SOCIETY OF ACTUARIES
Introduction to Ratemaking & Reserving

Exam GIIRR

MORNING SESSION

Date: Wednesday, October 28, 2015
Time: 8:30 a.m. – 11:45 a.m.

INSTRUCTIONS TO CANDIDATES

General Instructions

1. This examination has a total of 100 points. It consists of a morning session (worth 60 points) and an afternoon session (worth 40 points).

   a) The morning session consists of 13 questions numbered 1 through 13.

   b) The afternoon session consists of 8 questions numbered 14 through 21.

   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****
Morning Session

1. (*4 points*) You are given the following information:

Policy Number	Policy Premium	Policy Effective Date	Policy Expiration Date
101	1,000	July 1, 2009	June 30, 2011
102	1,200	April 1, 2010	March 31, 2012
103	2,400	January 1, 2010	December 31, 2014
104	800	April 1, 2011	March 31, 2013
105	1,400	October 1, 2011	September 30, 2013

- The written premiums are divided into equivalent annual values and recorded on the anniversary of the effective date.
- Premiums are earned evenly throughout the policy term.
- There were no cancellations.

(a) (*1 point*) Calculate the written premiums for 2011.

(b) (*1 point*) Calculate the earned premiums for 2011.

(c) (*1 point*) Calculate the unearned premiums as of December 31, 2011.

Even earnings throughout the policy term are a key assumption for the above analysis.

(d) (*1 point*) Describe two examples of coverages for which premium is not earned evenly throughout the year.

2. (*4 points*) You are given the following information related to accident year 2012 claim experience:

Earned premiums	1,600,000
Expected claim ratio	68%
Paid claims	330,000
Case reserves	400,000

Selected age-to-age reported claim development factors:

12-24 months	24-36 months	36-48 months	48-60 months	60-72 months
2.000	1.500	1.250	1.100	1.040

There is no development beyond 72 months.

(a) (*2.5 points*) Estimate accident year 2012 IBNR reserves as of December 31, 2014 using:

(i) the Development method,

(ii) the Bornhuetter Ferguson method, and

(iii) one iteration of the Benktander method.

(b) (*1 point*) Explain if this business is performing better or worse than expected using the methods above.

(c) (*0.5 points*) Identify one weakness of the Benktander method.

3. (*4 points*) You are estimating ultimate claims as of December 31, 2014 using the Generalized Cape Cod method and are given the following information:

Accident Year	On-Level Earned Premiums	Cumulative Reported Development Factors	Actual Reported Claims as of Dec. 31, 2014
2013	15,000	1.500	6,000
2014	12,000	3.000	4,000
Total	**27,000**		**10,000**

- The annual claim trend is 4%.
- The selected decay rate is 80%.

(a) (*0.5 points*) Calculate the total used-up on-level earned premiums.

(b) (*0.5 points*) Calculate the total adjusted reported claims.

(c) (*1 point*) Calculate the total expected claims based on reported data.

(d) (*1 point*) Calculate the total projected ultimate claims.

(e) (*1 point*) Describe two differences between the Cape Cod method and the Generalized Cape Cod method.

4. (*4 points*) You are performing a risk classification analysis for a book of business, given the following information:

Rating Class A				
Accident Year	**Earned Exposures**	**Reported Claims at Dec. 31, 2014**	**Weights**	**Cumulative Development Factors**
2012	1,200	200,000	20%	1.105
2013	1,260	210,000	30%	1.250
2014	1,270	195,000	50%	1.530
Total	**3,730**	**605,000**		

- New rates will be in effect for one year, beginning May 1, 2016.
- All policies are written for twelve-month policy terms.
- The annual severity trend is 2%.
- The annual frequency trend is 5%.
- A legislative reform will be effective for all accidents occurring on or after January 1, 2016 that is anticipated to reduce the annual frequency trend for this line of business to 2%.

(a) (*2 points*) Calculate the trended ultimate pure premium for rating class A.

You are given the following information on all rating classes:

Rating Class	2014 Written Exposures	Ultimate Counts	Trended Ultimate Pure Premium	Industry Relativities
A	1,300	450	*From part (a)*	1.15
B	900	288	200	0.85
C	700	200	266	1.20
Total	**2,900**	**938**		

- The full credibility standard is 800 ultimate counts.
- The square root rule is used for partial credibility.
- The complement of credibility is assigned to the industry relativity.

(b) (*0.5 points*) Explain why written exposures should be used instead of earned exposures in a pure premium single variable analysis.

(c) (*1.5 points*) Calculate the credibility-weighted pure premium rating class relativities.

5. (*4 points*) Old Insurance Company (OIC) is not writing new business or renewing any policies or endorsements effective January 1, 2016. Attorney Jones (AJ) has always had claims-made legal professional indemnity insurance with OIC and plans to retire from legal practice December 31, 2018.

New Insurance Company (NIC) has offered AJ coverage based on the following assumptions:

- Coverage will begin on January 1, 2016 with no retroactive date.
- Premium will be level for each of the three years AJ intends to practice law.
- Any nose or tail premium will be included in the level premium.
- The occurrence pure premium for 2016 is 12,000 with a three-year occurrence reporting pattern with equal amounts reported in each year.
- The annual pure premium trend is 25%.
- There is no acquisition cost or other variable expense, but there is an expense fee of 1,000 for each of the three years and a one-time policy fee (viewed as premium) of 190.

(a) (*1 point*) Calculate the total pure premium based on the coverage described above.

(b) (*1 point*) Calculate the level premium that NIC proposes to offer AJ.

Your underwriter has come to you with suggestions for offering various schedule rating credits to AJ.

(c) (*2 points*) Explain how each of the following might or might not affect the frequency and severity of claims experience:

(i) The existence of an effective risk management program

(ii) AJ's planned retirement at the end of 2018

6. (*5 points*)

(a) (*1 point*) Explain whether you would consider each of the following expenses as either fixed or variable for ratemaking purposes:

(i) Policyholder dividends

(ii) Reinsurance provisions

You are given the following information:

Calendar Year	Written Premiums	Trended Earned Premiums at Current Rate Level	Acquisition Expenses	Taxes and Licenses
2012	11,880	11,245	1,722	290
2013	12,348	11,828	1,802	345
2014	13,521	13,006	1,933	425

- Two-thirds of the acquisition expenses are categorized as variable.
- The annual trend for fixed expenses is 0.7%.
- Taxes and licenses were restructured in 2013 and increased by 20%.
- Rates are to be effective April 1, 2015 for one year.
- All policies are written for twelve-month policy terms.

(b) (*2 points*) Calculate the acquisition expense ratios.

(c) (*1 point*) Calculate the taxes and licenses expense ratio.

CH Auto Insurance considers salaries and rent as variable expenses.

(d) (*1 point*) Explain how such an approach could lead to a mismatch between actual expenses and premium provisions for salaries and rent.

7. (*5 points*) As part of your investigations into IBNR reserves for XYZ Insurer, you are conducting diagnostic tests for changing levels of case reserve adequacy. You are given the following information:

Accident Year	Reported Claims (000)		
	12	24	36
2012	3,850	4,950	5,533
2013	6,326	8,056	
2014	5,045		

Accident Year	Paid Claims (000)		
	12	24	36
2012	2,200	3,850	4,675
2013	2,472	6,326	
2014	2,461		

Accident Year	Open Counts		
	12	24	36
2012	900	300	150
2013	990	330	
2014	960		

- The annual severity trend is 0%.
- There is no development after 36 months.
- There was a large accident year 2013 claim of 2,000,000 reported in 2013 and paid in 2014.

(a) (*2.5 points*) Calculate the average case estimate triangle, adjusted to eliminate the large accident year 2013 claim.

(b) (*0.5 points*) Explain why the adjusted average case estimate triangle indicates decreasing, increasing or stable case reserve adequacy.

(c) (*2 points*) Calculate the indicated IBNR using the reported development method, with a Berquist-Sherman adjustment.

8. (*4 points*) Describe key risk management strategies that are employed with regard to catastrophe losses by each of the following private sector stakeholders:

(a) (*1 point*) Residential property owners

(b) (*1 point*) Commercial property owners

(c) (*1 point*) Insurers

(d) (*1 point*) Reinsurers

9. (*5 points*) You are estimating claim trend by fitting historical data using exponential regression.

(a) (*2 points*) State four considerations in the selection of which data points to include in trending procedures.

You are given the following information:

- Six-month policies are introduced beginning September 1, 2015.
- Rates are to be effective September 1, 2015 for one year.
- 50% of all written policies are expected to be six-month policies.
- 50% of all written policies are expected to be twelve-month policies.
- Exponential regression analysis was applied to semi-annual data to produce semi-annual trend indications.
- The exponential regression line selected for severity is $y = 30,000e^{(0.0123x)}$.
- The exponential regression line selected for frequency is $y = 0.012e^{(0.0101x)}$.

(b) (*2 points*) Calculate the pure premium trend factors for accident year 2013.

(c) (*1 point*) Explain the circular trending process when projecting ultimate claims using the Cape Cod method.

10. (*4 points*) You are calculating premium liabilities as of December 31, 2014 for a one-year policy with significant windstorm risk. You are given the following information:

Policy inception date	October 1, 2014
Gross written premium	50,000
Historical gross claim ratio including ALAE	60%
Quota share reinsurance	25%
ULAE	5% of gross claims
Policy administration costs	4% of gross premium written

Premiums are earned according to the following seasonal exposure and claims pattern:

Calendar Quarter	**% Claims**
1	10%
2	10%
3	60%
4	20%

Policy administration costs are incurred evenly during the year.

(a) (*1 point*) Calculate the gross and net unearned premium.

(b) (*2 points*) Calculate the equity in the gross and net unearned premiums.

Recent information suggests that higher claims than normal are likely to occur in 2015. The gross claim ratio for accident year 2015 is expected to be 80%.

(c) (*1 point*) Recalculate the equity in the gross and net unearned premiums.

11. (*5 points*) You are calculating the experience rating modification for a commercial automobile liability policy. You are given the following information:

Policy Year	Claim ID	Reported Claims at April 1, 2015	
		Total Limits Indemnity	ALAE
July 1, 2012 – June 30, 2013	1	18,000	15,000
	2	25,000	35,000
July 1, 2013 – June 30, 2014	3	45,000	5,000
	4	12,000	4,000

Policy Year	Basic Limits Premiums Subject to Experience Rating	Percentage of Claims Expected to be Unreported at April 1, 2015
July 1, 2012 – June 30, 2013	76,200	10%
July 1, 2013 – June 30, 2014	80,000	30%
Total	**156,200**	

- The basic limit for indemnity is 30,000.
- The Maximum Single Limit (MSL) is 40,000.
- The Adjusted Expected Loss Ratio (AELR) is 0.63.
- Credibility for this policy is 35%.

(a) (*2 points*) Calculate the total reported claims subject to experience rating limited by the basic limit and the MSL.

(b) (*1 point*) Calculate the expected unreported claims and ALAE at April 1, 2015.

(c) (*1 point*) Calculate the experience modification.

The insured has requested consideration for a lower premium as a result of a newly implemented loss reduction program on July 1, 2014.

(d) (*1 point*) Explain how you would further adjust premium to reflect this loss reduction program in the following policy periods:

(i) Next year's policy period

(ii) The policy period five years from now

12. (*5 points*) You are estimating unpaid unallocated loss adjustment expenses (ULAE) as of December 31, 2014 and are given the following information:

Calendar Year	Paid ULAE	Paid Claims
2011	7,200	72,000
2012	7,700	75,000
2013	9,200	76,000
2014	7,400	73,000
Total	**31,500**	**296,000**

	As of Dec. 31, 2014
Case Reserves	20,000
IBNER Reserves	5,000
IBNYR Reserves	10,000
Total	**35,000**

Based on discussions with claim department management, you have learned the following:

- Calendar year 2013 paid ULAE included an unusual charge of 1,500 related to implementation of a new system. This expense is not expected to occur again.
- Approximately 25% of claim department expenses relate to opening a claim file and 75% relate to maintaining and closing a claim file.

(a) (*3 points*) Estimate unpaid ULAE as of December 31, 2014 using a paid-to-paid method.

(b) (*0.5 points*) Identify the weakness in the classical paid-to-paid method according to Kittel.

(c) (*0.5 points*) Explain why the weakness identified in part (b) occurs.

Count-based ULAE methods resolve two major drawbacks of ratio-based ULAE methods.

(d) (*1 point*) Explain these two major drawbacks.

13. (*7 points*) You are using a development-based frequency-severity method to estimate ultimate claims. Due to uncertainty in the 2014 projected ultimate counts and projected ultimate severity from the development method, an alternative approach is needed to estimate these values.

You are given the following information determined from the development method:

Accident Year	Projected Ultimate Counts	Projected Ultimate Severity	Earned Exposures
2011	900	14,800	41,800
2012	880	14,600	41,000
2013	850	15,400	40,800
2014	790	14,200	40,900

- The annual frequency trend is –1%.
- The annual severity trend is 3%.

(a) (*1.5 points*) Calculate the trended frequency at the 2014 cost level for each accident year.

(b) (*1 point*) Select the 2014 cost level frequency. Justify your selection.

(c) (*1.5 points*) Calculate the trended severity at the 2014 cost level for each accident year.

(d) (*1 point*) Select the 2014 cost level severity. Justify your selection.

(e) (*1 point*) Calculate the accident year 2014 ultimate claims.

(f) (*1 point*) Explain how the result from part (e) differs from an estimate based on the development method.

****END OF EXAMINATION****
Morning Session

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