ratio to paid loss rather than to ultimate loss, failing to use the development data from AY 2011, and developing paid ALAE rather than the paid ALAE/paid loss ratio. In order to receive full credit for a response in which the candidate chose an ultimate ALAE/loss ratio for AY 2014 that differed from the ratio resulting from the multiplicative method, the candidate needed to provide justification for this decision.

Most candidates received full credit for part a.

Part b

The candidate is expected to know how to calculate additive development factors from paid ALAE to paid loss triangles and apply those factors to determine ultimate ALAE to loss ratios by Accident Year.

The candidate is expected to know how to apply ultimate ALAE to loss ratios to ultimate loss to determine estimates of ultimate ALAE by Accident Year.

Common errors included calculating ultimate ALAE for only AY 2014, applying ultimate ALAE/loss ratio to paid loss rather than to ultimate loss, failing to use the development data from AY 2011, developing paid ALAE rather than the paid ALAE/paid loss ratio, and multiplying instead of adding the calculated ATA factors. In order to receive full credit for a response in which the candidate chose an ultimate ALAE/loss ratio for AY 2014 that differed from the ratio resulting from the additive method, the candidate needed to provide justification for this decision.

Most candidates received full credit for part b.

Part c

The candidate was expected to be able to compare the advantages and disadvantages of multiplicative and additive development techniques.

Multiple answers were accepted, and since many candidates exercised judgment when selecting ultimate ALAE/loss ratios in parts a and b, part c was graded based on consideration of the candidate's response in parts a and b.

Common errors included not stating which method the candidate selected and not appropriately and adequately justifying the selection.

Most candidates received full credit in part c.

QUESTION 25	
TOTAL POINT VALUE: 2.5	**LEARNING OBJECTIVE: B3, B8**

SAMPLE ANSWERS

Part a: 1 point

Sample Answer 1

LDF: 12 24
Rep 2.00 1.25
Paid 5.00 2.50
Reported: $7,500 ((2/1.25)-1) = $4,500
Paid: $2,200 ((5/2.5)-1) = $2,200

Sample Answer 2

	% reported	
2013 Reported ATU =	12,500/10,000 = 1.25	0.8
2014 Reported ATU =	15,000/7,500 = 2.00	0.5
	% paid	
2013 paid =	12,500/4,800 = 2.5	0.4
2014 paid =	11,000/2,200 = 5.0	0.2

Reported: (15,000 – 7,500) * (0.8 – 0.5)/(1 – 0.5) = 4,500
Paid: (11,000 – 2,200) * (0.4 – 0.2)/(1 – 0.2) = 2,200

Part b: 1 point

Sample Answer 1

LDF: 12 24
Rep 2.00 1.25
Paid 5.00 2.50
Rep (13,000 – 7,500) * (1/1.25 – 1/2)/(1 – 1/2) = 3,300
Paid (13,000 – 2,200) * (1/2.5 – 1/5)/(1 – 1/5) = 2,700

Sample Answer 2

	% reported	
2013 Reported ATU =	12,500/10,000 = 1.25	0.8
2014 Reported ATU =	15,000/7,500 = 2.00	0.5
	% paid	
2013 paid =	12,500/4,800 = 2.5	0.4
2014 paid =	11,000/2,200 = 5.0	0.2

Reported: (13,000 – 7,500) * (0.8 – 0.5)/(1 – 0.5) = 3,300
Paid: (13,000 – 2,200) * (0.4 – 0.2)/(1 – 0.2) = 2,700

Sample Answer 3

% Reported at 12 = 7,500/13,000 = 0.577
% Reported at 24 = 10,000/12,250 = 0.816

% Paid at 12 = 2,200/13,000 = 0.169
% Paid at 24 = 4,800/12,250 = 0.392

Reported: (13,000 – 7,500) * (0.816 – 0.577)/(1 – 0.577) = 3,107.57
Paid: (13,000 – 2,200) * (0.392 – 0.169)/(1 – 0.169) = 2,898.19

Part c: 0.5 point

Sample Answer 1

Reported developed as expected using expected ultimate claims ($3,300 = $3,300)
Paid developed is lower than expected, between expected and development ($2,400 < $2,700)
Paid is still leveraged and immature
Actuary doesn't need to change estimate since reported agrees and some volatility is expected in paid.

Sample Answer 2

Actual reported – Expected reported = 3,300 – 3,107.57 = 192.43
Actual paid – Expected paid = 2,400 – 2,898.19 = -498.19
Actual reported claims are only slightly higher than expected while paid claims are below expectations by a decent amount. This low paid amount could be due to paying small claims versus large claims, or settlement rate decrease. I would investigate further for settlement rate decrease and leave ultimate as is, since reported development is similar.

EXAMINER'S REPORT

Part a

The candidate is expected to know that Accident Year 2013 at 12/31/2014 is at 24 months of development and the ratio of the ultimate claims to the claims as of 12/31/2014 for AY 2013 is the 24-ultimate development factor (or that the reciprocal is the percent reported or paid). Similarly, the candidate is expected to know that Accident Year 2014 at 12/31/2014 is at 12 months of development and the ratio of the ultimate claims to the claims as of 12/31/2014 for AY 2014 is the 12-ultimate development factor (or that the reciprocal is the percent reported or paid).

The candidate is expected to know how to calculate the expected incremental reported (or paid) for the next calendar year using the development factors or the % reported (or paid). They only need to calculate this for the most recent Accident year so only the 12 to 24 development is needed.

Most candidates performed well on part a.

Part b

The candidate is expected to use the "Selected Claims" as the ultimate for both paid and reported and then determine what would be expected to be paid and reported given the development factors and percent reported at 12 and 24 months as calculated in part a. A significant number of candidates recalculated the factors and percentages based using the selected ultimate rather than the developed ultimate. Both methods were given full credit.

Some candidates lost credit for providing the total expected amount as of 12/31/2015 rather than the "expected for calendar year 2015".

Most candidates who attempted part b. performed well.

Part c

The candidate was expected to compare the actual reported and paid claims in calendar year 2015 to what was expected (the calculation in part b) AND give an assessment what that result would mean in terms of the actuary's estimate.

Since there were two acceptable answers for part b., the answer in part c. depended on how part b. was answered.

Candidates struggled with part c. Candidates only received partial credit if they compared the actual to expected but did not offer any comment as to whether the actuary's estimate of ultimate should change.