

Exam 5



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Exam 5

Basic Techniques for Ratemaking and Estimating Claim Liabilities

4 HOURS

INSTRUCTIONS TO CANDIDATES

1. This 58.25 point examination consists of 24 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. 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 specified number of items are requested, do not offer more items than requested. For example, if you are requested to provide three items, 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

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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.

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.
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 17, 2014.

END OF INSTRUCTIONS

EXAM 5, FALL 2014

1. (2 points)

In an attempt to improve poor workers compensation underwriting results, an insurance company is considering changing its exposure base from number of employees to number of hours worked.

a. (0.5 point)

Identify two criteria of a good exposure base.

b. (0.5 point)

Briefly discuss whether this change in exposure base is appropriate for each of the criteria from part a. above.

c. (0.25 point)

Briefly describe the impact the exposure base change could have on frequency.

d. (0.25 point)

Briefly describe the impact the exposure base change could have on severity.

e. (0.5 point)

Discuss an impact the exposure base change could have on the company's loss ratio.

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EXAM 5, FALL 2014

2. (1.5 points)

Given the following policy data:

Policy	Effective Date	Expiration Date	Initial Policy Premium
1	June 1, 2012	May 31, 2013	480
2	July 1, 2012	December 31, 2012	125
3	March 1, 2013	February 28, 2014	225
4	August 1, 2013	March 31, 2014	300

- Six months after the policy expires, the initial policy premium on every policy increases by 8% due to the final audit.

a. (0.5 point)

Calculate calendar year 2013 earned premium as of December 31, 2013.

b. (0.5 point)

Calculate calendar year 2013 written premium as of December 31, 2013.

c. (0.25 point)

Calculate policy year 2013 earned premium as of December 31, 2013.

d. (0.25 point)

Calculate policy year 2013 written premium as of December 31, 2014.

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EXAM 5, FALL 2014

3. (2 points)

A personal auto insurer has a highly-refined classification rating plan. In the calculation of a rate level indication for this insurer, fully assess the use of the following methods to adjust premium to current rate level:

- i. Parallelogram method
- ii. Extension of Exposures method

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EXAM 5, FALL 2014

4. (1.5 points)

Given the following workers compensation information for an employer:

Ratio of Wage to the State Average Weekly Wage (SAWW)	Percentage of Workers
0.50	6%
0.85	18%
1.00	31%
1.45	26%
1.90	17%
2.20	2%

- Minimum benefit = 45% of State Average Weekly Wage (SAWW).
- Current Compensation Rate = 80% of Worker's Pre-Injury Wage.
- Proposed Compensation Rate = 85% of Worker's Pre-Injury Wage.
- Current Maximum Benefit = 130% of SAWW.
- Proposed Maximum Benefit = 115% of SAWW.

a. (1 point)

Assuming no changes to claim frequency, calculate the combined percent impact of both the compensation rate and maximum benefit changes to the average weekly expected claim benefit.

b. (0.5 point)

Briefly describe a potential indirect effect of the maximum benefit changes on:

- i. Frequency
- ii. Duration

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EXAM 5, FALL 2014

5. (3.25 points)

The following information is available for a homeowners insurance company as of December 31, 2013:

Period (months)	Reported Loss and ALAE Age-to-Age Development Factors
12-24	1.10
24-36	1.05
36-48	1.01

Calendar/Accident Year	Earned Exposures (000)	Amount of Insurance Years (AIY) (\$000)	Reported Non-Catastrophe Loss and ALAE (\$000)
2011	45	13,500	23,000
2012	50	15,300	25,000
2013	40	12,500	20,000

- Annual loss and ALAE trend = 4%.
- Historical non-catastrophe ULAE to loss and ALAE ratio = 1.05.
- Historical catastrophe ULAE to loss and ALAE ratio = 1.09.
- Long-term non-modeled catastrophe loss and ALAE-to-AIY ratio = 0.25.
- Modeled catastrophe loss and ALAE-to-AIY ratio = 0.07.
- Rates will take effect on January 1, 2015, and will be in effect for one year.
- All policies are annual.
- Assume no development after 48 months.

Using three years of historical data, determine the provision for loss and LAE to be used in the pure premium indication.

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EXAM 5, FALL 2014

6. (2.25 points)

Given the following information:

- Projected ultimate pure premium, including LAE = \$450.
- Underwriting profit provision = 5%.
- Projected average premium per exposure = \$750.

Expense Category	Selected Expense Ratio	% Fixed
General Expenses	6.0%	75%
Other Acquisition	9.5%	75%
Taxes, Licenses and Fees	2.8%	25%
Commission and Brokerage	12.0%	0%

a. (0.5 point)

Calculate the indicated average rate using the all variable expense method for determining expense provisions.

b. (1 point)

Calculate the indicated average rate using the premium-based projection method for determining expense provisions.

c. (0.75 point)

Assume the historical average premium per exposure on which the selected expense provisions are based is \$675. Discuss whether the result calculated in part b. above is excessive or inadequate.

EXAM 5, FALL 2014

7. (2.5 points)

An insurance company began writing personal automobile policies in 2011. Given the following information for the insurance company:

Calendar/ Accident Year	Written Policies	Ultimate Loss & LAE (\$000)
2011	44,000	14,250
2012	48,400	19,500
2013	53,240	22,000

Variable expense ratio	20%
Profit and contingency provision	5%
Fixed expense per exposure	\$50

- Expense and profit provisions are not expected to change.
- Policies have six-month terms, are written uniformly throughout the year, and include one automobile per policy.
- The company is currently charging an average premium per policy of \$500.
- The annual loss trend factor = 3%.
- The data is fully credible.
- When calculating the indication, consider data from all three years.
- Rates are assumed to be effective July 1, 2014, and in effect for six months.

Calculate the overall indicated rate change, including justification for the selection of projected ultimate pure premium.

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EXAM 5, FALL 2014

8. (4.25 points)

A company is reviewing the rate level adequacy in State X. Given the following information for a book of business:

- All policies are annual.
- Rate change history:
 - -5% effective April 1, 2012, mandated by law to apply to all policies in force with no impact on losses.
 - 10% effective January 1, 2013.
- New rates will be in effect for 12 months beginning on April 1, 2015.
- Selected annual underlying loss trend = 2%.
- Selected annual premium trend = 0%.
- Loss adjustment expense provision = 4% of loss.
- Projected expense ratios:
 - Fixed = 5%.
 - Variable = 27%.
- Underwriting profit and contingencies provision = 8%.
- Ultimate losses are estimated using the reported development technique.
- Credibility of the indicated rate change = 0.6.
- State X's earned premium is 5% of the total earned premium countrywide.
- State X is part of Region A, and accounts for 50% of the total earned premium for that region.
- Potential complements of credibility include:
 - Countrywide rate indication = 10%.
 - Total Region A rate indication = 8%.
 - Major competitor rate indication for State X = 4%.
 - Annual inflation trend for State X = 3%.

Calendar Year Ending	Earned Premium (\$000)
December 31, 2012	9,500
December 31, 2013	9,800

Accident Year as of December 31, 2013	Reported Losses (\$000)
2012	4,800
2013	4,100

Accident Year	Age-to-Age Reported Loss Development Factors				
	12-24 months	24-36 months	36-48 months	48-60 months	60-72 months
2008	1.37	1.15	1.06	1.02	1.00
2009	1.35	1.15	1.05	1.02	
2010	1.32	1.12	1.07		
2011	1.28	1.09			
2012	1.25				

a. (1 point)

Recommend a complement of credibility from the list above. Briefly explain the recommendation, including a brief discussion of each potential complement not selected.

b. (3.25 points)

Calculate the indicated rate change using the complement of credibility recommended in part a. above. Briefly justify selection of age-to-age reported loss development factors.

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EXAM 5, FALL 2014

9. (2.75 points)

An insurance market with a fixed number of insureds consists of two insurers – Company A and Company B. Company A has identified a new potential rating variable to segment its risks, consisting of High Risk and Low Risk.

Variable	True Expected Cost	Insured Risks	
		Company A	Company B
High Risk	\$200	10,000	90,000
Low Risk	\$100	10,000	90,000

- All policies are annual.
- True expected cost is known only to Company A
- The probability each risk will switch insurers at renewal if they are offered a lower price by the new insurer is given by the following equation: $\text{Probability} = 0.9 \times (\text{Difference in Offered Rates}) / \text{True Expected Cost}$
- The probability each risk will switch insurers at renewal if they are offered a higher or equal price by the new insurer is 0.

Company A intends to charge the true cost for High Risk insureds, and is evaluating two different prices for Low Risk insureds: \$130 or \$140. Company B charges \$150 for all risks.

a. (1.75 points)

Determine which of the two rates Company A should charge the Low Risk insureds to maximize profits, assuming Company B does not adjust its price.

b. (0.5 point)

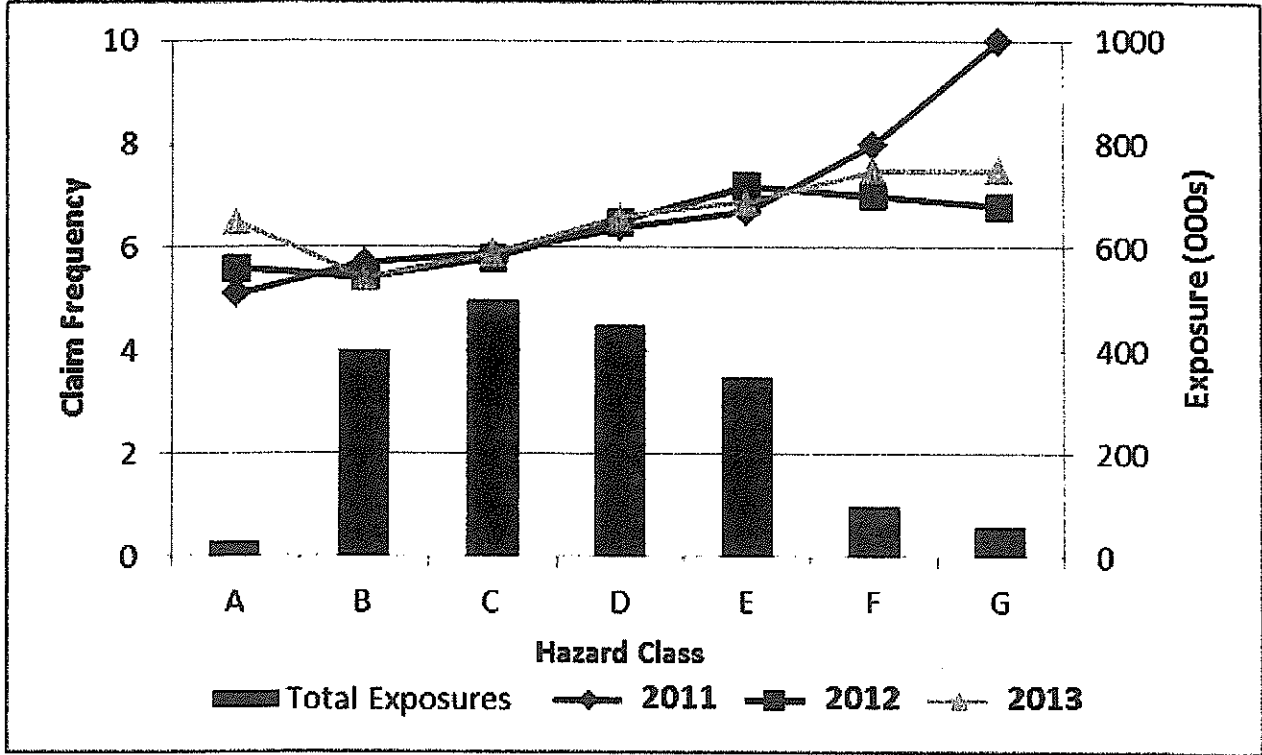
Describe the ultimate impact on the distribution of risks and each company's profitability if Company B does not adjust its strategy.

c. (0.5 point)

Briefly describe two possible strategies Company B could utilize in response to Company A's new rate plan.

10. (1.75 points)

An actuary performed an analysis of a products liability class plan using a Generalized Linear Model (GLM) for the first time on this book of business. The insureds are categorized by hazard classes A through G. The following graph shows claim frequency and exposure data by hazard class.



a. (0.75 point)

Fully evaluate the predictive value of hazard class based on the information provided above.

b. (1 point)

Briefly describe two data mining techniques and how each might be used to enhance a GLM multivariate classification analysis.

EXAM 5, FALL 2014

11. (3 points)

Given the following information for a homeowners book of business:

Territory	Earned Exposures	Earned Premium (\$000)	Ultimate Losses Excluding Catastrophes (\$000)	Current Relativity
1	2,500	3,375	3,200	1.150
2	7,000	11,200	6,200	1.000
3	500	700	1,000	0.900

- Ratio of ALAE to loss = 4%.
- Full credibility standard for exposures = 5,000.
- Use square root rule for credibility calculations.
- Territory 2 is the base class.
- The rating algorithm is Base Rate x Territory Factor x Amount of Insurance Factor.

a. (2 points)

Calculate the credibility-weighted indicated non-catastrophe relativity to the base for each territory using the pure premium method.

b. (0.5 point)

Territory 1 has a high percentage of low-value homes relative to territories 2 and 3. Describe a possible distortion to the indicated territory 1 relativity resulting from the distribution of home values.

c. (0.5 point)

Assume that \$1,000,000 of the loss in territory 2 came from a single loss. Discuss an appropriate adjustment to the analysis.

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EXAM 5, FALL 2014

12. (2.5 points)

Given the following information:

Policy Year	Premium	Present Value of Losses	Variable Expenses		Fixed Expenses		Income
			New	Renewal	New	Renewal	
1	\$800	\$656	\$242	-	\$142	-	\$(240)
2	\$872	\$701	-	\$54	-	\$32	\$86
3	\$950	\$748	-	\$59	-	\$33	\$110
4	\$1,036	\$799	-	\$64	-	\$34	\$139
5	\$1,129	\$853	-	\$70	-	\$36	\$170

Policy Year	Persistence	Cumulative Persistence	Profit	Discount Factor	Present Value of Profits	Present Value of Premiums
1	100%	100%	\$(240)	1.00	\$(240)	\$800
2	85%	85%	\$73	1.12	\$65	\$662
3	86%	73%	\$81	1.25	\$64	\$554
4	87%	64%	\$88	1.40	\$63	\$469
5	88%	56%	\$95	1.57	\$61	\$402
Total					\$13	\$2,886

- Premium-to-surplus ratio is 2 to 1.
- Surplus equals GAAP equity.
- The company seeks growth in this market.
- Management requires the present value of profit of policy years 1 to 5 to be positive in total.

a. (0.5 point)

Briefly describe two differences between asset share pricing and pure premium ratemaking when they are used to price property and casualty products.

b. (1 point)

After preparing the asset share model shown above, the actuary evaluates an alternative set of persistency assumptions in which persistency in the third and fourth policy years are changed to 81% and 82%, respectively. Calculate the revised present value of premiums.

c. (1 point)

Briefly discuss the results of the asset share model under each set of persistency assumptions with regard to Management's profitability requirement. Provide a recommendation to management on whether to make a change to the current rating structure.

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EXAM 5, FALL 2014

13. (1.5 points)

The importance of accurately estimating unpaid claims can be examined from three points of view: internal management, investors, and regulators.

a. (0.75 point)

Briefly describe how a redundant unpaid claim estimate can impact decisions for each of these three groups.

b. (0.75 point)

Briefly describe how an inadequate unpaid claim estimate can impact decisions for each of these three groups.

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EXAM 5, FALL 2014

14. (3 points)

Given the following information:

Claim ID	Accident Date	Report Date	2011 Transactions		2012 Transactions		2013 Transactions	
			Cal. Yr. Paid	Ending Case O/S	Cal. Yr. Paid	Ending Case O/S	Cal. Yr. Paid	Ending Case O/S
1	March 3, 2011	July 1, 2011	260	0	0	0	0	0
2	September 18, 2011	October 2, 2011	200	500	0	500	230	270
3	December 1, 2011	February 15, 2012			620	0	0	0
4	March 1, 2012	April 1, 2012			200	200	400	0
5	June 15, 2012	September 9, 2012			460	0	0	0
6	September 30, 2012	October 20, 2012			0	400	700	400
7	December 12, 2012	March 11, 2013					300	230
8	April 12, 2013	June 18, 2013					400	200
9	May 28, 2013	July 23, 2013					600	300
10	November 12, 2013	December 5, 2013						100
11	October 30, 2013	January 31, 2014						

- Reported claims are closed when case outstanding equals 0.

a. (2 points)

Create the following cumulative annual triangles organized by accident year:

- paid claims
- reported claims
- reported claim count
- closed claim count

b. (1 point)

Use the triangles produced in part a. above to generate one additional triangle to show that an operational change took place during the experience period. Identify and briefly describe an operational change consistent with the data.

EXAM 5, FALL 2014

15. (2 points)

Given the following data as of December 31, 2013:

Accident Year	Reported Claims (\$000)	Reported Development Factor to Ultimate	On-Level Earned Premium (\$000)
2011	20,900	1.600	38,000
2012	21,000	2.100	50,000
2013	11,500	3.700	67,000

- Annual loss trend = 7%.
- There has been a law change effective July 1, 2012, applicable to all claims occurring after the effective date.
- Estimated reduction to ultimate claims based on law change = 20%.

Estimate IBNR for accident year 2013 using the expected claims technique.

EXAM 5, FALL 2014

16. (1.75 points)

The following information is available for an insurer:

Accident	<u>Reported Claim Counts as of (months)</u>				
<u>Half - Year</u>	<u>6</u>	<u>12</u>	<u>18</u>	<u>24</u>	<u>30</u>
2011-1	28	35	39	39	39
2011-2	40	80	140	168	168
2012-1	20	25	28	28	
2012-2	32	64	112		
2013-1	36	45			
2013-2	35				

- There is no development after 30 months.
- The actuary's estimate of ultimate claim counts for accident year 2013 is 152.

Assess the reasonability of the actuary's estimate of ultimate claim counts.

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EXAM 5, FALL 2014

17. (3.5 points)

A monoline insurance company writes business in one state. The state has experienced significant increases in insurance costs. In an effort to reduce costs, the state's government passes legislative reforms effective January 1, 2013, which impacts all outstanding and future reported insurance claims.

The legislative reforms were expected to have the following impacts:

- Reduce the amount of time claims remained open.
- Reduce the average annual inflation by half of what it was prior to the reforms.

The following information is available for the insurance company as of December 31, 2013:

Accident Year	Cumulative Paid Claims as of (months)			
	12	24	36	48
2010	\$1,000,000	\$1,750,000	\$2,350,000	\$2,850,000
2011	\$1,210,000	\$2,117,500	\$3,059,100	
2012	\$1,089,000	\$2,042,370		
2013	\$1,709,000			

Accident Year	Cumulative Closed Claim Counts as of (months)			
	12	24	36	48
2010	100	150	180	200
2011	110	165	209	
2012	90	144		
2013	132			

Accident Year	Incremental Closed Claim Counts as of (months)			
	12	24	36	48
2010	100	50	30	20
2011	110	55	44	
2012	90	54		
2013	132			

Accident Year	Ultimate Claim Counts
2010	200
2011	220
2012	180
2013	220

a. (2.5 points)

Assuming the closure rates and inflation observed during calendar year 2013 continue, use a frequency-severity approach to estimate unpaid claims for accident year 2013.

b. (1 point)

Discuss whether or not each of the legislative reform impacts has occurred.

EXAM 5, FALL 2014

18. (1.5 points)

Given the following data as of December 31, 2013:

Accident <u>Year</u>	On-level Earned <u>Premium</u>	Reported <u>Claims</u>	Reported Development Factor <u>to Ultimate</u>	Expected Claims <u>Ratio</u>
2010	25,000	11,000	1.05	57.9%
2011	26,000	13,000	1.10	57.9%
2012	28,000	10,000	1.30	57.9%
2013	30,000	12,000	1.80	57.9%

a. (1.25 points)

Calculate the IBNR for accident year 2013 using the Benktander technique.

b. (0.25 point)

The Benktander technique can be viewed as a credibility weighting of other common techniques. Identify these techniques.

EXAM 5, FALL 2014

19. (2.25 points)

For each situation below an insurer uses the reported development technique based on its historical accident year data to set reserves. For each situation:

- i. Discuss the effect on estimated ultimate claims and
- ii. Identify either an alternate technique or an adjustment to the reported development technique to improve the estimate, if necessary.

a. (0.75 point)

Mid-year the company institutes a new policy for setting case outstanding for open claims, in which case outstanding is set at policy limits.

b. (0.75 point)

The company had historically stable writings, but undertakes an advertising initiative in the second quarter and increases its premium volume written through the end of the year by 300%.

c. (0.75 point)

At the beginning of the year, the company began offering a general liability product covering losses in excess of its basic limits.

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EXAM 5, FALL 2014

20. (3.75 points)

The following information is available for an insurance company:

<u>Cumulative Paid Claims</u>					<u>Case Outstanding</u>				
Accident	<u>(\$000) as of (months)</u>				Accident	<u>(\$000) as of (months)</u>			
<u>Year</u>	<u>12</u>	<u>24</u>	<u>36</u>	<u>48</u>	<u>Year</u>	<u>12</u>	<u>24</u>	<u>36</u>	<u>48</u>
2010	1,050	2,350	4,370	6,250	2010	520	2,200	1,790	1,500
2011	1,100	3,970	6,350		2011	600	1,270	690	
2012	1,160	4,860			2012	730	770		
2013	1,460				2013	920			

<u>Closed Claim Counts</u>					<u>Open Claim Counts</u>				
Accident	<u>(000) as of (months)</u>				Accident	<u>(000) as of (months)</u>			
<u>Year</u>	<u>12</u>	<u>24</u>	<u>36</u>	<u>48</u>	<u>Year</u>	<u>12</u>	<u>24</u>	<u>36</u>	<u>48</u>
2010	5	7	10	13	2010	3	4	3	1
2011	5	9	12		2011	3	2	1	
2012	5	10			2012	3	1		
2013	6				2013	3			

Accident	<u>Projected Ultimate</u>
<u>Year</u>	<u>Claim Counts (000)</u>
2010	13
2011	13
2012	13
2013	13

The interpolation of cumulative paid claims (in \$000s) by accident year (AY) is as follows:

<u>Closed Claim Counts</u>	<u>AY 2010</u>	<u>Closed Claim Counts</u>	<u>AY 2011</u>	<u>Closed Claim Counts</u>	<u>AY 2012</u>
5	1,050	5	1,100	5	1,160
6	1,700	6	1,818	6	1,900
7	2,350	7	2,535	7	2,640
8	3,023	8	3,253	8	3,380
9	3,697	9	3,970	9	4,120
10	4,370	10	4,763	10	4,860
11	4,997	11	5,557		
12	5,623	12	6,350		
13	6,250				

- The selected annual severity trend rate for all maturities is 5%.
- Use an all-year simple average to determine age-to-age claim development factors.
- There is no development beyond 48 months.

Calculate an estimate of ultimate claims for accident year 2013 utilizing the reported Berquist-Sherman method with adjustments reflecting changes in both case outstanding and claim settlement rates.

EXAM 5, FALL 2014

21. (2 points)

Given the following information for an insurance company:

Accident Year	<u>Gross Cumulative Reported Claims (\$000)</u>			
	<u>12 Months</u>	<u>24 Months</u>	<u>36 Months</u>	<u>48 Months</u>
2010	3,500	8,120	12,180	14,616
2011	3,000	6,840	10,465	
2012	3,300	7,656		
2013	3,250			

Accident Year	<u>Net Cumulative Reported Claims (\$000)</u>			
	<u>12 Months</u>	<u>24 Months</u>	<u>36 Months</u>	<u>48 Months</u>
2010	2,275	5,278	7,917	9,500
2011	2,100	4,788	7,326	
2012	2,475	5,742		
2013	2,600			

- Assume no further development after 48 months.

a. (0.5 point)

Using the data, determine the structure of the company's reinsurance program.

b. (1.5 points)

Estimate the ceded IBNR for accident year 2013.

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EXAM 5, FALL 2014

22. (1.75 points)

The following information is available for accident year 2013 as of December 31, 2013:

- Selected ultimate claims = \$5,000.
- Reported claims = \$3,000.
- Selected cumulative development factor at 12 months = 6.67.
- Selected cumulative development factor at 24 months = 2.86.

a. (1.25 points)

Calculate cumulative expected reported claims as of July 31, 2014, using linear interpolation.

b. (0.5 point)

Describe why linear interpolation may not be appropriate for estimating the expected reported claims for an immature accident year.

EXAM 5, FALL 2014

23. (3.75 points)

The following information is available for an insurance company that began writing business in 2010:

Accident Year	Cumulative Paid Claims as of (months)			
	12	24	36	48
2010	\$198	\$285	\$325	\$347
2011	\$1,220	\$1,763	\$2,044	
2012	\$13,000	\$18,750		
2013	\$11,060			

Calendar Year	Paid ULAE
2010	\$23
2011	\$59
2012	\$814
2013	\$688

- The actuary has selected a 24-month cumulative paid claim development factor of 1.25.
- The initial expected claims for accident year 2013 are \$31,500.
- Case outstanding for accident year 2013 as of December 31, 2013 is \$5,720.

a. (1.25 point)

Estimate IBNR for accident year 2013 as of December 31, 2013 using the paid Bornhuetter-Ferguson technique.

b. (1.25 point)

Estimate unpaid ULAE for accident year 2013 as of December 31, 2013, using the classical technique and the results from part a. above.

c. (0.75 point)

State the key assumptions of the classical technique, and briefly comment on the appropriateness of utilizing the classical technique in estimating unpaid ULAE for this company.

d. (0.5 point)

Describe a refinement to the classical technique that can be used to derive a reasonable estimate of unpaid ULAE for this company.

CONTINUED ON NEXT PAGE

EXAM 5, FALL 2014

24. (2.25 points)

An insurer's policyholders were exposed to a severe storm that occurred on December 1, 2013. As of December 31, 2013, the claims related to the storm have been recorded in the claims system, but payments on the claims have not yet been processed. The claim history does not include any severe storms.

The following information is available for accident year 2013 as of December 31, 2013:

- Reported claims = \$20,000.
- Paid claims = \$5,000.
- Initial expected claims as of the beginning of the accident year = \$100,000.
- 12-month age-to-ultimate factor for reported claims = 8.000.
- 12-month age-to-ultimate factor for paid claims = 20.000.

a. (0.75 point)

Identify a technique that will result in a reasonable estimate of ultimate claims. Calculate ultimate claims for accident year 2013 using the identified technique and briefly describe why the estimate is reasonable.

b. (0.75 point)

Identify a technique that will overstate the estimate of ultimate claims. Calculate ultimate claims for accident year 2013 using the identified technique and briefly describe why the estimate is overstated.

c. (0.75 point)

Identify a technique that will understate the estimate of ultimate claims. Calculate ultimate claims for accident year 2013 using the identified technique and briefly describe why the estimate is understated.

Exam 5

Basic Techniques for Ratemaking and Estimating Claim Liabilities

October 28, 2014

POINT VALUE OF QUESTIONS

QUESTION	VALUE OF QUESTON	SUB-PART OF QUESTION						
		(a)	(b)	(c)	(d)	(e)	(f)	(g)
1	2.00	0.50	0.50	0.25	0.25	0.50		
2	1.50	0.50	0.50	0.25	0.25			
3	2.00	2.00						
4	1.50	1.00	0.50					
5	3.25	3.25						
6	2.25	0.50	1.00	0.75				
7	2.50	2.50						
8	4.25	1.00	3.25					
9	2.75	1.75	0.50	0.50				
10	1.75	0.75	1.00					
11	3.00	2.00	0.50	0.50				
12	2.50	0.50	1.00	1.00				
13	1.50	0.75	0.75					
14	3.00	2.00	1.00					
15	2.00	2.00						
16	1.75	1.75						
17	3.50	2.50	1.00					
18	1.50	1.25	0.25					
19	2.25	0.75	0.75	0.75				
20	3.75	3.75						
21	2.00	0.50	1.50					
22	1.75	1.25	0.50					
23	3.75	1.25	1.25	0.75	0.50			
24	2.25	0.75	0.75	0.75				
TOTAL	<u>58.25</u>							

EXAM 5 FALL 2014 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.
- 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.
- Generally, candidates were fairly well prepared for this exam. However, candidates should be cautious of relying solely on study manuals, as some candidates lost credit for failing to provide basic insights that were contained in the syllabus readings.

EXAM STATISTICS:

- Number of Candidates: 733
- Available Points: 58.25
- Passing Score: 40.75
- Number of Passing Candidates: 258
- Raw Pass Ratio: 35.20%
- Effective Pass Ratio: 37.72%

EXAM 5 FALL 2014 SAMPLE ANSWERS AND EXAMINER'S REPORT

QUESTION 1	
TOTAL POINT VALUE: 2.0	LEARNING OBJECTIVE: A2
SAMPLE ANSWERS	
Part a: 0.5 point	
Accepted Answer 1	
Proportional to Loss Practical	
Accepted Answer 2	
Directly proportional to losses – twice the exposure = twice the loss Consider historical precedence	
Accepted Answer 3	
Practical, objective & inexpensive to verify Consider the historical precedence. Change the exposure may cause	
<ol style="list-style-type: none">1) Large prem swings -> retention on customer may drop2) Expensive to change system3) Require significant adjustment in future ratemaking analysis	
Accepted Answer 4	
Proportional to expected losses Objective, easy to obtain and verify	
Part b: 0.5 point	
Accepted Answer 1	
[Practical] Number of hours worked is easy to obtain but is hard to be verified compared to number of employees. Number of hours is more subjected to manipulation. [Historical Precedence] Number of hours worked is also not used before in the company therefore may be costly to change rating algorithm in IT system and may cause large premium swings with the new exposure base. Therefore suggest that the chg is not appropriate due to # of hrs worked hard to be verified and no historical precedence	
Accepted Answer 2	
Proportional to loss: number of hours worked is proportional to work -> the longer hours workers work, the higher the chances of having an accident. This only accounts for freq of loss but not severity of loss	

EXAM 5 FALL 2014 SAMPLE ANSWERS AND EXAMINER'S REPORT

Practical: it is difficult to track employee's hours and hard to verify. This is subject to employee's manipulation of # of hrs worked.

Accepted Answer 3

Yes Hours worked is proportional (more so than # ee's) b/c ee's who spend more time @ jobsite are more likely to have claims and are likely paid more, resulting in greater severity
[Practical] Also hours works is easily available from payroll systems & badge-in/badge-out systems that employers have. It will be harder for salaried ee's, but badge-in/out systems can be used for many such ee's.

Accepted Answer 4

Changing from employee number to hours worked

1) Not appropriate to Practical

Reason is hour is objective but we need to have clear definition on partial hours e.g. if employee worked half an hour, should it be counted as 1?

Secondly # working hours may be hard & expensive to verify. It's really depends on whether the insurer has kept tracking the working hours historically & in a systematic and good way.

2) Not appropriate to Consider the Historical Precedence

- a. Large prem swings
- b. Expensive to change system
- c. Require significant adjustment in the future ratemaking analysis

Part c: 0.25 point

Accepted Answer 1

Decrease frequency as hours worked will be a larger number than number of employees.

Accepted Answer 2

Shifting from number of employees to hours worked would increase frequency. Part time employees would be treated as having the same exposure as full time employees when using number of employees so shifting to hours work would correct for this and decrease the exposure. Frequency is calculated as claim counts divided by exposure so frequency would increase.

Accepted Answer 3

Assume frequency = # of claim/exposure

As the exposure changed to the # of working hour which is a large base the frequency (numerically) will drop

EXAM 5 FALL 2014 SAMPLE ANSWERS AND EXAMINER'S REPORT

Accepted Answer 4

Frequency = # claims/# exposure

Assuming no change in claim definition, number of hours worked \geq number of employees, thus the frequency would decrease.

Part d: 0.25 point

Accepted Answer 1

Sev = Loss \$/clm ct

No change -> exposure not part of calculations

Accepted Answer 2

It does not have any effect on severity because the number of claim and claim amount will not change.

Accepted Answer 3

Severity = claim amount/# of claim

There is no impact as both claim amount & # of claim will have no change

Part e: 0.5 point

Accepted Answer 1

The base change could lead to wide premium swing

- Many good customers might go to other insurers
- Only the ones with bad risks who cannot afford to leave stays (because no one would take them)

Therefore the company L/R is likely to get worse

Accepted Answer 2

The customers whose rates increase due to this change will try to switch carriers. Since the proposed base is proportionate to the risk, the riskier customers will be leaving, all else equal. This should improve the loss ratio.

EXAMINER'S REPORT

Part a

Successful candidates needed to identify 2 of 3 criteria of good exposure base. Most candidates received full credit.

EXAM 5 FALL 2014 SAMPLE ANSWERS AND EXAMINER'S REPORT

Part b

Based on the criteria identified in Part A, candidates needed to evaluate the appropriateness of the change in exposure base from number of employees to number of hours worked. It was not necessary to ultimately determine whether or not to switch.

Most candidates were able to demonstrate some evaluation.

Common mistakes included:

- Not defining broad statements from the criteria such as what it means to be practical or the implications from historical precedence. For example, it was not enough just to say number of hours worked had not been used before but to explain why this might be a problem.
- Identifying Payroll as the prior historical base for this company.

Part c

The question asked the candidate to explain how the change in exposure base would impact frequency. Frequency is defined very generally as claim counts/exposures. A successful candidate demonstrated that they knew this definition of frequency and then indicated whether this calculation would increase or decrease based on the new measure of exposures. Most candidates received full credit on this part. The most common mistake made was to evaluate how number of hours worked related to the number of claims that may occur rather than the frequency.

Part d

Similar to Part c, this question asked the candidate to explain how the change in exposure base would impact the severity. Severity is defined as claim dollars /claim counts. Since exposures are not included in the calculation there should be no impact. Again, most candidates received full credit on this part. The most common mistake made was to evaluate how number of hours worked related to the size of claims that may occur.

Part e

The final part of this question asked the candidates to assume the company implemented the exposure base change and then determine an impact on the loss ratio based on their evaluation in prior subparts along with any other factors that may come into play. Candidates who received credit generally referenced the impact insured behavior would have as a result of the change, for example due to change in premiums the company would suffer or benefit from adverse selection, the insureds may manipulate number of hours worked thus understating exposures, etc.

This was the most challenging subpart for candidates as they were required to incorporate the factors identified in prior subparts and then synthesize with real world business outcomes that

EXAM 5 FALL 2014 SAMPLE ANSWERS AND EXAMINER'S REPORT

may result. Most candidates left this blank or received no credit.

Common mistakes included:

- Describing how an increase/decrease in premium/losses in general would impact a loss ratio, without relating to the exposure base change.
- Identifying the potential one time increase in expenses that would result in changing the exposure base change as an increase in loss ratio (underwriting loss ratio would not include these expenses).

EXAM 5 FALL 2014 SAMPLE ANSWERS AND EXAMINER'S REPORT

QUESTION 2	
TOTAL POINT VALUE: 1.5	LEARNING OBJECTIVE: A3
SAMPLE ANSWERS	
Part a: 0.5 point	
<p>CY 2013 EP = Policy 1: $5/12 \times 480 + 480 \times 0.08 = 238.4$ 2: $125 \times 0.08 = 10$ 3: $10/12 \times 225 = 187.5$ 4: $5/8 \times 300 = 187.5$</p> <p>CY total EP = $238.4 + 10 + 187.5 + 187.5 = 623.4$</p>	
Part b: 0.5 point	
<p>CY 2013 WP Policy 1: $480 \times 0.08 = 38.4$ 2: $125 \times 0.08 = 10$ 3: 225 4: 300 Total = 573.4</p>	
Part c: 0.25 point	
<p>PY 2013 EP Policy 1: 0 2: 0 3: $225 \times 10/12 = 187.5$ 4: $300 \times 5/8 = 187.5$ Total = 375</p>	
Part d: 0.25 point	
<p>PY 2013 WP Policy 1: 0 2: 0 3: $225 \times 1.08 = 243$ 4: $300 \times 1.08 = 324$ Total = 567</p>	
EXAMINER'S REPORT	
<p>This question was rather challenging. Overall very few candidates received full credit and, in general, candidates did better on the questions asking to calculate the 2013 written premium (b and d) as opposed to calculating the 2013 earned premium (a and c).</p>	

EXAM 5 FALL 2014 SAMPLE ANSWERS AND EXAMINER'S REPORT

Part a

The most common mistakes included multiplying the 8% audit by the 2013 earned premium for policy 1 (instead of total premium), not including the audit for policy 2, and multiplying the policy 4 WP by 5/12. Other mistakes were including the policy 2 premium or including the wrong % earned for some or all of the policies 1 through 3.

Part b

The most common errors were not including the audits for policies 1 and/or 2. Other mistakes included including audit premiums for policies 3 and/or 4.

Part c

The most common errors included multiplying the policies by a wrong % of earned amount, especially policy 4, where many candidates used 5/12 as the % earned.

Part d

The most common errors included not multiplying the premiums for policies 3 and 4 by the 8% audit.

EXAM 5 FALL 2014 SAMPLE ANSWERS AND EXAMINER'S REPORT

QUESTION 3	
TOTAL POINT VALUE: 2	LEARNING OBJECTIVE: A3
SAMPLE ANSWERS	
<p>i. Parallelogram method is easier to calculate than extension of exposure, but it is not as accurate as extension of exposure. Parallelogram assumes policies are written evenly throughout the year, which may not be accurate. Parallelogram calculates rate level indication on an aggregate basis. It doesn't fit for the personal auto insurer which has a highly-refined classification. Rate level at each class may not be calculated correctly.</p> <p>ii. Extension of Exposure is the most accurate method, but it requires more detailed data and more computation.</p> <p>I would recommend Extension of Exposure to be used here.</p>	
EXAMINER'S REPORT	
<p>This question was very open ended. The candidate received full credit if they commented on underlying assumptions, the pros and cons of each method, and related these to the specifics of the company's situation in the problem.</p> <ul style="list-style-type: none">- Which method is easier/more difficult- Which method is more accurate and why- Assumption of equal writing/earning throughout policy term for parallelogram method- One additional pro/con including the heavy IT requirement or resource intensity for EoE, the need for and difficulty of getting historical exposure data for EoE, etc.	

EXAM 5 FALL 2014 SAMPLE ANSWERS AND EXAMINER'S REPORT

QUESTION 4			
TOTAL POINT VALUE: 1.5		LEARNING OBJECTIVE: A4	
SAMPLE ANSWERS			
Part a: 1 point			
Accepted Answer 1			
(1)	(2)	(3)	(4)
Ratio of Wage to Average Weekly Wage	Percentage of Workers	Current Benefit Rate	Proposed Benefit Rate
0.50	6%	0.45	0.45
0.85	18%	0.68	0.7225
1.00	31%	0.8	0.85
1.45	26%	1.16	1.15
1.90	17%	1.3	1.15
2.20	2%	1.3	1.15
(5) Total		0.946	0.93805
(6) Change			-0.8%
<p>(3) = 0.80*(1), limited to minimum of 0.45 and maximum of 1.3 (4) = 0.85*(1), limited to minimum of 0.45 and maximum of 1.15 (5) = Sumproduct of (2), weighted average benefit rate (6) = percentage change in benefits</p>			
Accepted Answer 2			
Current:			
Min wage = 45% ÷ 80% = 56.25%			
Max wage = 130% ÷ 80% = 162.5%			
Average weekly expected clam benefit = 45% × 6% + 80% × (85%×18% + 100%×31%+145%×26%)			
+ 130% × (17%+2%)			
= 94.6%			
Proposed:			
Min wage = 45% ÷ 85% = 52.94%			
Max wage = 115% ÷ 85% = 135.3%			
Average weekly expected clam benefit =			
45% × 6% + 85% × (85%×18% + 100%×31%) +115% × (26%+17%+2%)			
=93.805%			
The change = (93.805% - 94.6%) ÷ 94.6% = -0.84%			

EXAM 5 FALL 2014 SAMPLE ANSWERS AND EXAMINER'S REPORT

Accepted Answer 3

$$\text{Curr benefit} = .06 \times .45 + .18 \times .85 \times .80 + .31 \times 1 \times .80 + .26 \times 1.45 \times .80 + .19 \times 1.3 \\ = .946$$

$$\text{New benefit} = .06 \times .45 + .18 \times .85 \times .85 + .31 \times 1 \times .85 + (.26 + .17 + .02) \times 1.15 \\ = .93805$$

$$\text{Percent impact} = .93805 / .946 - 1 = .9916 - 1 = -0.84\%$$

Accepted Answer 4

Current Comp Rate Proposed

.45	.45
.68	.7225
.8	.85
1.16	1.15
1.3	1.15
1.3	1.15

Current average = .946

Proposed average = .93805

Sum product of Comp Rate & % of workers

$$.93805 / .946 - 1 = -0.84\%$$

Part b: 0.5 point

Accepted Answer 1

Frequency: With a lower maximum benefit, workers may be less inclined to file claims which would decrease frequency.

Duration: Since more workers will now be subject to the maximum, and the maximum is lower, affected workers may be more likely to return to work sooner. This would decrease duration.

Accepted Answer 2

Frequency: Frequency will decrease as high-paid employees will have less motivation to file a claim.

Duration: Duration will decrease because the lower maximum will give high-paid workers a financial incentive to return to work more quickly than under the 130% maximum.

Accepted Answer 3

Frequency: Workers who would have reduced benefits (those making at least 1.45 of the SAWW) may be less likely to file a claim, so could reduce frequency.

EXAM 5 FALL 2014 SAMPLE ANSWERS AND EXAMINER'S REPORT

Duration: Workers with reduced benefits from before the changes might return to work sooner.

EXAMINER'S REPORT

Overall, candidates scored well on both parts a & b. Candidates were expected to be able to calculate the direct impact of benefit changes, as well as briefly explain the indirect impact from claimant's behavioral changes.

Part a

Overall, candidates did well on part a.

Candidates are expected to demonstrate their understanding by illustrating how each subgroup of workers are impacted by the change in both the compensation rate and maximum benefit cap, as well as using the correct weights to compute the overall impact.

A common mistake is that in the calculation of expected benefit level for the middle range, some candidate simply multiplied 0.85 (or 0.8) by the total % of the middle range without utilizing the information by subgroups provided in the question.

Linear interpolation is not necessary, but was given credit to the extent that the calculations were correct.

Part b

Overall, candidates did well on part b.

Candidates are expected to provide a brief reason for the "increase"/"decrease" answer.

Candidates were expected to discuss in greater details (e.g., Only high wage earners are impacted by the benefit decrease) when assuming the compound effect of changes in both compensation rate and max benefit level.

The most common mistake was to explain the indirect effect of the increase in compensation rate. Part b specifically asks for indirect effect of change in maximum benefit level. Another common mistake is that candidates conclude there is no indirect effect on frequency.

EXAM 5 FALL 2014 SAMPLE ANSWERS AND EXAMINER'S REPORT

QUESTION 5

TOTAL POINT VALUE: 3.25

LEARNING OBJECTIVE: A4

SAMPLE ANSWERS

Yr	AIY/E. Expo.	Change
11	300	
12	306	2%
13	312.5	2.10%
Proj		
15	312.5 * 1.02^2 = 325.125	
16	312.5*1.02^3 = 331.628	
Avg = 328.38		

(1) CAT PP (L&LAE) = 328.3 * (0.25 + 0.07) * 1.09 = 114.54

YR	(2) Rpt Non Cat L&LAE	(3) Trend Factor	(4) CDF Ult	(5) ULAE Load	(6) Proj Ult L&LAE
11	23,000	1.04 ^ 4.5	1.01	1.05	29,100
12	25,000	1.04 ^ 3.5	1.0605	1.05	31,934
13	20,000	1.04 ^ 2.5	1.1 * 1.05 * 1.01 = 1.16655	1.05	27,021
					88,055

(3) Trend from 7/1/XX to 1/1/16

(6) = (2)*(3)*(4)*(5)

(7) Non-cat PP = 88,055 / (45 + 50 + 40) = 652.26

(8) Proj PP = (1) + (7) = 766.80

EXAMINER'S REPORT

For the non-catastrophe provision, candidates were expected to calculate ultimate loss development factors, determine the loss trend period, and apply the non-catastrophe ULAE factor. Many candidates did well on this part. Common errors included not calculating a per-exposure provision for the pure premium indication or calculating the projected loss for each accident year but not determining a selected provision for the pure premium indication.

For the catastrophe portion, candidates were expected to determine the trend in average AIY per exposure and use this to trend AIY/Exposure to the proposed policy period. Candidates were then expected to apply the non-modeled and modeled catastrophe provisions and catastrophe ULAE provisions to determine the projected catastrophe loss and LAE per exposure. Common errors included not calculating or applying an AIY/Exposure trend and applying the incorrect ULAE provision to the projected catastrophe losses.

EXAM 5 FALL 2014 SAMPLE ANSWERS AND EXAMINER'S REPORT

QUESTION 6	
TOTAL POINT VALUE: 2.25	LEARNING OBJECTIVES: A5, A6
SAMPLE ANSWERS	
Part a: 0.5 point	
<p>All variable $V = 0.06 + 0.095 + 0.028 + 0.12 = 0.303$ Indicated rate = $450 / (1 - 0.05 - 0.303) = 695.52$</p>	
Part b: 1 point	
<p>Using the premium-based projection method $\% \text{ fixed} = 6.0\% * 75\% + 9.5\% * 75\% + 2.8\% * 25\% = 12.325\%$ Fixed expense = $12.325\% * 750 = 92.44$ $\% \text{ variable} = 30.3\% - 12.325\% = 17.975\%$ Indicated avg rate = $(450 + 92.44) / (1 - 5\% - 17.975\%) = 704.24$</p>	
Part c: 0.75 point	
<p>Projected ave. Prem (\$750) is higher than the historical one (\$675). Using prem based method to evaluate fix expense assumes fix expense scales with prem. This is not very accurate since #1. Some fix expense does not depend on size of policy; 2. Fix expense may trend differently from prem. So, fix expense may be over-estimated, and result in (b) excessive.</p> <p>The result in part b is excessive. Since the expense ratios were calculated using an Avg Prem of 675, the true fixed expense amount is $(675 * .12325) = 83.19$. However, in the rate calculation an avg prem of 750 was used, which means our fixed expense amount was estimated to be $(750 * .12325) = 92.44$. Since this estimated fixed expense is greater than the true fixed expense of 83.19, the indicated rate is excessive.</p>	
EXAMINER'S REPORT	
<p>Candidates were expected to know how to calculate the expense provisions and the indicated average rate, as well as understand the limitations of premium-based projection method for calculating expenses.</p> <p>Most candidates scored well on parts a and b. However, part c required a deeper understanding of the underlying concept with a more in-depth discussion and most candidates didn't receive full credit.</p>	
Part a	
<p>Candidates were expected to know how to calculate the expense provision assuming all expenses vary proportionally with projected average premium, then calculate the indicated average rate using the pure premium method.</p>	

EXAM 5 FALL 2014 SAMPLE ANSWERS AND EXAMINER'S REPORT

Most candidates correctly calculated the variable expense provision and the indicated average rate.

The most common mistake was calculating the indicated average rate change instead of the rate.

Part b

Candidates were expected to know how to calculate the fixed and variable expense provisions then calculate the indicated average rate using the pure premium method.

Most candidates correctly calculated the fixed and variable expense provisions and the indicated average rate.

Common mistakes included calculating the indicated average rate change instead of the rate and applying the fixed expense provision to the pure premium instead of the projected average premium.

Part c

Candidates are expected to understand the limitations of premium-based projection method for calculating expenses. Specifically, they should know that if the projected average premium differs from the historical average premium upon which selected expense ratios were based, then the fixed expenses and the resulting indicated rate would be inaccurate.

Most candidates correctly stated that the indicated rate in part b was excessive but were not able to fully discuss the underlying reasons.

Common mistakes included:

- Stating that expenses were distorted instead of fixed expenses only.
- Not fully discussing how the difference in average premium distorts the fixed expenses.
- Providing the correct support but reaching the wrong conclusion on the adequacy of the indicated rate in part b.
- Incorrectly comparing the indicated rate in part b to the historical average premium to determine its adequacy.

EXAM 5 FALL 2014 SAMPLE ANSWERS AND EXAMINER'S REPORT

QUESTION 7						
TOTAL POINT VALUE: 2.5				LEARNING OBJECTIVE: A6		
SAMPLE ANSWERS						
Accepted Answer 1						
Accident Year	Written Exposures	Earned Exposures	Trend Period	Trend Factor	Trended Ultimate Loss & LAE	Projected Pure Premium
2011	22,000	16,500	3.5	1.109	15,803,204	957.77
2012	24,200	23,650	2.5	1.077	20,995,570	887.76
2013	26,620	26,015	1.5	1.045	22,997,388	884.00
Total		66,165			59,796,163	903.74
<p>Written Exposures = Written Policies / 2 Earned Exposures = 0.75 * Current Year Written Exposures + 0.25 * Prior Year Written Exposures Trend Period = Time between 7/1/AY and 1/1/15 (Average Accident Date when rates in effect) Trend Factor = 1.03 ^ Trend Period</p> <p>Projected Pure Premium is based on all three years of data, since the data is fully credible.</p> <p>Indicated Rate = $(903.74 + 50) / (1 - 0.20 - 0.05) = 1,271.65$ Indicated Rate Change = $1,271.65 / 1,000 - 1 = 27.2\%$</p> <p>Accepted Answer 2 (justification of pure premium selection only):</p> <p>Given that the data is fully credible (though maybe not for individual years), I will select an average of the latest two to determine Pure Premium. AY 2011 seems like an outlier.</p> <p>Accepted Answer 3 (justification of pure premium selection only):</p> <p>I chose a three year weighted average to calculate the pure premium which is slightly higher than the straight average as I wanted to give more weight to more recent Pure Premium which have more exposures.</p>						
EXAMINER'S REPORT						
<p>This question tested candidates' knowledge of how to calculate written and earned exposures, trend losses, justify a pure premium selection from preliminary indications, and calculate a rate and rate change.</p> <p>The first portion requires knowledge that each six-month policy represents one-half of an exposure and a conversion of those written exposures to an earned basis to match the Accident Year losses presented. Candidates struggled most with this portion of the question. Most simply took the Written Policies as presented and used those as the exposure figure in calculating pure premium. Some recognized that each policy represented one-half of an exposure, but did not</p>						

EXAM 5 FALL 2014 SAMPLE ANSWERS AND EXAMINER'S REPORT

convert the result to an earned basis. Some converted the Written Policies figures to an earned basis correctly, but did not recognize that each policy represents one-half of an exposure. Few candidates made both necessary adjustments correctly.

Most candidates trended losses and calculated a pure premium appropriately. Some used an incorrect trend period or failed to properly justify their pure premium selection. Regarding the justification, candidates should offer a reason for making the selection that they did, not simply state that they chose some average. Most of the offered justifications were found reasonable and acceptable. Less common was the inclusion of an exposure trend, which is not appropriate for this question as the exposure base is not inflation-sensitive.

As the company in the question only began writing policies in 2011, the average accident date for Accident Year 2011 is actually skewed slightly later than halfway through the year. This would make the trend period for AY 2011 3.375 years rather than 3.5. Given the rather nuanced nature of this adjustment, the use of either 3.375 years or 3.5 years was deemed acceptable. Few candidates noticed this subtlety, and many used a 3.5 year period.

Candidates generally handled the rate and rate change calculations well. Some employed a loss ratio approach instead of a pure premium approach, which was found acceptable.

EXAM 5 FALL 2014 SAMPLE ANSWERS AND EXAMINER'S REPORT

QUESTION 8	
TOTAL POINT VALUE: 4.25	LEARNING OBJECTIVE: A3, A4, A6
SAMPLE ANSWERS	
Part a: 1 point	
<p>Accepted Answer 1</p> <p>I would choose CW indication as the complement of credibility because it is credible and accurate. State A only has 5% of CW data, so CW can also be seen as independent.</p> <p>Total Region A is not appropriate because State X is 50% of the exposure, so it is not independent.</p> <p>Major competitor rate indication is not unbiased because those two companies are not targeting the exact same market.</p> <p>Annual inflation is not appropriate because it will not accurately reflect rate need in State X.</p> <p>Accepted Answer 2</p> <p>I would not use CW rate indication because there may be many differences between the "average CW company" and companies in State X (operational, territorial)</p> <p>I would not use State A indication because State X accounts for 50% of the region which would make the complement not independent from base</p> <p>Major competitor may also have many operational differences with State X and the data is not available to make proper adjustments.</p> <p>My selection would be trended present rates. The info is available. Complement will be unbiased and independent since projection and experience period to not overlap. It is easy to compute and has logical relationship to base.</p> <p>Accepted Answer 3</p> <p>Recommending major competitor complement of 4%. Assuming that it will be approved by DOI as a logical complement, and available, easy to compute. It also does not cause issues with independence (will be independent of our company)</p> <p>Countrywide may not accurately capture state specific experience.</p> <p>Total region has too much of our company experience in the complement. May have independence issues.</p> <p>Inflation trend will not capture loss experience completely – there could be underlying behavioral/social patterns influencing indication, and I don't think it's as accurate as major competitor</p>	

EXAM 5 FALL 2014 SAMPLE ANSWERS AND EXAMINER'S REPORT

Part b: 3.25 point

Note: Candidates were given credit for all premium, loss and indication calculations for any LDF and complement selections, given calculations were performed correctly.
Below are two examples of accepted answers.

Accepted Answer 1

On Level Premium

$$\text{OLF 2012} = (0.95 * 1.1) / (0.25 * 1 + 0.75 * .95) = 1.086$$

$$\text{OLF 2013} = (0.95 * 1.1) / (0.5 * .95 + .5 * .95 * 1.10) = 1.048$$

Loss Trend

From Avg Accident date 7/1/20XX

To Avg Accident date 4/1/2016

Trend Factor

$$2012 \ 1.02^{3.75}$$

$$2013 \ 1.02^{2.75}$$

Loss Development

$$12-24 = 1.265$$

$$24-36 = 1.1$$

$$36-48 = 1.06$$

$$48-60 = 1.02$$

$$60-72 = 1.0$$

$$72\text{-Ult} = 1.0$$

Because recent two years' development pattern is different than previous years, I choose the most recent two years' average link ratio to be more responsive to recent data.

CDF

$$2012 \ 1.2$$

$$2013 \ 1.52$$

AY	EP	OLF	Prem Trend	Trended OLEP	Reported Loss	CDF	Loss Trend	ALAE	Trended Ult Loss ALAE
2012	9500	1.086	1	10317	4800	1.2	$1.02^{3.75}$	1.04	6452
2013	9800	1.048	1	10270	4100	1.52	$1.02^{2.75}$	1.04	6844

$$\text{Loss Ratio} = \text{Trended Ult Loss ALAE} / \text{Trended OLEP} = (6452 + 6844) / (10317 + 10270) = 64.58\%$$

$$\text{Indicated Rate Change in State X} = (64.58\% + 5\%) / (1 - 27\% - 8\%) - 1 = 7.1\%$$

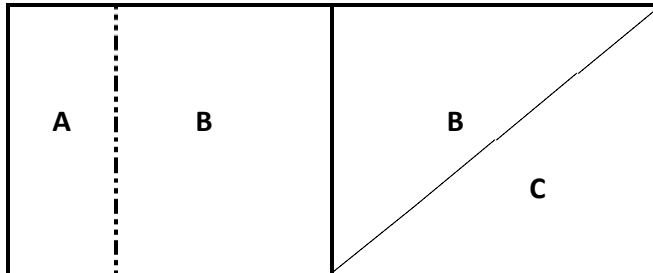
$$\text{Credibility Weighted Indication} = 7.1\% * .60 + 10\% * .40 = 8.23\%$$

EXAM 5 FALL 2014 SAMPLE ANSWERS AND EXAMINER'S REPORT

Accepted Answer 2

Premium -> no premium trend

Law Chg 4/1/12



1/1/2012

1/1/2013

1/1/2014

Current Rate Level = C = $0.95 * 1.1 = 1.045$

A = 1.0

B = $1.0 * .95 = .95$

CY 2012 OLF = $1.045 / (0.25 * 1.0 + 0.75 * .95) = 1.0857$

CY 2013 OLF = $1.045 / (0.5 * 0.95 + 0.5 * 1.045) = 1.0476$

	(1)	(2)	(3) = (1) *
<u>CY</u>	<u>EP</u>	<u>OLF</u>	<u>OLEP</u>
12	9,500,000	1.0857	10,314,150
13	9,800,000	1.0476	10,266,480

<u>AY</u>	<u>Trend from Date</u>	<u>Trend to Date</u>	<u>Trend Period</u>
12	7/1/12	4/1/16	3.75
13	7/1/13	4/1/16	2.75

Loss Dev

12-24 = Last 3 year average = 1.2833 because there appeared to be a decrease in 12-24 factors from 2010 to 2011 and I wanted to be somewhat responsive to this

24-36 = Last 3 year average = 1.1200 because same reason as 12-24

36-48 = All year average = 1.06 not much difference between factors

48-60 = 1.02

EXAM 5 FALL 2014 SAMPLE ANSWERS AND EXAMINER'S REPORT

	(4)	(5)	(6)	(7)	(8) = (4) * (5) * (6) * (7)	(9) = (8) / (3)
<u>AY</u>	<u>Rept Losses</u>	<u>Trend Period</u>	<u>Loss Dev</u>	<u>ALAE</u>	<u>Ult Proj Loss & ALAE</u>	<u>Proj Loss Ratio</u>
12	4,800,000	1.02^3.75	1.2109	1.04	6,510,787	0.6312
13	4,100,000	1.02^2.75	1.554	1.04	6,997,110	0.6815
					Average	0.6564

Company Indication = $(LR + FE) / (1 - V - Q) = (.6564 + 0.05) / (1 - .27 - 0.08) = 1.0868$

Cred Wtd Ind = Company Ind * Z + (1-Z) * CW Ind = $1.0868 * 0.60 + 0.40 * 1.10 = 1.09208$

Answer = 9.208%

Other Examples of Accepted LDF Selection Reasons

We can observe a change in the reporting patterns that may indicate an operation change (The LDFS @ 12-24 and 24-36 decrease along the AYs). However, without more information about this change, I am not confident about reflecting full change in indication. I will use a 3-yr average to reduce the impact, but would confirm change with management.

Use 3 yr simple average as the factors have dropped and continue to lower. Need to balance responsiveness and stability.

Since AY 2008, age to age factors at 12-24 mo and 24-36 mo have been steadily decreasing. I assume this is due to some operational change that is expected to continue, so I select the latest point for both ages.

EXAMINER'S REPORT

The candidate was expected to explain why the complements of credibility were appropriate/inappropriate as well as perform basic ratemaking calculations.

Candidates performed fairly well on the calculation component (part b) of the problem, whereas part a had more variability in candidate performance.

Candidates commonly missed points in part a for the inflation justification and part b for the LDF selection justification.

Part a

The candidate was expected to discuss why they choose their complement of credibility and provide reasons for not selecting the other potential complements. Listing the desirable characteristics of a complement of credibility wasn't sufficient since the candidate was expected to expand on why the complement did or didn't have the characteristic.

Candidates most commonly missed points on the inflation complement. Many said it wasn't logically related, but did not provide a reason why.

EXAM 5 FALL 2014 SAMPLE ANSWERS AND EXAMINER'S REPORT

Common errors made by candidates:

- Selecting Region A as the complement. This did not receive credit since State X comprises 50% of Region A and is clearly dependent. By selecting Region A, it was felt that the concept of credibility wasn't understood well.
- Mixing up the meaning of bias and independence, particularly when it came to justifying Region A as an inappropriate complement. If State X comprises 50% of Region A, this is an independence issue.

Part b

The candidate was expected to on-level premium, justify the LDF selection, develop and trend losses as well as calculate the indication and credibility weighted indication.

Most candidates performed well on this part of the question.

Common errors made by candidates:

- Not adequately justifying the LDF selection. Simply acknowledging the LDFs were decreasing over time did not receive credit. With proper support, any LDF selection was accepted.
- Trending losses to the wrong date, such as 4/1/15 or 10/1/15, not 4/1/16.
- The 2012 law change affected all in-force policies. Instead, some candidates calculated the on-level factor for 2012 as if it was a rate change.
- When on-leveling premium, calculating 4/1/2012 as a third of the way through the year instead of a quarter of the year.
- Forgetting to multiply the losses by the LAE.

EXAM 5 FALL 2014 SAMPLE ANSWERS AND EXAMINER'S REPORT

QUESTION 9	
TOTAL POINT VALUE: 2.75	LEARNING OBJECTIVE: A8
SAMPLE ANSWERS	
Part a: 1.75 points	
<p>\$130: Probability switching = $0.9 (150-130)/100 = 0.18$</p> <p>\$140: Probability switching = $0.9 (150-140)/100 = 0.09$</p> <p>No impact to profit from high risk, since charged true cost</p> <p>\$130: Profits = $10,000 (130-100) + 0.18 (90,000) (130-100) = \\$786,000$</p> <p>\$140: Profits = $10,000 (140-100) + 0.09 (90,000) (140-100) = \\$724,000$</p> <p>Company A should charge \$130 to low risk insureds</p>	
Part b: 0.5 point	
<p>Company B will experience adverse selection as more low risks move to company A from B and more high risks move from B to A, following lower rates offered. As the adverse selection continues, Company B will go through a cycle of increasing rates which leads to more adverse selection until it goes either insolvent, implements the rating variable A uses, or focuses on high risks only.</p>	
Part c: 0.5 point	
<p>Acceptable Answers:</p> <ul style="list-style-type: none">• Company B can implement the same rating variable as company A.• Charge lower than 130 but higher than 100 for the low risks.• Focus only on high risk insureds and charge the true costs.• It could exit the market. Since company A can better differentiate risks, it will be very hard to be profitable in this market.• B can find other rating characteristics to segment the market in a more refined manner that A has not discovered.• Change marketing strategy or provide better customer service to attract more low risk insureds.	
EXAMINER'S REPORT	
Part a	
<p>Most candidates understood that they should take a short term view (as the long term view is covered in part b) and that the decision ought to be based on profitability. They were given the probability of risks shifting which lead most of them to calculate those probabilities even if they didn't properly recognize what to do with that information after that.</p>	

EXAM 5 FALL 2014 SAMPLE ANSWERS AND EXAMINER'S REPORT

Common errors included:

- Using only the number of risks shifting between companies for the calculation of profit. They did not also factor in the 10K low risks that company A was already starting with. This is pertinent since changing the volume between companies would lead to a different answer.
- Using the correct probabilities of shifting against the incorrect number of risks.

Part b

There had to be a relatively clear recognition of the ultimate ramifications of the problem in order to get full credit.

The most common error was a lack of recognition of the ultimate impact of the adverse selection. Either the candidates didn't recognize the implications over a long period of time or they didn't recognize the seriousness of what could happen to a company that doesn't react. Neither of those types of answers would qualify as a full description of adverse selection.

Part c

Candidates should be able to cite at least one strategy.

The most common error was suggesting a change in underwriting guidelines to bring in fewer high risks. This addresses how to keep the unprofitable high risks from moving away from company A and into company B but fails to recognize that this won't solve the problem. Company B will still be unprofitable -- just an unprofitable company with fewer policies.

EXAM 5 FALL 2014 SAMPLE ANSWERS AND EXAMINER'S REPORT

QUESTION 10	
TOTAL POINT VALUE: 1.75	LEARNING OBJECTIVE: A9
SAMPLE ANSWERS	
Part a: 0.75 point	
<p>Indicated relativities generally increase without reversals, which suggest this variable could be statistically significant. Looking at the ind. rel. by years, all three year's curve lie closely on top of each other & show consistent upward direction, so the variable passes consistency test. Note that there's a little disparity for Hazard class A & G, but those levels have few exposures, so the disparity for those do not disqualify the stable results for B to F.</p>	
Part b: 1 point	
<p>CART: a tree structured series of if-then scenarios which helps to identify the relationships among variables. Could help to identify interaction variables for GLM analysis.</p> <p>Neural network: training program, data can be fed into the neural network & the program will automatically learn the structure of the data. Essentially an iterative GLM process. Could identify missing predictive variables in the GLM analysis.</p>	
EXAMINER'S REPORT	
Part a	
<p>Candidates generally were able to fully evaluate the predictive power. Responses were accepted for both good and poor predictive power given the response was supported by a reasonable rationale. Also, candidates were given credit for evaluative statements and did not need to comment of the usability of this variable in a rate plan to receive full credit.</p> <p>Some candidates simply described the graph. These responses were not given full credit unless accompanied by statements evaluating the predictive value of results.</p>	
Part b	
<p>To receive full credit, candidates needed to describe two techniques and explain how appropriate data mining techniques would enhance a GLM analysis. Some candidates only described or only related back to GLM, which did not receive full credit.</p> <p>Many candidates simply identified analysis techniques (model validation, supplementary data), which did not receive credit.</p>	

EXAM 5 FALL 2014 SAMPLE ANSWERS AND EXAMINER'S REPORT

QUESTION 11							
TOTAL POINT VALUE: 3				LEARNING OBJECTIVE: A9			
SAMPLE ANSWERS							
Part a: 2 points							
Accepted Answer 1							
Terr	EE	Ult nonCAT Loss	ALAE	PP	Normalized PP	Cred Z	Curr Rel
1	2,500	3,200	1.04	$3200 \times 1.04 / 2500 = 1.3312$	1.2308	$\sqrt{2500/5000} = 0.7071$	1.15
2	7,000	6,200	1.04	0.9211	0.8506	1	1
3	500	1,000	1.04	2.08	1.9231	0.3162	0.9
Total	10,000			1	1		1.0325
Terr	Normalized Curr Rel		Cred wted ind rel		ind rel to base		
1	1.1138		$0.7071 \times 1.2308 + (1 - 0.7071) \times 1.138 = 1.1965$		$1.1965 / 0.8506 = 1.4067$		
2	0.9685		0.8506		1		
3	0.8717		1.2042		1.4157		
Total							
Accepted Answer 2							
Terr	EE	(\$000) Ult Loss&ALAE	(\$000) PP	inc rel	cred	compliment	
1	2,500	$3200 \times 1.04 = 3328$	1.3312	1.23086	$\sqrt{2500/5000}$	$1.15 / 1.0325$	
2	7,000	$6200 \times 1.04 = 6448$	0.9211	0.85161	1	$1 / 1.0325$	
3	500	$1000 \times 1.04 = 1040$	2.08	1.9231	$\sqrt{500/5000}$	$0.9 / 1.0325$	
Total	10,000	10816	1.0816	1		1	
*Total current relativity = $0.25 \times 1.15 + 0.7 \times 1 + 0.05 \times 0.9 = 1.0325$							
compliment is the current relativity							
Adjust Terr 2 Relativity to 1 (base Rate)							
cred weighted relativities are							
Terr 1 = $[\sqrt{2500/5000} \times 1.23076 + (1 - \sqrt{2500/5000}) \times 1.15 / 1.0325]$ =1.405							
Terr 3 = $[\sqrt{500/5000} \times 1.9231 + (1 - \sqrt{500/5000}) \times 0.9 / 1.0325]$ 1.414							
Terr 2 =1							

EXAM 5 FALL 2014 SAMPLE ANSWERS AND EXAMINER'S REPORT

Part b: 0.5 point

Accepted Answer 1

Terr. 1 is likely to have high percentage of los sev. Losses that will impact into Terr 1 rate relativity, since Pure Premium method assumes uniform distribution of other variables and does not take correlation into account. Terr. 1 rate is understated.

Accepted Answer 2

Terr. 1 relativity may be unjustifiably low since we're not controlling for amount of insurance in this univariate analysis, ie we may be "double counting" the effect of low value homes

Accepted Answer 3

The pure premium method does not account for the fact that some rating variables might be correlated. When there is correlation b/w rating variables, we can see a double counting effect. Therefore, territory 1 might be picking up the fact that ult losses are smaller (b/c home values are smaller), which can distort the indicated territory 1 relativity. The indicated terr 1 relativity will be too low if it picks up the smaller avg loss amount in terr 1 due to smaller avg home values.

Part c: 0.5 point

Accepted Answer 1

This loss should be excluded and add-back an appropriate large loss load based on analysis with larger volume of data

Accepted Answer 2

Remove from losses and include it as a part of the large loss loading and apply loading factor back to the non-cat loss

Accepted Answer 3

This loss should be taken out of the analysis because it is a shock loss. If it is left in the analysis it can distort the results and make them volatile. If left in, the indicated rel will be higher in years with shock losses and lower in years without shock losses. Since we took it out of the analysis a large loss provision should be added back in to price for large losses over a longer term.

EXAMINER'S REPORT

Part a

Candidates were expected to apply the pure premium method to determine credibility weighted revised relativities. This includes calculating pure premium – including ALAE (unless mentioning that

EXAM 5 FALL 2014 SAMPLE ANSWERS AND EXAMINER'S REPORT

ALAE had no effect on this particular problem's answer) – by territory and in total, calculating territory relativity to total, and then credibility weighting against the normalized current relativity. Finally, relativities needed to be restated using Territory two as the base territory.

Common mistakes included omitting ALAE from pure premium, not calculating the revenue-neutral normalized current relativity and calculating a loss ratio rather than pure premium by dividing loss+ALAE by earned premium.

Part b

Candidates were expected to explain the direction and source of the distortion, as well as the underlying assumption of the pure premium method that was violated. Common mistakes included providing only discussion around one of those items (for example describing the assumption violated but not the direction of distortion) or simply restating the question as their reasoning. Other responses gave descriptions of how to correct for distortions, which while often insightful, did not address the question.

Part c

Candidates were expected to know how to reduce distortions in rating caused by large losses, specifically by capping/removing large losses and applying an excess/large loss load. Candidates generally did well on this part, although the most common mistake was neglecting to add in a large loss or excess loading back in.

EXAM 5 FALL 2014 SAMPLE ANSWERS AND EXAMINER'S REPORT

QUESTION 12																									
TOTAL POINT VALUE: 2.5	LEARNING OBJECTIVE: A13																								
SAMPLE ANSWERS																									
Part a: 0.5 point																									
<p>Acceptable Answers:</p> <ul style="list-style-type: none"> • Asset share pricing looks at the long term profitability of a policy where pure premium approach looks at profit over 1 policy period. • Asset share pricing takes into account persistency rates (renewal rates) where pure premium method does not. • Asset share pricing takes into account different expenses for new & renewal business whereas pure premium ratemaking uses the same expenses for both. • Asset share pricing uses a discount factor in analysis but PP ratemaking does not. • Asset share takes Present Value of losses + Premium. PP ratemaking does not. 																									
Part b: 1.0 point																									
<table border="1"> <thead> <tr> <th><u>PY</u></th> <th><u>Persistency</u></th> <th><u>Cumulative</u></th> <th><u>PV Premiums</u></th> </tr> </thead> <tbody> <tr> <td align="center">1</td> <td align="center">1</td> <td align="center">1.00</td> <td align="center">800</td> </tr> <tr> <td align="center">2</td> <td align="center">0.85</td> <td align="center">0.85</td> <td align="center">662</td> </tr> <tr> <td align="center">3</td> <td align="center">0.81</td> <td align="center">0.689</td> <td align="center">524</td> </tr> <tr> <td align="center">4</td> <td align="center">0.82</td> <td align="center">0.565</td> <td align="center">418</td> </tr> <tr> <td align="center">5</td> <td align="center">0.88</td> <td align="center">0.497</td> <td align="center">357</td> </tr> </tbody> </table>	<u>PY</u>	<u>Persistency</u>	<u>Cumulative</u>	<u>PV Premiums</u>	1	1	1.00	800	2	0.85	0.85	662	3	0.81	0.689	524	4	0.82	0.565	418	5	0.88	0.497	357	
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5	0.88	0.497	357																						
Where PV Premiums = Prem x Cumulative Persistency/Discount factor																									
Part c: 1.0 point																									
Present value of profit using persistency rates from Part B																									
<table border="1"> <thead> <tr> <th><u>PY</u></th> <th><u>Profit</u></th> </tr> </thead> <tbody> <tr> <td align="center">1</td> <td align="center">-240</td> </tr> <tr> <td align="center">2</td> <td align="center">65</td> </tr> <tr> <td align="center">3</td> <td align="center">61</td> </tr> <tr> <td align="center">4</td> <td align="center">56</td> </tr> <tr> <td align="center">5</td> <td align="center">54</td> </tr> <tr> <td></td> <td align="center"><hr/></td> </tr> <tr> <td></td> <td align="center">-4</td> </tr> </tbody> </table>	<u>PY</u>	<u>Profit</u>	1	-240	2	65	3	61	4	56	5	54		<hr/>		-4									
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1	-240																								
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5	54																								
	<hr/>																								
	-4																								
Under the first assumption of persistency, profits are positive; they are <u>NOT</u> under the second.																									
Sample Recommendation #1: Management could offer a renewal discount to improve persistency. Discount could be calculated so that overall profits remain positive.																									
Sample Recommendation #2:																									

EXAM 5 FALL 2014 SAMPLE ANSWERS AND EXAMINER'S REPORT

I recommend that marketing is increased to boost the persistency rates so that there can be growth and remain profitable. I am skeptical about increasing rates as this will reduce growth and persistency.

EXAMINER'S REPORT

Candidates were expected to know the differences between the standard pure premium rate making method and the asset share pricing approach, as well as the basic formulas for calculating the present value of both premiums and profits under the latter approach. Candidates were further expected to draw upon their understanding of ratemaking in general and the specific assumptions under the asset share pricing approach and provide a recommended course of action in light of the information provided in the question.

Subparts a & b of the question required the candidate to briefly discuss differences between methods and perform basic calculations showing an understanding of the asset share pricing method. Subpart c was challenging for most candidates with few receiving full credit, as it required a more comprehensive understanding of ratemaking in general and required synthesis across syllabus material. Many candidates confused the change in persistency assumptions with the requested rate change recommendation (that is, they thought that their recommendation should be whether or not to adopt the change in persistency, not whether or not to change the rating structure given the sensitivity of profitability results to assumptions in persistency).

Part a

Candidates were expected to be able to discuss two basic differences between the pure premium method and the asset share pricing method for ratemaking and identify the method associated with each of the characteristics for which those differences existed.

Common mistakes included:

- Restating the same difference twice, in two different ways, instead of providing two distinct differences.
- Providing characteristics that differed between the two methods but failing to identify the method to which those characteristics applied. (For instance, some candidates listed a difference as "persistency was used in the analysis", but failed to identify that it was the asset share pricing method and not the pure premium method that used persistency in its analysis.)

Part b

Candidates were expected to recalculate the cumulative persistency for PYs 3, 4 and 5, and to plug those revised persistency numbers into the formula to calculate the revised present value of premiums for all five policy years. The sum of the five revised policy years was not required to be shown if the five individual revised years were shown. Alternatively, the successful candidate could show only the three individual years requiring recalculation (for PYs 3, 4 and 5), in addition to either the final sum of the five policy years or a statement indicating that PYs 1 and 2 did not

EXAM 5 FALL 2014 SAMPLE ANSWERS AND EXAMINER'S REPORT

change.

Common mistakes included:

- Failing to recalculate the cumulative persistency and thus the present value of premium for PY 5.
- Calculating revised cumulative persistency and the present value of premium for PYs 4 and 5 instead of PYs 3, 4 and 5.
- Failing to include either (1) a sum of the revised present value of premiums for all five policy years or (2) a statement indicating that the present value of premiums for PYs 1 and 2 did not change.
- Calculating the revised present value of profits rather than the present value of premiums. (This subpart of the question did not require the recalculation of profits.)
- Failure to show any calculations whatsoever in determining the revised present value of premiums (regardless of attainment of correct answer).

Part c

Candidates were expected to be able to discuss the results of the asset share model under each set of persistency assumptions and to make an informed recommendation as to whether or not to change the rating structure in light of the management's profitability and growth goals.

Common mistakes included:

- Failing to calculate the present value of profits under the revised cumulative persistency assumptions.
- Applying the revised cumulative persistency to the original profit numbers rather than the income (that is, double-hitting persistency).
- Applying the same decrease in the present value of premiums to derive the revised present value of profits (does not reflect the impact that persistency has on the present value of losses).
- Erroneously calculating the ROE comparison by changing only the present value of premium (ROE is calculated as the ratio of PV(Profit) to PV(Premium). Both the numerator and denominator change with the revised persistency assumptions.)
- Failing to discuss the comparison of present value of profits under both persistency assumptions (that is, only discussing the present value of profits under one scenario, not both).
- Failing to provide a recommendation.
- Failing to provide a recommendation regarding the rating structure.
- Failing to address both the growth and profitability goals in the recommendation.
- Erroneously assuming the change in persistency assumption was the rate recommendation.

EXAM 5 FALL 2014 SAMPLE ANSWERS AND EXAMINER'S REPORT

QUESTION 13	
TOTAL POINT VALUE: 1.5	LEARNING OBJECTIVE: B1
SAMPLE ANSWERS	
Part a: 0.75 point	
Sample Answers:	
Internal Management	
<ul style="list-style-type: none">• It would make a book appear less profitable, causing a rate increase where one may not have been needed.• May purchase unnecessary reinsurance contracts or choose to increase reinsurance limits• Internal management will allocate capital towards meeting these liabilities which could have been invested elsewhere.• Lead to wrong interpretation of results and wrong decision to exit a LOB	
Investors	
<ul style="list-style-type: none">• Investors may see the decline in profitability and pull out their investments	
Regulators	
<ul style="list-style-type: none">• They may not correctly evaluate the liabilities of this insurer and thus take unnecessary measures to protect its solvency	
Part b: 0.75 point	
Sample Answers:	
Internal Management	
<ul style="list-style-type: none">• May decide to decrease rates since their loss ratios look good• May decide to grow their business when they should not because their profits are not as high as they believe• May be overly optimistic and may reduce reinsurance limits• Could lead internal management to hold less than required capital to pay future claims	
Investors	
<ul style="list-style-type: none">• Inadequate unpaid claim estimates mean ultimate loss estimates will be low and the company will look really profitable to investors. Investors may decide to invest based on this even though they shouldn't.	
Regulators	
<ul style="list-style-type: none">• May delay their intervention because they think the company is in a good position	
EXAMINER'S REPORT	
Many candidates received full credit on this question.	
Part a	

EXAM 5 FALL 2014 SAMPLE ANSWERS AND EXAMINER'S REPORT

Overall, candidates did well on part a. Common mistakes included not providing enough detail on specific impacts to decision making of the three viewpoints, not understanding the definition of a redundant unpaid claims estimate, and confusing the role of regulators with the role of rating agencies.

Part b

Candidates had a bit of a harder time correctly responding to Part B, specifically regarding the regulators. The most common mistake was for candidates to assume that the regulators recognized the inadequacy in unpaid claim estimates and would step in to address solvency concerns. However, the question was specifically addressing the impact on regulator's decision making in the situation where they believed the unpaid claim estimate to be accurate. Some candidates also lost points for not providing enough detail around their answers.

EXAM 5 FALL 2014 SAMPLE ANSWERS AND EXAMINER'S REPORT

QUESTION 14			
TOTAL POINT VALUE: 3		LEARNING OBJECTIVE: B2, B4	
SAMPLE ANSWERS			
Part a: 2 points			
i. Paid Claims			
	12	24	36
2011	460	1,080	1,310
2012	660	2,060	
2013	1,000		
ii. Reported Claims			
	12	24	36
2011	960	1,580	1,580
2012	1,260	2,690	
2013	1,600		
iii. Reported Claim Count			
	12	24	36
2011	2	3	3
2012	3	4	
2013	3		
iv. Closed Claim Count			
	12	24	36
2011	1	2	2
2012	1	2	
2013	0		
Part b: 1 point			
Accepted Answer 1 – Paid / Reported Claims			
	12	24	36
2011	0.48	0.68	0.83
2012	0.52	0.77	
2013	0.63		
Ratio of paid to reported claims has increased. This could be due to an increase in payments or a reduction in case reserve adequacy			

EXAM 5 FALL 2014 SAMPLE ANSWERS AND EXAMINER'S REPORT

Accepted Answer 2 – Closed / Reported Claim Counts

	12	24	36
2011	0.5	0.67	0.67
2012	0.33	0.5	
2013	-		

Ratio of closed to reported claim counts has decreased. This could be due to a slowdown in claim closure.

Accepted Answer 3 – Average Case Outstanding

	12	24	36
2011	500	500	270
2012	300	315	
2013	200		

Average case reserve is decreasing. This could be due to a decrease in case reserve adequacy.

Accepted Answer 4 – Average Reported Claim

	12	24	36
2011	480	527	527
2012	420	673	
2013	533		

Average reported is increasing. This could be due to an increase in payments or case reserve adequacy.

Accepted Answer 5 – Average Paid Claim

	12	24	36
2011	460	540	655
2012	660	1,030	
2013	n/a		

Average paid is increasing. This could be due to an increase in payments or a change in the type of claim that is being closed.

Accepted Answer 6 – Insufficient Data

11 claims are not credible enough to draw a conclusion about operational changes.

EXAM 5 FALL 2014 SAMPLE ANSWERS AND EXAMINER'S REPORT

EXAMINER'S REPORT

The candidate was expected to be able to put together cumulative annual triangles by accident year for paid, reported, reported claim count and closed claim counts. The candidate was also expected to be able to generate a diagnostic triangle that would help identify an operational change and then to be able to briefly discuss the change as it related to the available data.

Part a

The candidate was expected to be able to put together cumulative annual triangles by accident year for paid, reported, reported claim count and closed claim count.

The candidates in general scored well on this section. Some candidates had some had difficulties with accident date vs report date in terms of how to slot the claim. Some candidates did not create a cumulative triangle, and there were some arithmetic errors.

Part b

The candidate was expected to be able to generate one additional triangle to show that an operational change took place during the experience period. This part was a little bit more difficult and required analysis of the available data. Overall the candidates scored well, although some of the candidates did not both identify and describe the operational change as it related to the available data. Sometimes there were arithmetic errors.

EXAM 5 FALL 2014 SAMPLE ANSWERS AND EXAMINER'S REPORT

QUESTION 15							
TOTAL POINT VALUE: 2				LEARNING OBJECTIVE: B3			
SAMPLE ANSWERS							
	(1)	(2)	(3)	(4)	(5) = (1)*(2)*(3)*(4)	(6)	(7) = (5)/(6)
	Reported Claims (000's)	LDF	Trend	Law Adjustment	Trended Ultimate	On Level EP	Loss Ratio
AY							
2011	20,900	1.6	1.145	0.800	30,631	38,000	80.6%
2012	21,000	2.1	1.070	0.889	41,949	50,000	83.9%
2013	11,500	3.7	1.000	1.000	42,550	67,000	63.5%
					ELR (average of 11 & 12):		82.3%
<p>AY 13 Ult = 67,000 * 0.822 = 55,104 IBNR = 55,104 – 11,500 = 43,604</p>							
EXAMINER'S REPORT							
<p>Candidates generally did well on this question. The most common error was an incorrect calculation of the adjustment for the law change for 2012: a large portion of the candidates used an adjustment factor of 0.9 instead of 0.8/0.9. Another fairly common error was to include the 2013 year in the average loss ratio selection. Candidates who included 2013 only received credit if they provided a detailed, reasonable justification.</p>							

EXAM 5 FALL 2014 SAMPLE ANSWERS AND EXAMINER'S REPORT

QUESTION 16																			
TOTAL POINT VALUE: 1.75			LEARNING OBJECTIVE: B3																
SAMPLE ANSWERS																			
Accident Half Year	6-12	12-18	18-24	24-30															
2011-1	1.250	1.114	1.000	1.000															
2011-2	2.000	1.750	1.200	1.000															
2012-1	1.250	1.120	1.000																
2012-2	2.000	1.750																	
2013-1	1.250																		
2013-2																			
<p>Looks like there is a seasonality issue. First half claims develop differently from second half claims. Select development factors separately:</p> <table border="1"> <thead> <tr> <th></th> <th>6-12</th> <th>12-18</th> <th>18-24</th> <th>24-30</th> </tr> </thead> <tbody> <tr> <td>First Half</td> <td>1.250</td> <td>1.117</td> <td>1.000</td> <td>1.000</td> </tr> <tr> <td>Second Half</td> <td>2.000</td> <td>1.750</td> <td>1.200</td> <td>1.000</td> </tr> </tbody> </table> <p>Estimated AY 2013 Ultimate Claim Counts: $45 \times 1.117 + 35 \times 2.000 \times 1.750 \times 1.200 = 197$</p> <p>The actuary's estimate of 152 is too low – maybe he/she did not take seasonality into consideration.</p>						6-12	12-18	18-24	24-30	First Half	1.250	1.117	1.000	1.000	Second Half	2.000	1.750	1.200	1.000
	6-12	12-18	18-24	24-30															
First Half	1.250	1.117	1.000	1.000															
Second Half	2.000	1.750	1.200	1.000															
EXAMINER'S REPORT																			
<p>The candidate was expected to identify seasonal loss development, to separately calculate and apply unique loss development factors to the half-year data, and to comment on the reasonability of the actuary's projected ultimate for 2013.</p> <p>In general, candidates did well on this question. Most identified the need to apply seasonally-adjusted LDF's and were able to determine that the actuary's estimate, based on non-seasonally adjusted LDF's, was unreasonably low.</p> <p>Common mistakes included:</p> <ul style="list-style-type: none"> • Incorrectly calculating an LDF or incorrectly calculating/selecting an appropriate average for a specific age-to-age link factor (most notably, problems occurred with the 12-18 factor for the 1st half year) • Failing to note the seasonality (and calculating/applying "blended" ldf's) • Not applying the proper age-to-ultimate cumulative development factor (CDF) to the proper 2013 half-year raw claim count • Neglecting to comment on the reasonability of the actuary's projected ultimate of 152 																			

EXAM 5 FALL 2014 SAMPLE ANSWERS AND EXAMINER'S REPORT

QUESTION 17				
TOTAL POINT VALUE: 3.5			LEARNING OBJECTIVE: B3, B5	
SAMPLE ANSWERS				
Part a: 2.5 points				
Disposal Rate Triangle (Closed Claim Count / Ultimate Claim Counts)				
AY/Eval	12	24	36	48
2010	0.50	0.75	0.90	1.00
2011	0.50	0.75	0.95	
2012	0.50	0.80		
2013	0.60			
Incremental Closed Claim Counts for AY 2013 ((Ultimate Claims – Closed) x (1-%closed to date) x (incremental % closed)				
AY/Eval	12	24	36	48
2010	100	50	30	20
2011	110	55	44	
2012	90	54		
2013	132	44	33	11
Incremental Paid Severity Triangle (Incremental Paid / Incremental Closed Claims)				
AY/Eval	12	24	36	48
2010	10,000	15,000	20,000	25,000
2011	11,000	16,500	21,400	
2012	12,100	17,655		
2013	12,947			
Change in Incremental Severity Triangle				
AY/Eval	12	24	36	
2011/2010	10%	10%	7%	
2012/2011	10%	7%		
2013/2012	7%			
AY 2013 Trended Incremental Severities				
AY/Eval	12	24	36	48
2010	10,000	15,000	20,000	25,000
2011	11,000	16,500	21,400	
2012	12,100	17,655		
2013	12,947	18,891	24,501	30,626

EXAM 5 FALL 2014 SAMPLE ANSWERS AND EXAMINER'S REPORT

Unpaid Claims Estimate (Incremental Closed Claims x AY 2013 Trended Incremental Severities)

AY/Eval	24	36	48	Total
Severity	18,891	24,501	30,626	
Counts	44	33	11	
Ultimate	831,197	808,528	336,887	1,976,613

Part b: 1.0 point

As can be seen from the increase in disposal rates in the latest calendar year, the reforms have reduced the amount of time that claims remain open. (see triangle in part a)

Inflation in 2013 was reduced from prior years (7% from 10%, see severity trend triangle) but it did not decrease by half, so the reforms only had a partial impact here.

EXAMINER'S REPORT

Part a

Candidates were expected to be able to use the given counts and paid triangles to assess how the recently implemented reforms have affected claim closure and payment patterns in CY 2013, and then use adjusted claim counts and severities to calculate an unpaid estimate. On the claim count side, this involves calculating cumulative disposal rates for CY 2013 and then applying those disposal rates to the AY 2013 ultimate claim counts to project incremental closed claims. For severity, this involves knowing how to calculate incremental severities, severity trend, being able to correctly select the right trend, and then applying the trend to CY 2013 severities to bring them up to AY 2013 levels.

1. Cumulative Disposal Rate Triangle – Most candidates were able to get full credit here.
2. Incremental Closed Claim Counts for AY – This part was a little more challenging and was often skipped. Common mistakes involved taking a historical average of the disposal rates rather than using the most recent diagonal and calculation or formula errors that resulted in a change in the overall ultimate claim count.
3. Incremental Paid Severity Triangle – This was somewhat challenging. Many candidates calculated the cumulative severity triangle instead of the incremental triangle.
4. Change in Incremental Severity Triangle – Candidates who attempted this part generally did well, but this was often skipped.
5. AY 2013 Trended Incremental Severities – This was challenging for a lot of candidates. The most common mistakes were selecting the wrong trend, not correctly applying the trend, using an average severity as the base instead of the latest diagonal, or just skipping this section entirely.

EXAM 5 FALL 2014 SAMPLE ANSWERS AND EXAMINER'S REPORT

6. Unpaid Claims Estimate – This was somewhat challenging. Answers to this response were related to how the rest of the question was approached. One common mistake was to calculate paid LDFs and then calculate the unpaid estimate as ultimate severity times ultimate claims.

This was a challenging question overall. There were a significant number of candidates who used Frequency-Severity Method 1 or 2, which did not correctly adjust for the legislative reform.

Part b

Candidates were expected to be able to use the diagnostic severity trend and disposal rate triangles to assess whether the reforms were successful or not. Most candidates who answered this question did fairly well on part b. Some common errors were not calculating the inflation/severity trends correctly or not specifically stating that while the change in inflation was directionally consistent with the intent of the reforms, the reforms were still not fully successful.

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QUESTION 18	
TOTAL POINT VALUE: 1.5	LEARNING OBJECTIVE: B3
SAMPLE ANSWERS	
Part a: 1.25 points	
<p><u>Accepted Answer 1</u></p> <p>BF Ultimate = $30,000(.579)(1 - 1/1.8) + 12,000 = 19,720$ Benktander IBNR = $19,720(1 - 1/1.8) = 8,764.44$</p> <p><u>Accepted Answer 2</u></p> <p>IBNR Using Bornhuetter-Ferguson Technique $30,000(0.579)(1 - 1/1.8) = 7,720$</p> <p>IBNR Using Reported Development Technique $12,000(1.80) - 12,000 = 9,600$</p> <p>IBNR Using Benktander Technique $9,600(1/1.8) + 7,720(1 - 1/1.8) = 8,764.44$</p>	
Part b: 0.25 point	
<p><u>Accepted Answer 1</u> The Bornhuetter-Ferguson and Development techniques</p> <p><u>Accepted Answer 2</u> BF Technique and Chain-Ladder Technique</p> <p><u>Accepted Answer 3</u> Development Technique/Expected Claims Technique</p>	
EXAMINER'S REPORT	
<p>The candidate was expected to know how to apply the Benktander technique (and by extension, the B-F technique) to a set of summarized data. The candidate was also expected to know the credibility analogy for the Benktander technique.</p> <p>Candidates generally scored well. There was information included that was not necessary to calculate the correct answer, and in several cases this resulted in candidates providing more than was necessary for full credit or using the additional information in the calculation incorrectly.</p>	
Part a	

EXAM 5 FALL 2014 SAMPLE ANSWERS AND EXAMINER'S REPORT

The candidate was expected to know how to apply the Benktander technique (and by extension, the B-F technique) to a set of summarized data.

To obtain full credit, the candidate needed to calculate the B-F ultimate (or IBNR if using the credibility-weighting method for Benktander), including the correct formula or value for the unreported claims %. The candidate had to calculate the Benktander IBNR correctly, showing sufficient work to demonstrate a correct understanding of the Benktander method. The majority of candidates were able to calculate the Benktander IBNR correctly.

Common errors included:

- Providing the Benktander Ultimate, instead of the IBNR as asked
- Erroneously including the expected claims ratio in the Benktander formula
- Using information from years other than 2013 in calculating the solution

Part b

The candidate was expected to know two techniques which can be credibility weighted together to obtain the Benktander estimate.

To obtain full credit, the candidate had to provide two correct general techniques (i.e., not specific techniques such as paid or reported methods) since the question called for the Benktander technique without qualification rather than (for example) Reported Benktander. A fair number of candidates received full credit for this part.

Common errors included:

- Limiting the response to a specific technique (e.g., Reported development technique)
- Listing Expected claims and B-F as the two techniques
- Listing more than two methods, because three methods cannot be credibility weighted to obtain the Benktander estimate
- Many candidates wrote more than was required for this question, for example providing the full credibility formula/weights.

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QUESTION 19	
TOTAL POINT VALUE: 2.25	LEARNING OBJECTIVE: B4, B5
SAMPLE ANSWERS	
Part a: 0.75 point	
<p>The increase in case outstanding will cause historical LDFs to be too high when applied to higher reported claims. Estimated Ultimate Claims would be overstated.</p> <p>Acceptable answers for subpart ii:</p> <ul style="list-style-type: none">• Berquist-Sherman• Paid techniques• Expected Claims Ratio (Expected Loss Ratio)	
Part b: 0.75 point	
<p>The average accident date will shift to later in the year, causing the most recent year to be less mature than prior years at same evaluation point. Estimated Ultimate Claims would be understated.</p> <p>Acceptable answers for subpart ii:</p> <ul style="list-style-type: none">• Split data into accident quarters (or any other smaller interval than years)• Expected Claims Ratio (Expected Loss Ratio)	
Part c: 0.75 point	
<p>Accepted Answer 1 Excess product will develop slower, meaning the LDFs would be understated. Estimated Ultimate Claims would be understated.</p> <p>Accepted Answer 2 Development Technique is ideal for high frequency, low severity lines; estimated ultimate claims would be volatile (highly leveraged, inaccurate) due to volatile (thin) excess losses.</p> <p>Acceptable answers for subpart ii:</p> <ul style="list-style-type: none">• Use industry (benchmark) data• Adjust development pattern to account for slower development (apply new tail factor)• Expected Claims Ratio (Expected Loss Ratio)	
EXAMINER'S REPORT	
<p>The candidates were expected to state whether each situation caused the estimated ultimate to be overstated or understated, to explain why that was true, and an alternate technique or adjustment to improve the estimate.</p> <p>Generally candidates did very well on part a, but struggled with parts b and c.</p>	

EXAM 5 FALL 2014 SAMPLE ANSWERS AND EXAMINER'S REPORT

Common mistakes included:

- Simply saying that the ultimate would be distorted (instead of over or understated)
- Neglecting to answer all parts of the question, especially for part c

This question was challenging, and required the candidates to synthesize knowledge across multiple components of the syllabus. Candidates who clearly had a solid understanding of the reported development technique scored well.

Part a

Candidates needed to know that the estimate would be overstated because of the reserve strengthening or because historical LDFs would be overstated due to the increased reported claims

Most candidates were able to correctly identify another technique to improve estimated claims. The most common mistake was to argue that the case reserves would be decreased and thus the estimated ultimate would be understated. This answer was not accepted because it is unreasonable to assume the company had been setting reserves above policy limits prior to the change.

Part b

Candidates needed to know that the estimate would be understated because the average accident date shifted to later in the year.

Most candidates knew that splitting up the data into quarters would improve the estimate. The most common mistake was to argue that the estimated ultimate would increase proportionately as premium/exposure increased, which would produce an accurate estimated ultimate. This neglects the fact that a rapid increase in writings will cause the average accident date to shift and understate the ultimate.

Part c

Candidates needed to know that the estimate would be understated because of the slower developing excess product or that excess data is volatile which could cause a highly leveraged ultimate estimate.

Common mistakes included:

- Arguing that excess losses develop differently from basic losses rather than specifying that they develop slower.
- Mentioning that the excess data should be analyzed separately without specifying an alternate technique was identified to analyze the new excess losses.
- Some candidates said to apply an ILF or excess loss provision on top of the basic limits without identifying a specific technique to analyze the excess.

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QUESTION 20

TOTAL POINT VALUE: 3.75

LEARNING OBJECTIVE: B5

SAMPLE ANSWERS

Adjusted Reported Triangle = Adjusted Paid + Adj Open Claim Count x (Adj Avg CO)

Avg CO adj = Case outstanding / Open CC

2010	265	698	657	1500	↑ Adjusted using 5% trend
2011	278	733	690		
2012	292	770			
2013	307				

DR = Closed Claim Counts / Ult Claim Counts

Restated Closed Claim Counts

2010				1.000	2010	6	10	12	13
2011			0.923		2011	6	10	12	
2012		0.770			2012	6	10		
2013	0.461				2013	6			

<- select latest diagonal

Adjusted Paid Triangle

Adj Open CC = Reported – Adjusted

2010	1700	4370	5623	6250	2010	2	1	1	1
2011	1818	4763	6350		2011	2	1	1	
2012	1900	4860			2012	2	1		
2013	1460				2013	3			

Adjusted Reported Triangle

1700 + 265 (2)

↑

2010	2,230	5,068	6,280	7,750
2011	2,374	5,496	7,040	
2012	2,484	5,630		
2013	2,380			

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ATA

	12-24	24-36	36-48	
2010	2.27	1.239	1.234	
2011	2.315	1.281		
2012	2.27			
	2.285	1.26	1.234	<- All yr simple avg
CDF Ult	3.553			

Ult Claims = 2380 (3.553) = 8,456

EXAMINER'S REPORT

Candidates were expected to have an understanding of the Berquist-Sherman method and how to use it to adjust for environmental changes. They were expected to know the specific calculations/triangles required to calculate the adjusted ultimate.

The question was fairly challenging because it required the combination of two adjustments, which both include a large number of calculations/procedures that the candidate had to know and perform correctly.

Overall, most candidates received partial credit on this question. Most candidates who attempted the question received at least some partial credit. Very few candidates received full credit.

The most common mistake made by candidates was to not calculate and use an adjusted open count triangle. Other common mistakes included:

- Using the volume weighted average for the LDF selections, when the question specifically asked for a simple all-year average.
- Interpolating the paid triangle, when the interpolation table was provided (credit was still given for correct calculation via interpolation).
- Not combining the adjustments for case outstanding and claim settlements rates, and instead calculated two separate ultimates, when the question asked for one ultimate (or only doing one of the two calculation).
- Calculation errors.

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QUESTION 21				
TOTAL POINT VALUE: 2			LEARNING OBJECTIVE: B6	
SAMPLE ANSWERS				
Part a: 0.5 point				
Accepted Answer 1				
Accident	<u>Net to Gross triangle</u>			
<u>Year</u>	<u>12 Months</u>	<u>24 Months</u>	<u>36 Months</u>	<u>48 Months</u>
2010	0.65	0.65	0.65	0.65
2011	0.7	0.7	0.7	
2012	0.75	0.75		
2013	0.8			
Since the net to gross ratios are consistent along the accident years, we know that the reinsurance structure is Quota Share.				
Accepted Answer 2				
2010 has 65% quota share				
2011 has 70% quota share				
2012 has 75% quota share				
2013 has 80% quota share				
Part b: 1.5 points				
Accepted Answer 1				
Determine the Gross IBNR, apply the QS percentage to get ceded.				
	<u>12-24</u>	<u>24-36</u>	<u>36-48</u>	
<u>AY</u>	<u>Months</u>	<u>Months</u>	<u>Months</u>	
2010	2.320	1.5	1.2	
2011	2.280	1.53		
2012	2.320			
Select	2.307	1.515	1.2	
Age-to-Ult	4.194	1.818	1.2	
Gross IBNR = 3,250,000(4.194) – 3,250,000 = 10,380,500				
Net/Gross factor = .8 or Ceded factor = .2				
Ceded IBNR = 10,380,500 * (1-.8) = 2,076,100				

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Accepted Answer 2

Determine Ceded by calculating Gross Ultimate and Net Ultimate separately.

	12-24	24-36	36-48
<u>AY</u>	<u>Months</u>	<u>Months</u>	<u>Months</u>
2010	2.320	1.5	1.2
2011	2.280	1.53	
2012	2.320		
Select	2.307	1.515	1.2
Age-to-Ult	4.194	1.818	1.2

Gross Ultimate = 3,250,000(4.194) = 13,630,500

Net Ultimate = 2,600,000(4.194) = 10,904,400

Ceded Ultimate = 13,630,500 – 10,904,400 = 2,726,100

Ceded IBNR = 2,726,100 – (3,250,000 – 2,600,000) = 2,076,100

Accepted Answer 3

<u>Accident Year</u>	<u>Ceded Cumulative Reported Claims (\$000)</u>			
	<u>12 Months</u>	<u>24 Months</u>	<u>36 Months</u>	<u>48 Months</u>
2010	\$1,255	\$2,842	\$4,263	\$5,116
2011	\$900	\$2,052	\$3,139	
2012	\$825	\$1,914		
2013	\$650			

	12-24	24-36	36-48
<u>AY</u>	<u>Months</u>	<u>Months</u>	<u>Months</u>
2010	2.320	1.5	1.2
2011	2.280	1.53	
2012	2.320		
Select	2.307	1.515	1.2
Age-to-Ult	4.194	1.818	1.2

Ceded Ultimate = 650,000(4.194) = 2,726,100

Ceded IBNR = 2,726,100 – 650,000 = 2,076,100

EXAMINER'S REPORT

The candidate was expected to have a basic knowledge of the chain and ladder method and have a basic knowledge of quota share reinsurance.

Overall, candidates did very well on this question. Candidates who lost points on (a) also tended to lose points on (b).

EXAM 5 FALL 2014 SAMPLE ANSWERS AND EXAMINER'S REPORT

Part a

The candidate needed to show some calculation and deduce that the reinsurance structure was quota share.

Most candidates got full credit on this part. The most common error was claiming the reinsurance was excess loss because the net / gross ratios changed year over year.

Part b

The candidate was expected to calculate and select age-ultimate factors, correctly develop ultimate claims, correctly take out paid claims (depending on the candidate's method) and keep track of gross/net/ceded claims.

Most candidates did very well on this part. The most common mistakes were:

- Not subtracting paid claims to get IBNR
- Providing net IBNR not ceded IBNR
- Applying 20% quota share to the net claim estimate, not the gross.

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QUESTION 22	
TOTAL POINT VALUE: 1.75	LEARNING OBJECTIVE: B8
SAMPLE ANSWERS	
Part a: 1.25 points	
<p>Accepted Answer 1</p> <p>% rpt at 12 months: $1 / 6.67 = 15\%$ % rpt at 24 months: $1 / 2.86 = 35\%$</p> <p>At 7/31/2014, month of development = 19 months % rpt at 19 months: $0.15 + (19-12) / (24-12) * (0.35 - 0.15) = 0.2667$ % rpt at 19 months: $0.15 + 7/12 (0.35 - 0.15) = 0.2667$ IBNR = $5000 - 3000 = 2000$ Expected emergence from 12/31/2013 to 7/31/2014 = $2000 / (1-.15) * (0.2667 - 0.15) = 275$ Reported claims at 7/31/2014 = $3000 + 275 = 3275$</p> <p>Accepted Answer 2</p> <p>Expected emergence from 12 months to 24 months = $(5000 - 3000) / (1-15\%) * (35\% - 15\%) = 471$ Using linear interpolation at 19 months = $7 / 12 * 471 = 275$ Reported claims at 7/31/2014 = $3000 + 275 = 3275$</p>	
Part b: 0.5 point	
<p>Linear interpolation assumes that claims developed evenly and uniformly throughout the period. Reasons this assumptions may not hold include:</p> <ul style="list-style-type: none"> • Additional claims being incurred as well as development on claims already reported as well as faster reported claims earlier in the year may cause the linear interpolation to underestimate the expected claims (e.g. seasonality) • Highly leveraged development factors due to immature year • Claim distribution is typically not a straight line, but rather a curve, similar to the following: <div style="text-align: center;"> </div>	
EXAMINER'S REPORT	
Part a	

EXAM 5 FALL 2014 SAMPLE ANSWERS AND EXAMINER'S REPORT

Most candidates did well on this part. The candidate was expected to calculate (and demonstrate) their logic throughout the entire problem to obtain full credit.

Common errors included:

- Not realizing the question asked for projected values as 7/31/2014 and not 7/1/2014. This led to a wrong interpolation of the time frame.
- Determining the expected claims in the period 12/31/2013 to 7/31/2014, but failing to add the expected claims to the claims already reported at 12/31/2013.
- Coming up with a new ultimate claims amount by taking the reported claims and multiplying by the 12 to ultimate factor

Part b

Candidates generally did well on this question. The candidate was expected to understand and/or demonstrate that linear interpolation assumes uniform distribution throughout the year and give at least an example of why this assumption may not hold.

Common errors included:

- Stating insurance claims are not uniform, but not supporting the uniform argument by demonstrating understanding of the concept
- Using a restatement of the question as their answer

EXAM 5 FALL 2014 SAMPLE ANSWERS AND EXAMINER'S REPORT

EXAMINER'S REPORT
Part a
<p>Most candidates were able to correctly calculate 12-24 month link ratios and select 1.44 as the average. Most candidates correctly applied the 24-Ultimate link ratio to come up with a CDF of 1.80.</p> <p>The most common mistake was to calculate unpaid losses rather than IBNR.</p> <p>To note, very few candidates actually calculated the AY 2013 Ultimate Loss of 25,060, and then subtracted the 2013 Paid and the 2013 Case Reserves to arrive at an IBNR estimate. Instead, they calculated the unpaid losses of 14,000 (25,060-11,060), and then some of them subtracted the 5,720 case reserves to get the correct answer of 8,280.</p>
Part b
<p>Most candidates could correctly identify the final formula of the Classical Technique, which applied the ULAE ratios to $\frac{1}{2}$ the case reserves and the IBNR estimate from part a. The most common error was to use the latest diagonal of the accident year triangle as the inputs for the denominators of the "paid-to-paid" ratios rather than the calendar year losses.</p> <p>Many candidates also attempted to simply calculate a weighted average ratio by summing up the last diagonal and dividing by the sum of the ULAE figures. While this did give candidates a reasonable result, it did not follow the Classical Technique which specifically prescribed calculating year to year ratios, examining those ratios for any trends, and then making a ULAE ratio selection.</p>
Part c
<p>Most candidates correctly stated that the Classical Technique was not appropriate because of the fact that it was a new, rapidly growing company. Candidates generally got at least one of the assumptions correct, and many received full credit on this portion of the question.</p>
Part d
<p>Most candidates went with the Kittel Refinement as their refinement of choice for this question. Describing the refinement correctly was necessary to receive full credit. However, a lot of those candidates stated that the Kittel Refinement used the average of paid and reported losses in the denominator of the ULAE ratios, when it was actually paid & incurred (the text states that incurred includes reported plus IBNR losses).</p>

EXAM 5 FALL 2014 SAMPLE ANSWERS AND EXAMINER'S REPORT

QUESTION 24	
TOTAL POINT VALUE: 2.25	LEARNING OBJECTIVE: B3, B8
SAMPLE ANSWERS	
Part a: 0.75 point	
<p>Accepted Answer 1 (BF Incurred/Reported)</p> <p>The Reported BF technique will result in a reasonable estimate for ultimate claims $B-F \text{ Ult} = 20,000 + (1 - 1/8) * 100,000 = 107,500$ This estimate reflects the increased reported losses that resulted from the storm, but tempers those immature reserve estimates with IBNR calculated using a priori expected losses. Thus it doesn't overreact to the storm losses but still reflects them.</p> <p>Accepted Answer 2 (Expected with large loss load)</p> <p>Since severe storm = big large loss reported but not paid, we should take it out first. Expected reported @ 12 months = $100k \times 1/8 = 12.5k$ Large Loss = Total Reported – Expected Reported = $20k - 12.5k = 7.5k$ Since paid CDF is highly leveraged, I would recommend we use expected claim + large loss load. $\text{Ult} = 100k + 7.5k = 107.5k$</p> <p>Accepted Answer 3 (Paid Development with large loss load)</p> <p>Use paid development and add on a large loss (catastrophe load). No payments have yet to be processed so paid is not impacted. Current reported claims = 20,000 (w/ cat loss). Reported claims at beginning = $100,000 / 8 = 12,500$ (expectation w/o cat) Cat loss reported = $20,000 - 12,500 = 7,500$ Paid development = $5,000 * 20 = 100,000$ Add reported cat loss = 107,500 (assume storm cat loss is adequately reserved and does not require development)</p> <p>Accepted Answer 4 (BF Paid with large loss load)</p> <p>Reported development will overstate because includes storm loss. I use BF Paid and add in the storm loss for AY 2013. Expected loss of 100,000 with LDF reported of 8 => Reported as of 12/31/2013 should be $12,500 = 100k/8$. Let one adding storm; storm loss is 7,500. BF Paid method based on a priori estimate so won't affected by storm loss in the AY. So use BF Paid for Ult and add in storm. Ult based on BF Paid + Storm Loss = $[5,000 + 100,000 * (1-1/20)] + 7,500 = 107,500$</p> <p>Accepted Answer 5 (Reported with Storm Adjustment)</p> <p>I would use a Reported loss development with the severe storm losses removed. Develop the NonCAT to ultimate and add provision for the ultimate storm loss. This way LD method still</p>	

EXAM 5 FALL 2014 SAMPLE ANSWERS AND EXAMINER'S REPORT

works, history is usable and not distorted.

When expect 12,500 at 12 mos

$1/8 (100,000)$ so $20,000 - 12,500$ is storm losses 7,500.

$8 (12,500) = \text{Non Storm Ult} = 100,000 + 7,500 \text{ Storm Loss} = 107,500 \text{ Ult}$

Part b: 0.75 point

Accepted Answer 1 (Reported Development)

Reported development technique will overestimate

Rpt Dev Ult = $20,000 * 8.0 = 160,000$

This method applies the historical development to the current year. Because there are no severe storms in the experience used to calculate the Ult-CDF, it will treat the inflated 12-mo reported loss just like any other year and will result in an overestimate of the IBNR and thus the Ult loss.

Accepted Answer 2 (Case O/S Development)

Case O/S Development

ILDF = 8 PLDF = 20 $(8 - 1) * (20) / (20 - 8) + 1 = \text{OSLDF} = 12.667$

OS Ult = $5,000 + (15,000 * 12.667) = 195,000$

Overstated as the method develop a large event with large O/S. The observed experience is inconsistent with historical development.

Part c: 0.75 point

Accepted Answer 1 (Paid Development)

Paid development method will underestimate losses. This is because severe storm losses have not yet been paid (only reported) and historic LDF's do not include severe storm losses. So severe storm losses that occurred will not be taken into account at all.

Paid Development Ultimate = $5000 * 20 = 100,000$ (paid loss) x (paid loss CDF)

Accepted Answer 2 (Expected Claims)

Expected claims with given ultimate of 100,000 will understate because it is not responsive to the catastrophe event.

Accepted Answer 3 (Paid BF)

Paid BF = $5,000 + 100,000 * (1 - 1/20) = 100,000$

Paid is not processed. So paid BF doesn't consider effect of large loss. Loss estimate understated.

EXAMINER'S REPORT

EXAM 5 FALL 2014 SAMPLE ANSWERS AND EXAMINER'S REPORT

Candidates generally selected the correct methods and correctly calculated each part. Common errors included using the incorrect paid and reported data/LDFs when calculating ultimate claims, lacking a full explanation for why the selected method was appropriate or inappropriate, and not fully explaining why the method does or does not work in this problem's particular scenario.

Part a

The candidate had to identify the correct method, correctly calculate the method, and clearly explain why the method calculated a reasonable estimate of ultimate claims, identifying that the method is able to capture the reported to date storm loss but also not be overly responsive to the storm loss for future emergence.

Common errors included selection of the wrong method or identifying the method without describing why it worked in the problem's particular case. Also, when using the BF Reported Method, many candidates neglected to mention that it both includes the storm loss but also uses an a priori loss amount (which do not include storm losses) to calculate the IBNR.

Part b

The candidate had to identify the correct method, correctly calculate, and clearly explain why the method calculated an overstated estimate of ultimate claims, identifying that the method uses historical development factors, which did not include storm losses, and applies to storm losses, which should not be developed as much.

Common errors mostly included selection of the wrong method. When using the reported loss development as an answer (which was the most common response) some candidates simply stated that the reported development method was applying a high LDF to a high loss amount, without describing why that was inappropriate in this particular case. Also, many candidates said that the LDF was affected by the storm, which is not true (the LDF is based on historical years). When suggesting the Case Outstanding method as a response to the problem, only a handful of candidates calculated the correct ultimates; most either forgot to include paid to date or incorrectly calculated the factor used to derive the unpaid (Case + IBNR) portion of ultimates.

Part c

The candidate had to identify the correct method, correctly calculate, and clearly explain why the method calculated an understated estimate of ultimate claims, identifying that the method ignored the storm losses in some way.

Common errors included selection of the wrong method or not mentioning the lack of the storm or large loss impact on the chosen method. Again, some candidates simply described the method rather than commenting why it was inappropriate in this problem's scenario.