SOCIETY OF ACTUARIES
Introduction to Ratemaking & Reserving

Exam GIIRR

AFTERNOON SESSION

Date: Tuesday, October 28, 2014
Time: 1:30 p.m. – 3:45 p.m.

INSTRUCTIONS TO CANDIDATES

General Instructions

1. This afternoon session consists of 9 questions numbered 13 through 21 for a total of 40 points. The points for each question are indicated at the beginning of the question.

2. Failure to stop writing after time is called will result in the disqualification of your answers or further disciplinary action.

3. While every attempt is made to avoid defective questions, sometimes they do occur. If you believe a question is defective, the supervisor or proctor cannot give you any guidance beyond the instructions on the exam booklet.

Written-Answer Instructions

1. Write your candidate number at the top of each sheet. Your name must not appear.

2. Write on only one side of a sheet. Start each question on a fresh sheet. On each sheet, write the number of the question that you are answering. Do not answer more than one question on a single sheet.

3. The answer should be confined to the question as set.

4. When you are asked to calculate, show all your work including any applicable formulas.

5. When you finish, insert all your written-answer sheets into the Essay Answer Envelope. Be sure to hand in all your answer sheets since they cannot be accepted later. Seal the envelope and write your candidate number in the space provided on the outside of the envelope. Check the appropriate box to indicate morning or afternoon session for Exam GIIRR.

6. Be sure your written-answer envelope is signed because if it is not, your examination will not be graded.

Tournez le cahier d'examen pour la version française.

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Exam GIIRR-Front Cover

****BEGINNING OF EXAMINATION****
Afternoon Session
Beginning with Question 13

13. (*5 points*) You are estimating ultimate claims for a book of business using the expected method and are given the following information:

Accident Year	Earned Premiums	Projected Ultimate Claims from Development Method	Premium On-Level Factors at 2013 Level
2010	8,500	8,390	1.08
2011	7,480	6,990	1.04
2012	8,890	7,080	1.03
2013	9,150	6,950	1.00

- Annual claim trend is 2.2%.
- A tort reform was effective January 1, 2012, with the effect that claim severities were reduced by 20%.

(a) (*3 points*) Calculate and select the 2013 expected claim ratio to be used to calculate expected claims.

(b) (*1 point*) Calculate the 2012 expected claims.

(c) (*1 point*) Explain whether a ratemaking analysis would overstate or understate the true rate change required if the above tort reform adjustment were not made when estimating each of the following:

(i) Ultimate claims

(ii) Annual claim trend

14. (*6 points*) Two Dimensional Insurance Company uses only two rating variables for its automobile insurance policy. One is gender (male and female) and the other is location (urban, suburban, and rural). Rates are determined as

$$\text{base rate} \times \text{gender factor} \times \text{location factor}.$$

The base rate of 33.72 is the exposure-weighted average trended ultimate pure premium. The factors are to be determined using only experience data, with no credibility adjustments.

The exposures for the six rating class combinations are given in the following table:

Exposures			
	Location		
Gender	Urban	Suburban	Rural
Male	7	2	3
Female	2	6	5

(a) (*1 point*) Determine if the exposures exhibit distributional bias. Support your conclusion.

The trended ultimate pure premiums are given in the following table:

Trended Ultimate Pure Premiums				
	Location			
Gender	Urban	Suburban	Rural	Total
Male	50	35	25	41.25
Female	40	28	20	26.77
Total	47.78	29.75	21.88	**33.72**

(b) (*2 points*) Calculate the rebalanced pure premiums using one-way analysis relativities for each rating variable.

The minimum bias method is to be used to obtain the final relativities. The process starts with the one-way relativities for location.

(c) (*2 points*) Calculate the revised relativities for gender that result from a single iteration of the minimum bias method.

14. Continued

In this case the converged results of the minimum bias method will be factors that reproduce all six trended ultimate pure premiums. Your actuarial intern Tiffany asks you if this will always be the outcome of the minimum bias method.

(d) (*1 point*) Describe the conditions under which the minimum bias method reproduces the trended ultimate pure premiums and demonstrate that the conditions are met in this case.

15. (*4 points*) You are given the following information:

- Property with an insurable value of 100,000 is insured under a policy with an 80% coinsurance requirement.
- Claim sizes of 50,000 and 90,000 are equally likely; no other claim sizes are possible.
- There is no deductible.
- The expected claim cost for a policy with an amount of insurance of 80,000 is 520.

(a) (*1 point*) Explain the benefit to the insured of purchasing a policy with an amount of insurance of 90,000.

(b) (*2 points*) Calculate the expected claim cost for policies with each of the following amounts of insurance:

(i) 70,000

(ii) 90,000

An insured purchases a policy with an amount of insurance of 60,000 and a deductible of 1,500.

(c) (*1 point*) Calculate both the coinsurance penalty percentage and the amount retained by the insured for a claim of 50,000.

16. (*4 points*) Your company writes business covering two distinct groups with stable characteristics. IBNR claim liabilities are currently set using historical information for all groups aggregated. During 2013, there was a shift in the proportion of business written by group. You are investigating whether this will affect the accuracy of your reserving process. You are given the following information:

Group	Percentage of Claims Reported at Age			
	12	**24**	**36**	**48**
A	40%	60%	80%	100%
B	50%	75%	100%	

Group	Premium Mix %	
	Historical 2000-2012	**Actual 2013**
A	50%	70%
B	50%	30%

Group	Ultimate Claim Ratio
A	60%
B	40%

- Your company charges the same premium rates for Groups A and B.
- There were no changes in premium rates between 2012 and 2013.
- There has been no trend in claims.
- Assume 2013 experience was as expected and total 2013 premiums were 1,000.

(a) (*0.5 points*) Calculate ultimate claims for accident year 2013 using both the historical and actual business mix.

(b) (*0.5 points*) Calculate 2013 IBNR claim liabilities for accident year 2013 using the actual business mix.

(c) (*3 points*) Calculate the percentage over- or under-estimate in 2013 IBNR claim liabilities for accident year 2013 under the following methods if the historical business mix is assumed:

(i) Expected Claims

(ii) Reported Development

(iii) Reported Bornhuetter Ferguson

17. (*5 points*)

(a) (*0.5 points*) Explain the consistency test for increased limits factors.

(b) (*1 point*) Illustrate your answer to part (a) by means of a graph.

Claims are uniformly distributed between 0 and 100 and trend acts uniformly on claims of all sizes.

(c) (*2 points*) Calculate the trend factor in the layer 20 to 60 resulting from a 50% inflationary trend.

(d) (*1.5 points*) Explain why there is a difference between the effect of trend on claims capped by the basic limit and the effect of trend on claims excess of the basic limit.

18. (*4 points*) You are estimating unpaid unallocated loss adjustment expenses (ULAE) using the Mango and Allen smoothing adjustment and are given the following information:

Accident Year	Selected Ultimate Claims
2010	8,750
2011	8,920
2012	9,040
2013	9,250

	Maturity Age in Months		
	12	**24**	**36**
Reported CDF	1.923	1.205	1.000

(a) (*1 point*) State three circumstances where the Mango and Allen adjustment is particularly valuable.

(b) (*2 points*) Calculate the expected reported claims in calendar years 2012 and 2013.

You are given the following additional information:

Calendar Year	Paid ULAE	Expected Paid Claims
2012	828	8,860
2013	808	9,022
Total	**1,636**	**17,882**

(c) (*1 point*) Select the ULAE ratio using the Mango and Allen smoothing adjustment based on the average of expected paid and expected reported claims. Justify your selection.

19. (*4 points*) You are given the following information evaluated as of December 31, 2013 for a liability line of business:

Accident Year	Earned Premium	Paid Claims	Reported Claims
2010	12,700	3,700	7,650
2011	12,900	2,250	7,050
2012	12,400	1,570	5,200
2013	11,900	750	4,100
Total	**49,900**	**8,270**	**24,000**

Projected Ultimate Claims					
Accident Year	Development Method		Cape Cod Method		Frequency-Severity Closure Method
	Paid	Reported	Paid	Reported	
2010	9,300	10,500	9,400	9,850	9,100
2011	8,600	11,200	9,250	10,500	8,950
2012	9,600	11,600	9,300	11,200	8,800
2013	8,700	13,900	8,950	12,600	8,600
Total	**36,200**	**47,200**	**36,900**	**44,150**	**35,450**

Projected Ultimate Claim Ratios (for diagnostic purposes)					
Accident Year	Development Method		Cape Cod Method		Frequency-Severity Closure Method
	Paid	Reported	Paid	Reported	
2010	73%	83%	74%	78%	72%
2011	67%	87%	72%	81%	69%
2012	77%	94%	75%	90%	71%
2013	73%	117%	75%	106%	72%

Projected Ultimate Pure Premiums (for diagnostic purposes)					
Accident Year	Development Method		Cape Cod Method		Frequency-Severity Closure Method
	Paid	Reported	Paid	Reported	
2010	206	232	208	218	201
2011	199	259	214	243	207
2012	234	282	226	273	214
2013	223	356	229	323	221

- Earned premiums are adjusted to accident year 2013 rate levels.
- Rates have increased over the past five years consistent with indicated rate changes.
- Expected annual claims trend is estimated to be approximately 3%.

19. Continued

(a) (*3 points*) Select the ultimate claims for each accident year. Justify each selection using the information from the diagnostic tables.

(b) (*1 point*) Calculate the expected reported claims from December 31, 2013 through March 31, 2014 for accident year 2013 using the selections from part (a).

20. (*4 points*) You are part of a team at Cool Breeze Insurance Company that is setting rates for homeowners insurance catastrophe coverage with respect to hurricane losses in southern Florida.

Grossi and Kunreuther suggest that the base premium for a given county comprises three components.

(a) (*2 points*) Describe each of the three components and indicate how each may be determined for Cool Breeze.

Within a given county, Cool Breeze's rates may be adjusted based on attributes of the insured dwelling. Grossi and Kunreuther discuss two attributes that are of primary importance.

(b) (*1 point*) Describe each of the two attributes.

Friedland notes that when estimating expected claims from a catastrophe it is important to account for post-event inflation.

(c) (*1 point*) Define post-event inflation and provide an example that relates to hurricane losses.

21. (*4 points*) You are given the following information about a liability book of business:

Accident Year	Actual Reported Claims as of Dec. 31, 2013	Expected Claims	Cumulative Development Factors
2011	5,830	9,540	1.64
2012	4,650	9,750	2.27
2013	3,270	10,100	3.85

(a) (*1 point*) Calculate ultimate claims for accident years 2011, 2012 and 2013 using the Bornhuetter Ferguson method.

(b) (*1 point*) Assess the reasonableness of the inputs for the Bornhuetter Ferguson method using this data.

The Bornhuetter Ferguson method could also be described as a credibility weighting of the claim development and expected methods.

(c) (*1 point*) Critique the interpretation of the Bornhuetter Ferguson method as a credibility weighting of the claim development and expected methods.

(d) (*1 point*) Explain why the expected method is likely more appropriate than the development method for analyzing a new line of business.

****END OF EXAMINATION****
Afternoon Session

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