SOCIETY OF ACTUARIES
Introduction to Ratemaking & Reserving

Exam GIIRR

AFTERNOON SESSION

Date: Wednesday, October 30, 2013
Time: 1:30 p.m. – 3:45 p.m.

INSTRUCTIONS TO CANDIDATES

General Instructions

1. This afternoon session consists of 8 questions numbered 14 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 14

14. (*6 points*) You are given a table of reported claims and the corresponding age-to-age factors:

Accident Year	Reported Claims Maturity Age in Months						
	12	**24**	**36**	**48**	**60**	**72**	**84**
2006	13,944	16,887	18,990	20,178	21,040	21,708	22,209
2007	10,150	12,078	13,509	14,261	14,815	15,315	
2008	8,626	10,322	11,561	12,200	12,740		
2009	8,366	10,081	11,292	11,993			
2010	6,380	7,541	8,478				
2011	5,962	7,201					
2012	10,190						

Accident Year	Reported Claims Age-to-Age Factors Maturity Age Interval in Months					
	12 - 24	**24 - 36**	**36 - 48**	**48 - 60**	**60 - 72**	**72 - 84**
2006	1.211	1.125	1.063	1.043	1.032	1.023
2007	1.190	1.118	1.056	1.039	1.034	
2008	1.197	1.120	1.055	1.044		
2009	1.205	1.120	1.062			
2010	1.182	1.124				
2011	1.208					
Simple 3-year Average	1.198	1.121	1.058	1.042	1.033	1.023

(a) (*1.5 points*) Calculate three alternative average age-to-age factors for the interval 12-24, based on:

(i) Volume weighted 3-year

(ii) Medial 5x1

(iii) Geometric 3-year

(b) (*1 point*) List three considerations in selecting age-to-age factors.

14. Continued

You have decided to use the simple 3-year average with the original Bondy method as the tail factor.

(c) (*1.5 points*) Calculate the percentage of incremental reported claims expected between 48 and 60 months.

The reported claims for 2012 contain a single large claim of 4,000.

(d) (*1 point*) Calculate the ultimate claims for this accident year both with and without a large claim adjustment.

(e) (*1 point*) State an assumption underlying each approach in (d).

15. (*4 points*)

(a) (*1 point*) State the two basic principles on which prospective experience rating plans are based.

(b) (*2 points*) Propose an experience rating formula and explain how it takes into account these two basic principles.

An insured company, WC Plumbing, reported a substantial operating loss in the latest year. Given that it experienced only three claims during the year, it is considering enrollment in a retrospective rating plan in an attempt to save on insurance costs.

(c) (*1 point*) Recommend whether, from WC Plumbing's perspective, it would be a good candidate for retrospective rating and justify your recommendation.

16. (*6 points*) You are conducting a ratemaking analysis for a portfolio of automobile insurance policies and are given the information in the following two tables:

Calendar Year	General and Other Acquisition Expenses	Direct Earned Premiums
2008	108,000	691,000
2009	138,000	725,000
2010	115,000	770,000
2011	126,000	834,000
2012	130,000	866,000

Budgeted Direct Earned Premium at Current Rate Level	895,000
Budgeted Exposure Counts (vehicles)	1,150
Weighted Average Trended Pure Premium	476.00
ULAE as a Ratio to Claims	8.0%
Commissions as a Percentage of Premium	12.0%
Premium Taxes as a Percentage of Premium	2.0%
Licenses as a Percentage of Premium	1.0%
Profit and Contingencies Factor	3.0%

(a) (*2 points*) Select a fixed and variable expense ratio as a percentage of direct earned premiums to be used for ratemaking purposes assuming that historically 30% of general and other acquisition expenses are considered to be fixed expenses. Justify your selection.

(b) (*2 points*) Calculate the indicated rate and indicated rate change given the selected fixed expense ratio from (a).

Recent rate changes and shifts in the mix of business can lead to distortions when using an approach based on a selected fixed expense percentage applied to a projected average premium for ratemaking.

(c) (*2 points*) Explain how each of these situations can affect the level of fixed expenses in a ratemaking analysis and recommend a solution for each to avoid potential distortion.

17. (*5 points*) Student Insurance Company writes four-month property policies for university students living in apartments. Policies are issued according to the university terms, which are Fall (September 1 to December 31), Spring (January 1 to April 30), and Summer (May 1 to August 31). Assume an annual frequency trend of 0% and an annual severity trend of 2.5%.

Accident Period	Reported Counts at Maturity Age in Months						Exposures	Ultimate Severity
	4	8	12	16	20	24		
Summer 2010	2,510	5,010	7,079	7,079	7,079	7,079	250,000	2,300
Fall 2010	1,401	4,221	10,287	10,287	10,287	10,287	350,000	2,320
Spring 2011	3,009	4,805	8,672	8,672	8,672	8,672	300,000	2,340
Summer 2011	2,622	5,240	7,614	7,614	7,614	7,614	262,500	2,360
Fall 2011	1,466	4,406	10,696	10,696	10,696	10,696	367,500	2,380
Spring 2012	3,137	5,030	9,293	9,293	9,293		315,000	2,400
Summer 2012	2,687	5,422	7,912	7,912			270,000	2,420
Fall 2012	1,504	4,527	11,339				378,000	2,440
Spring 2013	3,246	5,163					324,000	2,460
Summer 2013	2,761						277,500	2,480

Accident Period	Age-to-Age Factors				
	Maturity Age Interval in Months				
	4-8	8-12	12-16	16-20	20-24
Summer 2010	2.00	1.41	1.00	1.00	1.00
Fall 2010	3.01	2.44	1.00	1.00	1.00
Spring 2011	1.60	1.80	1.00	1.00	1.00
Summer 2011	2.00	1.45	1.00	1.00	1.00
Fall 2011	3.01	2.43	1.00	1.00	1.00
Spring 2012	1.60	1.85	1.00	1.00	
Summer 2012	2.02	1.46	1.00		
Fall 2012	3.01	2.50			
Spring 2013	1.59				

Project ultimate claims for Spring 2013 and Summer 2013 using a frequency-severity method given the information above, and justify all selections.

18. (*4 points*) Big Cat Insurance Company (BCI) is considering entering into a securitization agreement with respect to hurricane losses in a well-defined geographic region. One of its concerns with regard to such agreements is basis risk.

(a) (*1 point*) Define basis risk and describe how it can occur in this context.

BCI is considering four types of securitization:

I. Indemnity-based securitization
II. Index-based transaction
III. Parametric indices
IV. Notional portfolio

(b) (*2 points*) State if there is basis risk for BCI with each of these securitization types. If there is no basis risk, explain why not, and if there is basis risk, explain how that securitization type creates basis risk.

(c) (*1 point*) Indicate an action BCI can take to reduce basis risk for two of the securitization types that you identified as having basis risk.

19. (*5 points*) The following table of reported counts for Exposition Insurance Company was produced based on information through December 31, 2012:

	Reported Counts at Maturity Age in Months							
Accident Year	**12**	**24**	**36**	**48**	**60**	**72**	**84**	**Selected Ultimate Count**
2006	1,492	1,940	2,134	2,198	2,242	2,264	2,287	2,287
2007	1,582	2,056	2,262	2,329	2,376	2,400		2,424
2008	1,676	2,179	2,397	2,469	2,519			2,544
2009	1,777	2,310	2,541	2,617				2,669
2010	1,884	2,449	2,694					2,800
2011	1,997	2,596						2,938
2012	2,116							3,081

You are conducting an actual to expected analysis of reported counts as of April 30, 2013. At your request, your actuarial student Tony produced the table below, based on actual reported counts as of April 30, 2013 that you provided. Tony noted that the percent reported values as of December 31, 2012 were determined by taking the ratio of the reported counts as of December 31, 2012 to the selected ultimate counts. He further noted that linear interpolation was used to obtain the April 30, 2013 cumulative development factors.

Accident Year	**Actual Reported April 30, 2013**	**Expected Reported April 30, 2013**	**Percent Reported Dec. 31, 2012**
2006	2,287	2,287	100.0%
2007	2,409	2,408	99.0%
2008	2,514	2,519	99.0%
2009	2,628	2,626	98.1%
2010	2,710	2,711	96.2%
2011	2,806	2,673	88.4%
2012	2,635	2,318	68.7%

19. Continued

(a) (*1 point*) Show that Tony's calculation for accident year 2010 is correct, based on the methodology he used.

The selected ultimate counts were based on taking several methods into account (rather than being the result of a strict application of one specific method, such as the development method).

(b) (*2 points*) Write a brief note to Tony explaining why it may have been more appropriate to use the cumulative development factors from one specific method for this task.

The actual reported values as of April 30, 2013 for accident years 2011 and 2012 are both larger than expected.

(c) (*2 points*) Provide two questions you would pose to your company colleagues in an investigation of this observation.

20. (6 *points*)

(a) (*1 point*) Describe two situations for which the expected method would be a preferred approach for projecting ultimate claims.

(b) (*1 point*) Define exposure base and leading indicator.

(c) (*1 point*) Describe two desirable characteristics of exposures for actuarial work.

You are given the following information about Motor Insurance Company (MI), which has been selling automobile insurance for five years:

- All policies are annual policies and are issued on January 1 of each year.
- At the 2012 cost level, the expected claim ratio is 75%.
- At the 2012 cost level, the pure premium is 220.
- The annual pure premium trend is 2.4%.
- MI has had no rate changes in the past five years.
- For 2008, the earned premium is 24,540,000 and earned vehicles are 87,600.
- Tort reform was instituted on January 1, 2009, resulting in a reduction in severity of 30%.
- MI introduced a 10% discount on January 1, 2010 that is applicable to 40% of its customers.

(d) (*3 points*) Calculate the expected claims for 2008 using the expected method with the following approaches:

(i) Expected claim ratio

(ii) Pure premium

21. (*4 points*)

You are given the following information to calculate deductible factors:

Claim Range	Counts in Interval	Claims
0-250	200	30,000
250-750	300	150,000
>750	100	150,000
Total	600	330,000

(a) (*2 points*) Calculate the indicated deductible factors for deductibles of 250 and 750 relative to a base of zero deductible.

(b) (*0.5 points*) State two assumptions that you needed to make in using the information above to perform the calculation in part (a).

(c) (*1.5 points*) Determine the range into which the deductible factor for a 500 deductible must fall in order to be consistent with the deductible factors calculated in part (a) and explain your reasoning.

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

USE THIS PAGE FOR YOUR SCRATCH WORK