



CASUALTY ACTUARIAL SOCIETY
AND THE
CANADIAN INSTITUTE OF ACTUARIES



David L. Menning
Vice President-Admissions

Daniel G. Roth
Chairperson
Examination Committee

Examination Committee
General Officers
Steven D. Armstrong
Arthur Placek
Thomas Struppeck
Rhonda Port Walker
William Wilder
Arlene Woodruff

Exam 6

Reserving, Insurance Accounting
Principles, and Reinsurance and
Enterprise Risk Management

October 27, 2010

4 HOURS

INSTRUCTIONS TO CANDIDATES

1. This 75.5 point examination consists of 35 problem and essay questions.
2. The number of points for each full question or part of a question is indicated at the beginning of the question or part. Answer the questions on the lined sheets provided in your Examination Envelope. Use dark pencil or ink. Do not use multiple colors.
 - Write your Candidate ID number and the examination number, 6, 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 specific number of items is requested, do not offer more items than the number requested. For example, if three items are requested, only the first three responses will be graded.
 - In order to receive full credit or to maximize partial credit on mathematical and computational questions, you must clearly outline your approach in either verbal or mathematical form, showing calculations where necessary. Also, you must clearly specify any additional assumptions you have made to answer the question.
3. Do all problems until you reach the last page of the examination where "END OF EXAMINATION" is marked.
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.

CONTINUE TO NEXT PAGE OF INSTRUCTIONS

©2010 Casualty Actuarial Society

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. Anything written in the examination booklet will not 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 16, 2010.

END OF INSTRUCTIONS

EXAM 6 - FALL 2010

1. (4 points)

Given the following loss information as of 12 months maturity for accident years 2006 through 2009:

<u>Accident Year</u>	<u>Paid Claims (\$000)</u>	<u>Reported Claims (\$000)</u>	<u>Closed Claim Counts</u>	<u>Open Claim Counts</u>
2006	9,688	17,299	2,800	1,522
2007	17,778	38,345	5,000	3,639
2008	25,519	51,836	6,900	4,119
2009	34,093	74,115	8,875	5,544

a. (1.75 points)

Test the above data for changes in case reserve adequacy and interpret the results.

b. (0.75 point)

Describe the leveraging effect that a change in case reserve adequacy has on the IBNR indicated by the reported loss development method.

c. (1.5 points)

Use the Berquist-Sherman technique for case reserve adequacy to calculate the adjusted reported claims for each accident year.

CONTINUED ON NEXT PAGE

EXAM 6 - FALL 2010

2. (4 points)

Given the following information:

Accident Year	<u>Case Outstanding (\$000)</u>			
	<u>12 Months</u>	<u>24 Months</u>	<u>36 Months</u>	<u>48 Months</u>
2006	3,860	4,630	4,500	3,565
2007	4,020	4,680	4,390	
2008	4,150	5,230		
2009	4,300			

Accident Year	<u>Cumulative Paid Claims (\$000)</u>			
	<u>12 Months</u>	<u>24 Months</u>	<u>36 Months</u>	<u>48 Months</u>
2006	1,520	3,500	6,450	9,950
2007	2,150	3,760	6,760	
2008	1,790	3,390		
2009	2,000			

- Assume no further reported claim development after 48 months
- Use an all-year straight average for all factor selections

a. (3.5 points)

Use Friedland's case outstanding development technique Approach #1 to estimate the paid loss for accident years 2006 through 2009 as of 48 months.

b. (0.5 point)

Explain whether the case outstanding development technique is generally more suitable for accident year or report year analysis.

CONTINUED ON NEXT PAGE

EXAM 6 - FALL 2010

3. (2 points)

Given the following information for a large deductible policy as of December 31, 2009:

<u>Accident Year</u>	<u>Unlimited Reported Loss</u>	<u>Limited Reported Loss</u>	<u>Unlimited Age-to- Ultimate LDF</u>	<u>Excess Age-to- Ultimate LDF</u>
2008	\$18,000,000	\$15,000,000	2.00	2.50
2009	10,000,000	8,000,000	3.00	4.00

a. (1.5 points)

Use the implied development method to calculate the limited loss age-to-ultimate development factor for each accident year.

b. (0.5 point)

Explain why it would be unusual to have excess loss development factors available rather than limited loss development factors.

CONTINUED ON NEXT PAGE

EXAM 6 - FALL 2010

4. (3 points)

Given the following information for a retrospectively rated workers compensation policy as of the end of the 2009 policy year:

<u>Retro Adjustment Period</u>	<u>PDLL Ratio</u>	<u>Cumulative Percent Loss Emerged</u>
First	2.00	70%
Second	0.80	85%
Third	0.30	95%
Subsequent	0.00	100%

<u>Policy Year</u>	<u>Expected Future Loss Emergence</u>	<u>Premium Booked from Prior Adjustments</u>	<u>Premium Currently Booked</u>
2006	\$0	\$300,000	\$300,000
2007	10,000	284,900	285,000
2008	50,000	302,000	305,000
2009	200,000	0	250,000

Calculate the total premium asset for policy years 2006 through 2009 as of the end of the 2009 policy year.

CONTINUED ON NEXT PAGE

EXAM 6 - FALL 2010

5. (1.5 points)

a. (0.5 point)

Briefly describe two characteristics of toxic tort losses that make it difficult to use standard triangulation techniques to estimate toxic tort ultimate losses.

b. (0.5 point)

Identify the two main elements of the Policy-Event Based Loss Estimation (PEBLE) approach.

c. (0.5 point)

Provide an example other than toxic tort losses where a PEBLE process would be appropriate. Briefly explain your answer.

CONTINUED ON NEXT PAGE

EXAM 6 - FALL 2010

6. (2 points)

According to the Casualty Actuarial Society's "Statement of Principles Regarding Property and Casualty Loss and Loss Adjustment Expense Reserves":

a. (1 point)

Identify four broad categories of operational changes within an insurance company that could affect an unpaid claim estimate.

b. (1 point)

Provide a specific example for each broad category of operational changes identified in part a. above.

CONTINUED ON NEXT PAGE

EXAM 6 - FALL 2010

7. (2 points)

Given the following information as of December 31, 2009:

Accident <u>Year</u>	Reported <u>Claims Only</u>	Reported <u>ALAE</u>
2007	\$163,900	\$1,253
2008	179,200	1,490
2009	176,300	1,567

Cumulative Development Factors to Ultimate

<u>Age</u>	Reported <u>Claims Only</u>	Reported <u>ALAE</u>	Ratio of Reported ALAE <u>to Reported Claims</u>
36	1.000	1.003	1.003
24	0.998	1.103	1.106
12	1.103	1.469	1.332

a. (1.5 points)

Use the development method applied to the reported ALAE-to-reported claims ratio to calculate the expected unreported ALAE for each accident year as of December 31, 2009

b. (0.5 point)

Briefly describe one advantage and one disadvantage of the method used in part a. above.

CONTINUED ON NEXT PAGE

EXAM 6 - FALL 2010

8. (1 point)

Given the following information:

- An insurer issues a crop protection policy on January 1, 2011 for the 2011 North American crop season.
- The policy premium is \$120,000.
- The insurer estimates that 60% of the loss exposure occurs during the crop harvest and sale in October and November, with the remainder spread evenly across the growing season, which runs from April 16 through September 30.

Under a deferral-matching accounting paradigm, calculate the required unearned premium reserve for this policy as of June 30, 2011.

CONTINUED ON NEXT PAGE

EXAM 6 - FALL 2010

9. (1.5 points)

Given the following information for accident year 2008 for a book of high-layer workers compensation insurance:

	<u>Reported Severities</u>	
	<u>12 months</u>	<u>24 months</u>
Limited	\$21,000	\$31,000
Unlimited	25,000	40,000

- 12-to-24 month unlimited development factor: 1.650

Use Siewert's development model to:

a. (0.75 point)

Calculate the excess 12-to-24 month development factor.

b. (0.75 point)

Calculate the limited 12-to-24 month development factor.

CONTINUED ON NEXT PAGE

EXAM 6 - FALL 2010

10. (1.75 points)

Given the following information:

Accident Year	<u>Cumulative Paid Loss (\$000)</u>			
	<u>12 Months</u>	<u>24 Months</u>	<u>36 Months</u>	<u>48 Months</u>
2006	75,000	212,500	288,000	337,000
2007	50,000	165,000	310,000	
2008	115,000	238,000		
2009	85,000			

Accident Year	<u>Case Outstanding (\$000)</u>			
	<u>12 Months</u>	<u>24 Months</u>	<u>36 Months</u>	<u>48 Months</u>
2006	188,000	115,000	74,000	35,000
2007	175,000	94,000	45,000	
2008	115,000	238,000		
2009	208,000			

a. (0.25 point)

Calculate reported claims for accident year 2007 as of December 31, 2009.

b. (0.5 point)

Calculate paid claims for calendar year 2009.

c. (0.5 point)

Calculate the change in case reserves for calendar year 2009.

d. (0.5 point)

Briefly describe two benefits of organizing data for reserving on an accident year basis.

CONTINUED ON NEXT PAGE

EXAM 6 - FALL 2010

11. (2 points)

Given the following information (\$000):

<u>Accident</u> <u>Year</u>	<u>Incurred Loss at</u> <u>12 Months</u>	<u>Incurred Loss at</u> <u>24 Months</u>
2006	10,000	12,000
2007	16,000	20,000
2008	10,000	16,000
2009	15,000	

Use the method of least squares development to calculate the estimated incurred loss at 24 months for accident year 2009.

CONTINUED ON NEXT PAGE

EXAM 6 - FALL 2010

12. (2 points)

Given the following information as of December 31, 2009:

Accident <u>Year</u>	On-Level <u>Earned Premium</u>	Reported <u>Claims</u>	Expected Percentage <u>Unreported</u>
2006	\$100,000	\$62,000	0%
2007	120,000	60,000	10%
2008	140,000	50,000	X%
<u>2009</u>	<u>160,000</u>	<u>40,000</u>	40%
Total	520,000	212,000	

- The expected claim ratio is 65%.
- The projected ultimate claims using the Bornhuetter-Ferguson technique is \$279,600 for all years combined.

Calculate X, the expected percentage unreported for accident year 2008.

CONTINUED ON NEXT PAGE

EXAM 6 - FALL 2010

13. (1.5 points)

Given the following information about two lines of insurance:

Commercial Auto Property Damage Reported Claims (\$000)

Accident	<u>Year</u>	<u>12 Months</u>	<u>24 Months</u>	<u>36 Months</u>	<u>48 Months</u>
	2006	10,000	14,000	16,800	18,480
	2007	15,000	21,000	25,200	
	2008	20,000	28,000		
	2009	25,000			

Personal Auto Property Damage Reported Claims (\$000)

Accident	<u>Year</u>	<u>12 Months</u>	<u>24 Months</u>	<u>36 Months</u>	<u>48 Months</u>
	2006	10,000	12,000	13,200	13,332
	2007	11,000	13,200	14,520	
	2008	12,000	14,400		
	2009	13,000			

a. (1 point)

Based on the data, provide two reasons why it would be inappropriate to combine these two lines of business for estimating unpaid claims.

b. (0.5 point)

Briefly describe two additional factors that generally should be considered when deciding whether to combine lines of business for estimating unpaid claims.

CONTINUED ON NEXT PAGE

EXAM 6 - FALL 2010

14. (2 points)

An insurance company decides to book a workers compensation unpaid claim estimate that exceeds the indicated value, reasoning that the additional reserve will give the company an extra layer of protection against future adverse development. Discuss four reasons this action could put the insurer at risk.

CONTINUED ON NEXT PAGE

EXAM 6 - FALL 2010

15. (1.75 points)

Given the following claim detail (\$000):

<u>Claim</u>	<u>Accident Date</u>	<u>Paid During 2007</u>	<u>Case Reserve at 12/31/07</u>	<u>Paid During 2008</u>	<u>Case Reserve at 12/31/08</u>	<u>Paid During 2009</u>	<u>Case Reserve at 12/31/09</u>
1	January 1, 2007	75	250	50	250	300	0
2	July 1, 2007	25	250	50	200	200	0
3	January 1, 2008			0	500	50	600
4	July 1, 2008			100	50	100	0
5	January 1, 2009					105	645

a. (0.5 point)

Construct an accident year cumulative paid loss triangle.

b. (0.5 point)

Construct an accident year cumulative reported loss triangle.

c. (0.75 point)

Perform a diagnostic test to determine whether the data suggests a speed-up in claim payments.

CONTINUED ON NEXT PAGE

EXAM 6 - FALL 2010

16. (4 points)

Given the following information:

Reported Claim Counts Excluding Claims Closed With No Payment

Accident					
	<u>Year</u>	<u>12 Months</u>	<u>24 Months</u>	<u>36 Months</u>	<u>48 Months</u>
	2006	200	250	350	375
	2007	250	350	370	
	2008	300	310		

Reported Claims (\$000)

Accident					
	<u>Year</u>	<u>12 Months</u>	<u>24 Months</u>	<u>36 Months</u>	<u>48 Months</u>
	2006	1,000	1,500	2,200	2,600
	2007	1,100	1,900	2,300	
	2008	1,250	1,725		

- The 48-to-ultimate development factor for claim counts is 1.010.
- The 48-to-ultimate development factor for reported severity is 1.025.
- The selected annual frequency trend is +2.0% for 2006 to 2009.
- The selected annual severity trend is -1.5% for 2006 to 2009.
- Volume-weighted averages are used to calculate development factors.
- Exposures have been constant and there is no exposure trend.

a. (3.25 points)

Use the frequency-severity technique to calculate the expected ultimate claim cost estimate for accident year 2009.

b. (0.75 point)

State the three key assumptions underlying the frequency-severity technique.

CONTINUED ON NEXT PAGE

EXAM 6 - FALL 2010

17. (1.75 points)

Given the following information for a reinsurance contract as of December 31, 2009:

Calendar/ Accident <u>Year</u> 2008	Earned Risk Pure <u>Premium</u> \$17,000,000	On-level <u>Premium</u> \$16,000,000	Chain Ladder <u>IBNR</u> \$3,000,000	Stanard- Bühlmann <u>IBNR</u> \$3,250,000
--	---	--	---	--

<u>Age Interval in Months</u>	<u>Reported Loss Development Factor</u>
12-24	1.35
24-36	1.15
36-48	1.08
48-60	1.03
60-ult.	1.00

a. (0.75 point)

Determine the aggregate report lag as of December 31, 2009.

b. (1 point)

Use Patrik's method with credibility factor 0.4 to calculate the credibility-weighted IBNR estimate as of December 31, 2009.

CONTINUED ON NEXT PAGE

EXAM 6 - FALL 2010

18. (2 points)

Given the following data for a reinsurer as of December 31, 2009:

<u>Calendar/ Accident Year</u>	<u>Earned Premium</u>	<u>Adjusted Premium</u>	<u>Aggregate Reported Loss</u>	<u>Age-to- Ultimate LDF</u>
2005	\$10,000	\$12,000	\$9,000	1.03
2006	11,000	12,000	9,000	1.11
2007	13,000	13,000	7,000	1.25
2008	15,000	14,000	10,000	1.47
2009	17,000	15,000	6,000	2.00

a. (1 point)

Use the Stanard-Bühlmann method to calculate the IBNR for accident year 2008 as of December 31, 2009.

b. (1 point)

Discuss two problems that may affect the accuracy of a reinsurer's earned premium data.

CONTINUED ON NEXT PAGE

EXAM 6 - FALL 2010

19. (2.25 points)

a. (0.5 point)

Briefly describe the two ways that the interests and liabilities agreement limits a reinsurer's liability under a reinsurance treaty.

b. (0.25 point)

Briefly describe a situation where an interests and liabilities agreement is not needed for a reinsurance treaty.

c. (0.5 point)

Describe the insolvency clause that is commonly included within a reinsurance treaty.

d. (0.5 point)

Explain which party or parties benefit from an interests and liabilities agreement in the case of a reinsurer's insolvency.

e. (0.5 point)

Explain which party or parties benefit from an insolvency clause in the case of a ceding insurer's insolvency.

CONTINUED ON NEXT PAGE

EXAM 6 - FALL 2010

20. (3.5 points)

Given the following information regarding a primary insurance company's property book of business:

<u>Range of Insured Values (\$000s)</u>	<u>Subject Premium</u>
100 - 200	\$300,000
200 - 300	250,000
300 - 700	423,000
700 - 1,300	871,000

- Exposure curve applicable to property risks:

<u>Percent of Insured Value</u>	<u>Exposure Factor</u>
0%	0%
20%	45%
40%	60%
60%	73%
80%	85%
100%	95%
120%	100%

- The primary insurance company's expected loss ratio: 60%
- A per risk treaty covers the layer of loss \$300,000 excess of \$200,000.
- The exposure rating method and linear interpolation is used to determine exposure factors.
- Reinsurer's expenses:
 - ULAE as a percent of loss: 10%
 - Fixed expense as a percent of subject premium: 5%
 - Variable expense ratio: 20%

a. (2.5 points)

Calculate the reinsurer's expected loss cost as a percentage of subject premium.

b. (1 point)

Calculate the final premium for the reinsurance treaty.

CONTINUED ON NEXT PAGE

EXAM 6 - FALL 2010

21. (1.5 points)

Given the following information for a catastrophe reinsurance program:

<u>Reinsurer</u>	<u>Layer of Ceded Loss (\$000,000)</u>	<u>Layer Participation</u>	<u>Reinsurance Premium Paid (\$000,000)</u>
A	125 excess of 75	100%	10
B	100 excess of 200	60%	4

- Gross written premium for the primary insurer's property program is \$35 million.
- One \$82.5 million catastrophe loss occurs during the treaty year.

a. (0.5 point)

Calculate the rate-on-line for each reinsurer.

b. (0.5 point)

Calculate the payback period for each reinsurer.

c. (0.5 point)

Calculate the burning cost for the total reinsurance program.

CONTINUED ON NEXT PAGE

EXAM 6 – FALL 2010

22. (1.25 points)

Given the following information for a property catastrophe reinsurance treaty:

• Effective date of treaty	January 1, 2009
• Expiration date of treaty	December 31, 2009
• Attachment point	\$30,000,000
• Treaty limit	\$20,000,000
• Annual premium	\$3,600,000
• Reinstatement provision	1.15

One \$45,000,000 gross loss subject to the treaty occurs on July 31, 2009.

a. (0.5 point)

If the reinstatement provision is pro rata as to amount, calculate the reinstatement premium.

b. (0.5 point)

If the reinstatement provision is pro rata as to both amount and time, calculate the reinstatement premium.

c. (0.25 point)

Briefly explain why property catastrophe reinstatement provisions are typically not pro rata as respects to time.

CONTINUED ON NEXT PAGE

EXAM 6 – FALL 2010

24. (1.5 points)

Given the following information for a surplus share treaty:

- The primary carrier retains a line of \$250,000 and cedes three lines.
- Insured values and losses by risk:

<u>Risk</u>	<u>Insured Value</u>	<u>Incurred Loss</u>
1	\$200,000	\$75,000
2	500,000	400,000
3	1,250,000	200,000

a. (1 point)

Calculate the total amount of loss retained by the primary insurer.

b. (0.25 point)

Briefly describe one benefit to the primary insurer provided by a surplus share treaty that is not provided by a quota share treaty.

c. (0.25 point)

Briefly describe one benefit to the primary insurer provided by a quota share treaty that is not provided by a surplus share treaty.

CONTINUED ON NEXT PAGE

EXAM 6 – FALL 2010

25. (1.5 points)

Given the following information for a primary insurer's book of liability policies:

<u>Policy Limit</u>	<u>Earned Premium</u>
\$5,000,000	\$20,000,000
10,000,000	50,000,000
20,000,000	100,000,000

- The expected loss ratio (gross of reinsurance) is 60%.
- Selected Increased Limit Factors (ILF):

<u>Size of Loss</u>	<u>ILF</u>
\$1,000,000	1.0
2,000,000	1.6
3,000,000	1.9
4,000,000	2.1
5,000,000	2.2
10,000,000	2.5
20,000,000	3.0

Calculate the expected loss for the reinsurance layer \$6,000,000 excess of \$4,000,000.

CONTINUED ON NEXT PAGE

EXAM 6 – FALL 2010

26. (2 points)

Given the following ground up loss and ALAE for occurrences subject to an umbrella excess-of-loss reinsurance treaty:

<u>Occurrence Number</u>	<u>Ground Up Loss</u>	<u>Ground Up ALAE</u>	<u>Limits of Policies Providing Coverage</u>
1	\$1,100,000	\$100,000	\$500,000 Umbrella over \$500,000 Homeowners Liability
2	900,000	100,000	\$1,000,000 Umbrella over \$1,000,000 Homeowners Liability
3	1,000,000	100,000	\$1,000,000 Umbrella over \$750,000 Auto Liability

- The treaty covers \$250,000 excess of \$250,000 per occurrence on the umbrella portfolio.
- The treaty covers ALAE pro rata with loss.
- The ceding commission for the treaty is 15% of the reinsurance premium.
- The reinsurance premium for the treaty is \$900,000.

Calculate the reinsurer's technical ratio for this umbrella treaty.

CONTINUED ON NEXT PAGE

EXAM 6 – FALL 2010

27. (2.25 points)

Given the following information for a primary company's reinsurance program:

- Ground up losses:

<u>Loss Number</u>	<u>Occurrence Number</u>	<u>Loss Amount</u>
1	1	\$100,000
2	1	200,000
3	1	300,000
4	2	200,000
5	2	100,000
6	3	450,000

- Subject earned premium equals \$1,500,000.
 - Treaty 1 covers the layer \$150,000 excess of \$200,000 per occurrence.
 - Treaty 2 covers the layer \$500,000 excess of \$250,000 per occurrence.
 - Treaty 1 inures to the benefit of Treaty 2.
 - Reinsurance premium for Treaty 1 equals \$200,000.
 - Reinsurance premium for Treaty 2 equals 7.5% of net subject premium.
- a. (0.75 point)
Calculate the expected recovery by the primary company from Treaty 1.
- b. (0.75 point)
Calculate the expected recovery by the primary company from Treaty 2.
- c. (0.75 point)
Calculate the ceded loss ratio for Treaty 2.

CONTINUED ON NEXT PAGE

EXAM 6 – FALL 2010

28. (1 point)

A primary insurer has the following reinsurance program:

- Excess-of-loss treaty: \$3,000,000 excess of \$500,000 per occurrence
- Clash cover: \$9,000,000 excess of \$1,000,000

Given the following losses from a single occurrence subject to the treaties:

<u>Policy</u>	<u>Ground Up Loss</u>
1	\$200,000
2	1,500,000
3	2,000,000
4	1,000,000

a. (0.5 point)

Calculate the total ceded losses under the excess-of-loss treaty.

b. (0.5 point)

Calculate the total ceded losses under the clash treaty.

CONTINUED ON NEXT PAGE

EXAM 6 – FALL 2010

29. (5 points)

Given the following information for a primary carrier:

- The estimated 2010 gross written premium is \$1,000,000.
- There is a 25% commission on gross written premiums.
- There are no expenses other than commission.
- The expected investment income is \$0.
- The average agents' balances equal 10% of gross written premium.

The projected balance sheet and income statement as of December 31, 2010 (\$000) assuming no reinsurance are as follows:

<u>Balance Sheet</u>		<u>Income Statement</u>	
Assets		Earned Premium	1,000
Bonds & Cash	1,475	Incurred Losses	700
Agents' Balances	100	Expenses	250
Total Assets	1,575	Net Underwriting Income	50
Liabilities		Investment Income	0
Loss Reserves	700	Total Income	50
Unearned Premium Reserves	500		
Ceded Agents' Balances	0		
Total Liabilities	1,200		
Surplus	375		

The carrier has purchased quota share reinsurance effective January 1, 2010. The treaty cedes 50% of premiums and losses, with a ceding commission of 25%.

a. (1.25 points)

Restate the projected income statement to include the effects of the reinsurance.

b. (1.75 points)

Restate the projected balance sheet to include the effects of the reinsurance.

c. (0.75 point)

Calculate the change in the ceding company's net written premium to surplus ratio due to the reinsurance contract.

CONTINUED ON NEXT PAGE

EXAM 6 – FALL 2010

29. (Continued)

d. (0.75 point)

Calculate the change in the ceding company's net loss reserves to surplus ratio due to the reinsurance contract.

e. (0.5 point)

Discuss whether the reinsurance treaty provides surplus relief.

CONTINUED ON NEXT PAGE

EXAM 6 – FALL 2010

30. (2 points)

Given the following information regarding a prospective property catastrophe excess of loss reinsurance program:

<u>Cumulative Probability</u>	<u>Gross Loss</u>	<u>Ceded Loss</u>	<u>Reinsurer Loss Ratio</u>	<u>Reinsurer Net Present Value</u>	<u>Reinsurer Return on Premium</u>
0.0010	\$67	\$0	0.0%	0.0%	100.0%
0.0200	634	0	0.0%	0.0%	100.0%
0.0500	28,580	0	0.0%	0.0%	100.0%
0.1000	94,876	0	0.0%	0.0%	100.0%
0.2000	304,129	0	0.0%	0.0%	100.0%
0.3000	606,834	0	0.0%	0.0%	100.0%
0.4000	1,138,932	0	0.0%	0.0%	100.0%
0.5000	2,003,679	0	0.0%	0.0%	100.0%
0.7000	4,930,257	0	0.0%	0.0%	100.0%
0.8000	8,109,422	0	0.0%	0.0%	100.0%
0.9000	15,682,078	682,078	21.0%	20.2%	79.8%
0.9500	24,035,802	9,035,802	278.0%	267.3%	-167.3%
0.9750	37,972,066	22,972,066	706.8%	679.6%	-579.6%
0.9900	68,380,228	50,000,000	1,538.5%	1,479.3%	-1,379.3%
0.9950	83,580,202	50,000,000	1,538.5%	1,479.3%	-1,379.3%
0.9990	126,792,315	50,000,000	1,538.5%	1,479.3%	-1,379.3%
0.9999	163,627,870	50,000,000	1,538.5%	1,479.3%	-1,379.3%

a. (0.75 point)

Describe the “10-10 rule” and how it is used to determine the accounting treatment required for a reinsurance contract.

b. (0.5 point)

Demonstrate whether the reinsurance contract modeled above passes the 10-10 rule.

c. (0.75 point)

Discuss the shortcoming of the 10-10 rule that this example highlights.

CONTINUED ON NEXT PAGE

EXAM 6 – FALL 2010

31. (1.5 points)

According to "Statement of Financial Accounting Standards No. 5, Accounting for Contingencies":

a. (0.5 point)

Define a loss contingency.

b. (0.5 point)

State the two conditions required to establish a loss contingency as a charge to income.

c. (0.5 point)

State the two situations in which a disclosure of a loss contingency is required in lieu of establishing a charge to income.

CONTINUED ON NEXT PAGE

EXAM 6 – FALL 2010

32. (2.5 points)

Given the following information for a book of business:

- Earned premium for January 2010 is \$100,000.
- Five claims occurred in January 2010: three were reported in January 2010; the other two in February 2010.
- Case reserves were established at \$15,000 per claim when the claims was reported.
- For each claim, \$5,000 was paid in the month of reporting and \$10,000 in the subsequent month.
- For accident month January 2010, the IBNR was initially set at 20% of the earned premium as of January 31, 2010, and was then released evenly over the following two months.

For each of the first three accounting months of 2010, calculate the income statement incurred losses for accident month January 2010.

CONTINUED ON NEXT PAGE

EXAM 6 – FALL 2010

33. (1 point)

Given the following information for a policy:

- The policy is sold on February 1, 2010.
- The policy is effective April 15, 2010.
- The policy term is 12 months.
- The premium is received on March 15, 2010.
- The written premium is \$1,200.

a. (0.5 point)

Use the deferral matching approach to calculate the premium-related balance sheet entries for this policy as of March 31, 2010.

b. (0.5 point)

Use the deferral matching approach to calculate the premium-related balance sheet entries for this policy as of December 31, 2010

CONTINUED ON NEXT PAGE

EXAM 6 – FALL 2010

34. (3 points)

Given the following information for an actuarial consulting firm:

- The firm employs eight actuarial consultants.
- The firm conducts actuarial reviews for a large number of different clients.
- The firm has a billing policy of collecting 10% at the outset of an engagement and 90% within 30 days from delivery of the final work product.
- The firm has office space for its consultants; however, a number of them work remotely about 50% of the time.
- The firm's hourly billing rate is 15% higher than the competition.
- The firm has outsourced its information technology function; accordingly, technicians are no longer on site.
- The firm recently lost two employees to a competing consulting firm.
- The firm employs two of the industry's experts in catastrophe modeling.

a. (1 point)

Identify the four types of enterprise risk discussed in the CAS paper "Overview of Enterprise Risk Management."

b. (2 points)

For each of the four types of enterprise risk identified in part a. above, describe a source or example of that risk for this firm.

CONTINUED ON NEXT PAGE

EXAM 6 – FALL 2010

35. (2 points)

Identify and briefly discuss four methods for developing probability distributions for the risks being considered in an Enterprise Risk Management (ERM) analysis.

END OF EXAMINATION

EXAM 6 2010

QUESTION	POINT VALUE OF QUESTION	(a)	(b)	(c)	(d)	(e)
1	4.00	1.75	0.75	1.50		
2	4.00	3.50	0.50			
3	2.00	1.50	0.50			
4	3.00					
5	1.50	0.50	0.50	0.50		
6	2.00	1.00	1.00			
7	2.00	1.50	0.50			
8	1.00					
9	1.50	0.75	0.75			
10	1.75	0.25	0.50	0.50	0.50	
11	2.00					
12	2.00					
13	1.50	1.00	0.50			
14	2.00					
15	1.75	0.50	0.50	0.75		
16	4.00	3.25	0.75			
17	1.75	0.75	1.00			
18	2.00	1.00	1.00			
19	2.25	0.50	0.25	0.50	0.50	0.50
20	3.50	2.50	1.00			
21	1.50	0.50	0.50	0.50		
22	1.25	0.50	0.50	0.25		
23	2.00	1.00	0.50	0.50		
24	1.50	1.00	0.25	0.25		
25	1.50					
26	2.00					
27	2.25	0.75	0.75	0.75		
28	1.00	0.50	0.50			
29	5.00	1.25	1.75	0.75	0.75	0.50
30	2.00	0.75	0.50	0.75		
31	1.50	0.50	0.50	0.50		
32	2.50					
33	1.00	0.50	0.50			
34	3.00	1.00	2.00			
35	2.00					

Sample Solutions
Exam 06, 2010, Question 1

Solution 1

a)

AY	Average Paid Severity	Change from prior AY	Case O/S	Average Case O/S	Change from prior AY
	= Paid / Closed Counts		= Rep. - Paid	= Case O/S / Open Counts	
2006	9688 / 2800 = 3.46	---	7,611	7611 / 1522 = 5.001	---
2007	3.56	1.03	20,567	5.652	1.13
2008	3.70	1.04	26,317	6.389	1.13
2009	3.84	1.04	40,022	7.219	1.13

The average case outstanding increases much more rapidly than the average paid severity. This indicates an increase in case outstanding adequacy.

- b) Higher case adequacy leads to higher LDFs. More over, these higher LDFs are applied to higher reported amounts, thus overestimating both ultimate losses and IBNR.
- c) Detrend at 4% per year, consistent with inflation on paid severity

AY	(1) Restated Avg Case O/S	(2) Open Counts	(3) Paid Claims	(1) × (2) + (3) Adjusted Reported
2006	$7.219/1.04^3 = 6.418$	1,522	9,688	19,456
2007	$7.219/1.04^2 = 6.674$	3,639	17,778	42,065
2008	$7.219/1.04 = 6.941$	4,119	25,519	54,109
2009	7.219	5,544	34,093	74,115

Solution 2

a)

Average Paid			Trend in Average Paid		
2006	3460	$=9,688,000 \div 2,800$	2006-2007	2.7%	$=3555.6 \div 3460 - 1$
2007	3555.6		2007-2008	4%	
2008	3698.4		2008-2009	3.8%	
2009	3841.4		Selected Average	3.5%	

Average Case			Trend in Average Case	
2006	5000	$=(17,299,000-9,688,000) \div 1,522$	2006-2007	13%
2007	5651.8		2007-2008	13%
2008	6389.2		2008-2009	13%
2009	7219			

Since average case is increasing 13% per year, but average paid is only increasing 3.5% per year, there is a strengthening of case adequacy.

b) If there is an increasing case reserve adequacy, it will overstate the IBNR using reported development method. This is due to historical LDFs (too high) being applied to reported claims.

c)

Restated Average Case			Restated Reported (000)		
2006	6511.1	$=7,219 \div 1.035$	2006	19,598	$=(6974.9 \times 4,119) + 25,519,000$
2007	6739		2007	42,301.3	
2008	6974.9		2008	54,248.5	
2009	7219		2009	74,115	

Sample Solutions
Exam 06, 2010, Question 2

Solution 1

a) Case Outstanding (CO) on Previous CO

AY	12 - 24	24 - 36	36 - 48
2006	1.2	0.97	0.79
2007	1.16	0.94	
2008	1.26		
Avg	1.21	0.96	0.79

Incremental Paid Claims

AY	12	24	36	48
2006	1,520	1,980	2,950	3,500
2007	2,150	1,610	3,000	
2008	1,790	1,600		
2009	2,000			

Incr. Paid Claims to Previous Case Outstanding

AY	12 - 24	24 - 36	36 - 48
2006	0.51	0.64	0.78
2007	0.4	0.64	
2008	0.39		
Avg	0.43	0.64	0.78

Projected Case Outstanding

AY	12	24	36	48
2006				
2007				
2008			5,020	
2009		5,203	4,994	

Projected Incremental Paid Claims

AY	12	24	36	48
2006				
2007				3,424
2008			3,347	3,916
2009		1,849	3,330	3,896

Paid Losses as of 48 Mos

AY		
2006	9,950	(given)
2007	10,184	6760 + 3424
2008	10,653	3390 + 3916 + 3347
2009	11,074	2000 + 1849 + 3330 + 3896

- b) Report year since there is no Pure IBNR.

Solution 2

a) Ratio of Case O/S to Previous Case O/S

AY	12 - 24	24 - 36	36 - 48
2006	1.2	0.97	0.79
2007	1.16	0.94	
2008	1.26		
Avg	1.207	0.955	0.79

Incremental Paid Claims

AY	12	24	36	48
2006	1,520	1,980	2,950	3,500
2007	2,150	1,610	3,000	
2008	1,790	1,600		
2009	2,000			

Ratio of Incremental paid to previous case o/s

AY	12 - 24	24 - 36	36 - 48
2006	0.513	0.637	0.778
2007	0.401	0.641	
2008	0.386		
Avg	0.433	0.639	0.778

Case Outstanding

AY	12	24	36	48
2006	3,860	4,630	4,500	3,505
2007	4,020	4,680	4,390	3,468
2008	4,150	5,230	4,995	3,946
2009	4,300	5,190	4,957	3,916

Incremental Paid Claims

AY	12	24	36	48	Total
2006					9,950
2007				3,415	10,175
2008			3,342	3,886	10,618
2009		1,862	3,316	3,857	11,035
Total Paid					41,778

- b) It's more suitable for reported year since it is more suitable when most losses are reported during the 1st year.

Sample Solutions
Exam 06, 2010, Question 3

Solution 1

a) (Amounts are in \$000,000)

Develop unlimited losses and limited losses.

AY	Developed Unlimited Loss	Developed Excess Loss	(unlimited – XS) Developed Limited Loss
2008	$36 = 18 \times 2$	$7.5 = (18-15) \times 2.5$	$28.5 = 36 - 7.5$
2009	$30 = 10 \times 3$	$8 = (10 - 8) \times 4$	$22 = 30 - 8$

2008 Limited LDF = $28.5/15 = 1.9$ (Developed / Reported)

2009 Limited LDF = $22/8 = 2.75$

b) Implied development is generally intended to derive excess loss development factors usually already established unlimited and limited factors. Direct development for excess losses is difficult since excess losses are thin, volatile, and may not even appear at early maturities.

Solution 2

a) Ultimate Limited = Ultimate Unlimited – Ultimate XS

For AY 2008,

$$\begin{aligned} \text{Ultimate limited} &= 18,000,000 \times 2.00 - (18,000,000 - 15,000,000) \times 2.50 \\ &= 28,500,000 \end{aligned}$$

$$\text{Limited loss age to ultimate factor} = 28,500,000 / 15,000,000 = 1.90$$

For AY 2009,

$$\begin{aligned} \text{Ultimate limited} &= 10,000,000 \times 3.00 - (10,000,000 - 8,000,000) \times 4.00 \\ &= 22,000,000 \end{aligned}$$

$$\text{Limited loss age to ultimate factor} = 22,000,000 / 8,000,000 = 2.75$$

b) Limited data develops faster and is more stable. The loss will develop in the limited layer first before it emerges into the excess layer.

Solution 2

(1)	(2)	(3)	(4) = (2)×(3)	(5)	(6)	(7) = (5)/(6)
Retro Adj Per	PDLLD Ratio	% Loss Emergед	PDLLD × % Emergед	Upward Cumulative of (4)	Upward Cumulative of (3)	CPDLLD Ratio
1st	2.00	0.70	1.40	1.55	1.00	1.55
2nd	0.80	0.15	0.12	0.15	0.30	0.50
3rd	0.30	0.10	0.03	0.03	0.15	0.20
Sub	0.00	0.00	0.00	0.00	0.05	0.00

(7)	(8)	(9) = (7)×(8)	(10) - given	(11) = (9)+(10)	
Policy Year	CPDLLD Ratio	Exp Future Loss	Exp Future Premium	Prem Booked Prior	Expected Ult Premium
2009	1.55	200,000	310,000	-	310,000
2008	0.50	50,000	25,000	302,000	327,000
2007	0.20	10,000	2,000	284,900	286,900
2006	0.00	-	-	300,000	300,000

(11)	(12) - given	(13) = (11)- (12)	
Pol Yr	Exp Ult Prem	Prem curr booked	Premium Asset
2009	310,000	250,000	60,000
2008	327,000	305,000	22,000
2007	286,900	285,000	1,900
2006	300,000	300,000	-
			83,900

Sample Solutions
Exam 06, 2010, Question 5

Solution 1

- a)
 1. Lack of correlation between the accident date and accounting for the loss. There's a calendar year emergence, affecting all accident years at once.
 2. It's a newer type of loss, so history provides no guidance.
- b)
 1. Loss event model
 2. Policy data, including policy terms and exposure information
- c) Hurricane losses. Hurricane losses are not easily "triangularized" because they are such infrequent but severe events. The loss event model can be complex because of all the scientific information involved, but the loss allocation to individual policies is simple because of the discrete nature of the loss.

Solution 2

- a)
 1. This is a relatively new type of loss. Little historical data is available.
 2. Claims emerge in such a way that they correlate more with Calendar Year than Accident Year
- b) Loss Event – the actual loss event
Policy Data – includes policy terms and exposure characteristics

The interaction between the loss event and the policy-specific exposure and terms is used to estimate the insured cost.
- c) PEBLE can be used for a Workers' Compensation claim. Evaluate the type of injury that occurred, and analyze the claimant characteristics (age, sex), benefits that apply, that will interact with the injury to estimate insured cost.

Sample Solutions
Exam 06, 2010, Question 6

Solution 1

- a) Change in underwriting guidelines;
Change in reinsurance structure;
Change in claims handling philosophy;
Change in information technology.

- b) Write more large risks;
Change reinsurance limit and attachment point;
Change in settlement rate;
Change in accounting process because of new technology implementation.

Solution 2

- a) Underwriting;
Marketing;
Reserving;
Information technology.

- b) May loose underwriting standards causing a deteriorating loss ratio;
May emphasize a specific product causing a change in the mix of business;
May decide to strengthen case reserves;
May implement a new database causing temporary lags while employees get used to the new system.

Sample Solutions
Exam 06, 2010, Question 7

Solution 1

a)

	(1) Ratio = Rpt ALAE/Rpt Claims	(2) CDF to Ult	(3) = (1) × (2) Ult Ratio	(4) Rpt CDF Ult
AY				
07	1253/163900 = .0076	1.003	0.0077	1.000
08	1490/179200 = .0083	1.106	0.0092	0.998
09	1567/176300 = .0089	1.332	0.0118	1.103
	(5) Ult Claims	(6) = (3) × (5) Ult ALAE	(7) Rpt ALAE	(8) = (6) - (7) Unrpt ALAE
	163900 (1) = 163900	1257	1253	4
	179200 (.998) = 178842	1645	1490	155
	176300 (1.103) = 194459	2302	1567	735
				Total = 894

b) Advantage: Development factors of ALAE to claims are less leveraged for reported ALAE only

Disadvantage: There may be claims with zero reported indemnity but substantial ALAE payments - ie for defense expenses

Solution 2

a)

(1) AY	(2) Reported Claims	(3) Reported Claim ATU	(4) = (2) × (3) Ult Claims
07	163900	1.000	163900
08	179200	0.998	178842
09	176300	1.103	194459

(5) Reported ALAE	(6) = (5)/(2) Rpt ALAE-to-Claim Ratio	(7) Ratio in (6) ATU	(8) = (6) × (7) Ult ALAE to Clm Ratio
1253	0.7644%	1.003	0.7668%
1490	0.8315%	1.106	0.9196%
1567	0.8889%	1.332	1.1839%

(9) = (4) × (8) Ult ALAE	(10) = (9) - (5) Expected Unrpt ALAE
1256.76	3.76
1644.64	154.64
2302.23	735.23

Total 893.63

b) Advantage - allows for interjection of actuarial judgment in selection of ultimate ALAE to reported claim ratio to reflect operational or judicial/external changes

Disadvantage - an error in the estimation of ultimate claim will lead to an error in the estimation of ultimate ALAE to reported claim ratio to reflect operational or judicial/external changes

Sample Solutions
Exam 06, 2010, Question 8

Solution 1

40% of the loss spread across 5.5 months
April 16 to June 30 is 2.5 months, which has $(0.4/5.5) \times 2.5 = 0.1818$ exposure
Unearned premium reserve as of June 30, 2011:
 $= (1-0.1818) \times 120,000 = \$98,181.82$

Solution 2

Month	Earned Premium
1	0
2	0
3	0
First half of 4	0
Second half of 4 – 6	21,818.18
7-9	$26,181.82 = (120K - 72K) \times 3/5.5$
10-11	$72,000 = 120K \times 0.6$
12	0

UEPR @ 6/30/11 = 72K + 26,181.82 = \$98,181.82

Sample Solutions
Exam 06, 2010, Question 9

Solution 1

$$\text{a) } \text{XSLDF}^L = \frac{(1-R^L)}{(1-R_t^L)} \text{LDF}$$

$$R_L^{24} = 31\text{K} / 40 \text{K} = 0.775$$

$$R_L^{12} = 21\text{K} / 25 \text{K} = 0.840$$

$$\text{XSLDF}_{12-24} = (1 - 0.775) / (1-0.840) \times 1.065 = 2.320$$

$$\text{b) } \text{LDF}^L = \frac{R^L}{R_t^L} \text{LDF}$$

$$0.775 / 0.840 \times 1.650 = 1.522$$

Solution 2

$$\text{a) } \text{XSLDF}^L = \text{LDF}^U \Delta (1 - R_L) = 1.650 \times (1 - 0.775) / (1 - 0.840) = 2.3203$$

R = Reported Relativities %

$$R^L @12 \text{ months} = 21,000 / 25,000 = 0.840$$

$$R^L @24 \text{ months} = 31,000 / 40,000 = 0.775$$

$$\text{b) } \text{LDF}^L = \text{LDF}^U \Delta (R_L) = 1.650 \times 0.775 / 0.840 = 1.5223$$

$$\text{Check: } \text{LDF}^U = \text{LDF}^L \times R_L + \text{XSLDF}^L \times (1 - R_L)$$

$$1.650 = \text{LDF}^L \times 0.84 + 2.3203 \times (1 - 0.84)$$

$$\text{LDF}^L = 2.5223$$

Sample Solutions
Exam 06, 2010, Question 10

Solution 1

- a) $AY\ 2007\ at\ 12/31/2009 = \$310M + \$45M = \$355M.$
- b) $\$337M + \$310M + \$238M + \$85M - \$288M - \$165M - \$115M = \$402M$
- c) $\$35M + \$45M + \$238M + \$208M - \$74M - \$94M - \$115M = \$243M$
- d) Numerous benchmarks are tracked by accident year. Tracking claims by accident year can be very useful when economic/regulatory changes have recently occurred, or if a significant large loss has occurred.

Solution 2

- a) $Reported = Cumulative\ Paid + Cumulative\ Outstanding = \$310,000 + \$45,000 = \$355,000.$
- b) $Paid\ claims\ in\ 2009 = \$85,000 + (\$238,000 - \$115,000) + (\$310,000 - \$165,000) + (\$337,000 - \$288,000) = \$402,000$
- c) $2008\ case\ outstanding = \$115,000 + \$94,000 + \$74,000 = \$283,000.$
 $2009\ case\ outstanding = \$208,000 + \$238,000 + \$45,000 + \$35,000 = \$526,000.$
 $Change\ in\ case = \$526,000 - \$283,000 = \$243,000.$
- d) It's easier to understand. It's a shorter time period than policy year.

Sample Solutions
Exam 06, 2010, Question 11

Solution 1

$$\begin{aligned}\bar{x} &= 12,000 \\ \bar{y} &= 16,000 \\ \overline{xy} &= 200,000,000 \\ \overline{x^2} &= 152,000,000\end{aligned}$$

$$\begin{aligned}b &= \frac{\overline{xy} - \bar{x} \cdot \bar{y}}{\overline{x^2} - \bar{x}^2} = 1 \\ a &= \bar{y} - b\bar{x} = 4000\end{aligned}$$

$$\begin{aligned}L(x) &= a + bx = 4000 + x \\ L(15000) &= 4000 + 15000 = 19000\end{aligned}$$

Solution 2

X's are Incurred Loss at 12 months
Y's are Incurred Loss at 24 Months

$$y = b + ax$$

$$b = \frac{\overline{xy} - \bar{x} \cdot \bar{y}}{\overline{x^2} - \bar{x}^2}$$

$$a = \bar{y} - b\bar{x}$$

Use calculator

$$a=4000, b=1$$

$$y = 4000 + 1 \times 15000 = 19,000$$

Sample Solutions
Exam 06, 2010, Question 12

Solution 1

	(1)	(2)	(3)	(4)	(5)
<u>AY</u>	<u>On-Level</u> <u>EP (\$000)</u>	Rpt Claims <u>(\$000)</u>	Exp % <u>Unrprtd</u>	65% × (1) <u>Expected</u> <u>Claims</u>	(2) + (3) × (4) <u>Projected Ult.</u> <u>Claims</u>
2006	100	62	0%	65	62
2007	120	60	10%	78	62.8
2008	140	50	X%	91	50 + 91X%
<u>2009</u>	<u>160</u>	<u>40</u>	<u>40%</u>	<u>104</u>	<u>81.6</u>
Total	520	212		338	261.4 + 91X%

$$261,400 + 91,000X\% = 279,600$$

$$X\% = 20\%$$

Solution 2

(A) AY	(B) On Level EP	(C) Expected Loss (B × .65)	(D) Expected % Unreported	(E) Reported Claims
06	100,000	65,000	0%	62,000
07	120,000	78,000	10%	60,000
08	140,000	91,000	X%	50,000
09	<u>160,000</u>	<u>104,000</u>	40%	<u>40,000</u>
Total	520,000	338,000		212,000

(A) AY	(F) B-F Ultimate (C × D) + E
06	62,000
07	67,800
08	91,000 (X%) + 50,000
09	<u>81,600</u>
Total	91,000 (X%) + 261,400

$$91,000 (X\%) + 261,400 = 279,600$$

$$91,000 (X\%) = 18,200$$

$$X\% = 20\%$$

Sample Solutions
Exam 06, 2010, Question 13

Solution 1

- a) 1 Commercial is growing at a faster pace than personal.
 2 Commercial has a longer reporting pattern (or at least a different reporting pattern)
- b) 1 Severity may differ between the two lines
 2 Credibility of each line – may want to combine to improve credibility

Solution 2

- a) 1 All year weighted Average LDF's

	12-24	24-36	36-48
Commercial APD	1.4	1.2	1.1
Personal APD	1.2	1.1	1.01

The two lines of business have different reporting patterns as seen above

- 2 AY trend in CAPD

	12	24	36
2006-2007	50%	50%	50%
2007-2008	33%	33%	
2008-2009	25%		

- AY trend in PAPD

	12	24	36
2006-2007	10%	10%	10%
2007-2008	9.1%	9.1%	
2008-2009	8.3%		

It appears that the CAPD book is growing much faster than the PAPD based on the AY trends

- b) 1 Credibility of data – want block of data to be large enough and homogenous enough
 2 Coverage trigger – don't want to group claims made policies with occurrence

Sample Solutions
Exam 06, 2010, Question 14

Solution 1

- 1) Can alter financial measurements that investors look at; they may not want to invest based on the resulting measurements.
- 2) Alters insurer's decision for reinsurance and reinsurance terms;
- 3) Alters decisions to grow business or pull out. If reserves too high, may take underwriting actions that are not needed.
- 4) Alters pricing of the product, may result in loss of competitiveness.

Solution 2

- 1) This is against the law. There are state laws that require accurate reserving.
- 2) Investors will see the business as less profitable because of the large reserve.
- 3) Regulators won't be able to monitor the company effectively when the company actually needs help.
- 4) This may skew pricing decisions. It may cause the pricing actuary to overstate the indication and therefore cause the underwriters to charge a price that's too high and cause adverse selection.

Sample Solutions
Exam 06, 2010, Question 15

Solution 1

a) Cumulative Paid Triangle

	12	24	36
2007	100	200	700
2008	100	250	
2009	105		

b) Cumulative Reported = Cumulative Paid + Outstanding Case at Valuation

	12	24	36
2007	600	650	700
2008	650	850	
2009	750		

c) Cumulative Paid/Cumulative Reported

	12	24	36
2007	0.167	0.308	1.000
2008	0.154	0.294	
2009	0.140		

There seems to be a decrease in the paid/reported ratio at 12 months. This could be caused by either a slow-down in claim payments or increase in reserve adequacy. However, it is difficult to draw conclusions with this small amount of data. There is little credibility.

Solution 2

a) Cumulative Paid Triangle

	12	24	36
2007	100	200	700
2008	100	250	
2009	105		

b) Cumulative Reported = Cumulative Paid + Outstanding Case at Valuation

	12	24	36
2007	600	650	700
2008	650	850	
2009	750		

c) Closed Claim Count/Reported Claim Count

	12	24	36
2007	0%	0%	100%
2008	0%	50%	
2009	0%		

It seems that we closed the claim in the 12-24 period faster for AY2008 than for AY2007. However, the experience is too thin, so it might be just random change but not intentional speeding up.

Average Cumulative Payment

	12	24	36
2007	50	100	350
2008	50	125	
2009	105		

Again, it seems that we increase the average cumulative payment over years, but experience is too thin to draw meaningful conclusions.

Sample Solutions
Exam 06, 2010, Question 16

Solution 1

a) Reported Claim Count Link Ratios

<u>12-24</u>	<u>24-36</u>	<u>36-48</u>	<u>48-ult</u>
1.213	1.200	1.071	1.010
<u>12-ult</u>	<u>24-ult</u>	<u>36-ult</u>	<u>48-ult</u>
1.575	1.298	1.082	1.010

Compute trended and developed claim counts.

AY	data	ATU	trend	trended ult
2006	375	1.010	1.02^3	402
2007	370	1.082	1.02^2	416
2008	310	1.298	1.02	410
Select				409

Reported Severity = Reported Claims / Claim Count

AY	12	24	36	48
2006	5,000	6,000	6,286	6,933
2007	4,400	5,429	6,216	
2008	4,167	5,565		

Reported Severity Link Ratios

<u>12-24</u>	<u>24-36</u>	<u>36-48</u>	<u>48-ult</u>
1.253	1.094	1.103	1.025
<u>12-ult</u>	<u>24-ult</u>	<u>36-ult</u>	<u>48-ult</u>
1.550	1.237	1.131	1.025

Compute trended and developed severities

AY	data	ATU	trend	trended ult
2006	6,933	1.025	0.985^3	6,791
2007	6,216	1.131	0.985^2	6,821
2008	5,565	1.237	0.985	6,781
				6,798

Expected Ultimate Claim Cost of AY 2009

$$409 \times 6,798 = 2,780,382$$

- b) 1. Definition of claim counts is consistent throughout experience period.
 2. Development of future claim is similar to development of prior claims.
 3. Mix of claim type is relatively consistent.

Solution 2

a) Selected Rpt Claim Count Dev Factors

	12-24	24-36	36-48	48- ult
	1.213	1.20	1.071	1.01
To-ult	1.575	1.298	1.082	1.01

<u>AY</u>	<u>Ult. Claim Counts</u>	<u>Freq Trend to 2009 Level</u>
06	$(375)(1.01) = 379$	$379 \times 1.02^3 = 402$
07	$(370)(1.082) = 400$	$400 \times 1.02^2 = 416$
08	$(310)(1.298) = 402$	$402 \times 1.02 = 410$

Rept Severities

AY	12	24	36	48
06	5000	6000	6286	6933
07	4400	5429	6216	
08	4167	5565		

Selected Age-to-age

	12-24	24-36	36-48	48- ult
	1.253	1.094	1.103	1.025
To-ult	1.550	1.237	1.131	1.025

<u>AY</u>	<u>Ult. Severities</u>	<u>Sev Trend to 2009 Level</u>
06	7106	$7106 \times 0.985^3 = 6791$
07	7030	$7030 \times 0.985^2 = 6821$
08	6884	$6884 \times .985 = 6781$

Selected ultimate claims = 409 (straight average of 06-08)
 Selected ultimate Severity = 6798
 2009 Estimated ult claim cost = $409 \times 6798 = 2,780,382$

- b)
- The definition of a claim is consistent over historical period used
 - The mix of types of claims used is consistent
 - Claims and claim count will continue to develop in a similar manner in the future as they have in historical periods.

Sample Solutions
Exam 06, 2010, Question 17

Solution 1

a) Age-to-Ultimate Factor for 24 months = $ATU_{24} = 1.15 \times 1.08 \times 1.03 \times 1.00 = 1.27926$

Report Lag = $1/1.27926 = 0.7817$ or 78.17%

b) IBNR Estimate = $Z \times \text{Rept. Lag} \times \text{CL} + (1-Z \times \text{Rept. Lag}) \times \text{SB}$

= $0.4(.7817)(3M) + (1-0.4 \times 0.7817) \times 3.25M$

= 3,171,829

Solution 2

a) Report Lag = % Reported

24-Ult Development factor = $1.15 \times 1.08 \times 1.03 = 1.27926$

% rep = $1 / \text{LDF (24-ult)} = 1 / 1.27926$

% rep = **78.17%**

b) Cred Factor \times Report Lag \times IBNR (CL) + (1 – Cred Factor \times Rep Lag) \times IBNR (SB)

= $0.4 \times 0.7817 \times 3M + (1 - 0.4 \times 0.7817) \times 3.25M$

IBNR = **3,171,830**

Sample Solutions
Exam 06, 2010, Question 18

Solution 1

a) $SB\ ELR = (9+9+7+10+6)/(12/1.03+12/1.11+13/1.25+14/1.47+15/2) = 0.82$

$0.82 \times 14,000 \times (1-1/1.47) = 3,678$

- b) i) Inaccurate rate change data
 ii) Imprecise by line breakdown

Solution 2

a)

C/AY	"Used-Up" Premium	SB IBNR
2005	11,650	
2006	10,811	
2007	10,400	
2008	9,524	$14,000 \times (.8219)(1-1/1.47)=3,679$
2009	7,500	
TOTAL	49,885	

$LR = 41000/49885 = 82.19\%$

- b) 1. The reinsurer relies on the insurer to report premium , there can be a lag in this reporting.
 2. Earned premium is often reported in aggregate to reinsurer, so the reinsurer must make assumptions to split premium.

Sample Solutions
Exam 06, 2010, Question 19

Solution 1

- a) It defines all the reinsurers that are part of the treaty and the amount they are reinsuring, therefore limiting the max amt. a rein. is responsible for.

It imposes several, not joint, liability.

- b) When there is only one rein. involved.
- c) It states that if the primary becomes insolvent & cannot pay full liabilities to the claimants, the rein. Still owes the full amt. of rein. Loss to the primary. It's paid w/o diminution.
- d) The other reinsurers involved. Since it is not joint liab., they do not become responsible for the amt. the insolvent rein. cannot pay.
- e) The primary (ceding) company. They will still receive full amts owed from rein even if full claim is never paid. Recoveries are not reduced.

Solution 2

- a) It tells the % of reins losses (& ALAE if applicable) the reins is responsible for. It establishes several rather than joint liab (so if another reins doesn't pay their share, this reins's share doesn't increase).
- b) When that reinsurer is the only participating reinsurer in the treaty.
- c) States that if primary insurer is insolvent & settling claims for less than underlying policies would stipulate, reinsurer's payment of part of loss to prim ins is not reduced (same as if prim ins was not settling claims lower)
- d) The other reinsurers participating in treaties with the insolvent one benefit (their % participation does not increase).
- e) The ceding insurer benefits – they're paying out claims at possibly lower amounts than if not insolvent, but still getting same share from reins as without insolvency.

Sample Solutions
Exam 06, 2010, Question 20

Solution 1

a)

Range	Midpoint	Subject Premium	Retention of I.V.	Factor	Retention + Limit as % of I.V.	Factor
100 – 200	150	300,000	1.333	1.000	3.333	1.000
200 - 300	250	250,000	.800	.850	2.000	1.000
300 - 700	500	423,000	.400	.600	1.000	.950
700 – 1300	1000	871,000	.200	.450	.500	.665
		1,844,000				

Exposure Factor	Exposure Premium
0	0
.150	37,500
.350	148,050
.215	187,265
<hr/>	
372,815	

$$\text{Reinsurer's expected loss cost} = 372,815 \times .60 / 1,844,000 = 0.121$$

$$\text{b) Final Premium} = \frac{(372,815 \times .600)(1.100) + .05(1844000)}{(1 - .20)} = 422,822$$

Solution 2

a)

Range	Prem	Midpt	Ret	Ret + Limit	Exposure Factor
100 – 200	300000	150	133%	333%	0
200 - 300	250000	250	80%	200%	100% - 85% = 0.15
300 - 700	423000	500	40%	100%	95% - 60% = 0.35
700 – 1300	871000	1000	20%	50%	66.5% - 45% = 0.215

Prem	ELR	Exposure Factor	Loss Cost
(1)	(2)	(3)	(4) = (1) × (2) × (3)
300000	0.60	0	0
250000	0.60	0.15	22500
423000	0.60	0.35	88830
871000	0.60	0.215	112359
1844000			223689

As a % of Prem = $223689 / 1844000 = 12.1\%$

b) Rate = $\frac{12.1\% (1.10) + 5\%}{1 - 0.20} = 22.89\%$

Prem = $1844000 (0.2289) = 422046$

Sample Solutions
Exam 06, 2010, Question 21

Solution 1

a) Rate on Line = Reinsurance Premium/Reinsurance Limit

$$A: 10M/(125M \times 100\%) = 0.08$$

$$B: 4M/(100M \times 69\%) = .0667$$

b) Payback Period = 1/ROL

$$A: 1/0.08 = 12.5 \text{ Yrs}$$

$$B: 1/0.0667 = 15 \text{ Yrs}$$

c) Burning Cost = Reinsured Loss/Subject Premium

$$\text{Reinsured Losses} = \text{Min}(82.5M-75M, 125M) = 7.5M$$

$$\text{Burning Cost} = 7.5M/35M = .2143$$

Solution 2

a) Rate on Line = Premium / Amount of Insurance

$$A: 10M/125M = 0.08$$

$$B: 4M/60M = .0667$$

b) Payback Period = 1/Rate on Line

$$A: 1/0.08=12.5 \text{ Yrs}$$

$$B: 1/0.0667=15 \text{ Yrs}$$

c) Burning Cost = Expected Loss to Reinsured Layer / Total Trended on-leveled Premium

$$\text{Rate} = (82.5 - 75)/35 = .214$$

Sample Solutions
Exam 06, 2010, Question 22

Solution 1

- a) Coverage used 15M out of 20M possible
 $(15/20)(3.6M)(1.15) = 3.105M$
- b) $(15/20)(3.6M)(1.15)(5/12) = 1,293,750$
Five months left of coverage $\rightarrow 5/12$
- c) Because hurricane season is not evenly distributed throughout the calendar year. So price should not be pro rate with respect to time.

Solution 2

- a) Reinstatement premium = $3,600,000(1.15)(15,000,000/20,000,000) = 3,105,000$
45M-30M=15M loss subject to treaty
- b) Reinstatement premium = $3,600,000(1.15)(15/20)(153/365) = 1,301,548$
After July 31 (Date of loss) there are 153 days remaining in treaty period
- c) The property loss exposure tends to be more concentrated at certain parts of the year (winter or hurricane season) instead of uniformly spread over the year.

Sample Solutions
Exam 06, 2010, Question 23

Solution 1

a) $AP = (AP - \text{Tax Basis Reserve}) \text{ Tax Rate} + \text{Basis of AP}$

$$AP = (AP - 1,600,000)(.35) + 1,727,399$$

$$AP = .35AP - 560,000 + 1,727,399$$

$$\boxed{AP = 1,795,998}$$

b) PV of payments: $800,000 \times 1.05^{-5} = 780,720$

$$800,000 \times 1.05^{-1.5} = 743,543$$

$$400,000 \times 1.05^{-2.5} = \underline{354,068}$$

$$1,878,331$$

The reinsurer is the seller of the commutation, and the ambivalence point is the max that the seller will pay to commute. So no, the reinsurer should not accept a commutation price equal to the present value of loss payments since it is $> AP$.

c) A commutation ends the obligation of the reinsurer to the insurer for the book. By commuting, the insurer (primary) has the advantage of getting a definite amount now rather than an uncertain amount later (uncollectibility?), the primary has an improvement in current wealth with more “cash-in-hand” and has the opportunity to invest those dollars. The primary can also save on administrative costs associated with ceding the claims to the reinsurer. For all these reasons, the primary wants to commute and may even take a slightly low offer due to all those benefits.

Solution 2

a) Let x = ambivalence point

$$(x - 1,600,000) \times 35\% + 1,727,399 = x$$

$$\Rightarrow x = 1,795,998.46$$

b) The reinsurer, as a seller, will consider the present value of the loss payment too high to be accepted. The reinsurer needs a consideration less than present value to compensate its additional tax burden from such transaction.

c) The insurer may accept a lower consideration due to

1. it can make additional administration cost savings from such transaction
2. the cash input is provided on a term favorable than its current borrowing cost.

Alternate Solution - part c)

c) The primary company may fear a potential reinsurer insolvency and prefer a certain payment today compared to an uncertain payment in the future (risk aversion)

Sample Solutions
Exam 06, 2010, Question 24

Solution 1

a)

Risk	Ceded		
1	0		
2	.5(400,000)	=	200,000
3	750/1250(200,000)	=	<u>120,000</u>

$$75K + 400K + 200K - 320K = \mathbf{355,000}$$

- b) Can retain smaller risks
- c) Less costly to administer

Solution 2

a)

Risk	IV	% Share of Reinsurer	% of p.i.
1	200K	0%	100%
2	500K	50%	50%
3	1.25M	60%	40%

	p.i. Retention
1	75,000
2	200,000
3	<u>80,000</u>
	355,000

- b) Increase large line capacity
- c) Quota share provides more ceding commission.

Sample Solutions
Exam 06, 2010, Question 25

Solution 1

(1) <u>Policy Limit</u>	(2) <u>x1 Factor</u>	(3) = (2) × EP <u>Exp Premium</u>
5M	$\frac{2.2 - 2.1}{2.2}$	909,091
10M	$\frac{2.5 - 2.1}{2.5}$	8,000,000
20M	$\frac{2.5 - 2.1}{3.0}$	<u>13,333,333</u>
		22,242,424

Expected loss = 22,242,424 × 0.6 = 13,345,454

Solution 2

	<u>XS4</u>	<u>XS10</u>		
5	1/22	0	1/22	909,091
10	4/25	0	4/25	8,000,000
20	9/30	5/30	4/30	<u>13,333,333</u>
				22,242,424

22,242,424 × 0.6 = \$13,345,455

Sample Solutions
Exam 06, 2010, Question 26

Solution 1

In 000's

	<u>GU Loss</u>	<u>Umb Covered</u>	<u>Umb Retained</u>	<u>Loss to Umb Reinsurance</u>
1	1100	500	250	250
2	900	0	0	0
3	1000	250	250	0

$$\text{ALAE covered for loss 1} \Rightarrow 250/1100 \times 100 = 22.727\text{K}$$

$$\text{Total loss \& ALAE to umbrella } 250 \times 250 \Rightarrow \$272,727$$

$$\text{LR} = 272,727/900,000 = 30.3\%$$

$$\text{Technical Ratio} = \text{LR} + \text{Ceding Commission} = 30.3\% + 15\% = 45.3\%$$

Solution 2

<u>Occurrence</u>	<u>Umbrella</u>	<u>Ceded on Umbrella</u>	<u>% Ceded</u>	<u>Ceded ALAE (\$000)</u>
1	500	250	$250/1100 = .22727$	$100 \times .22727 = 22,727$
2	0	0	0	0
3	250	0	0	0
	<u>750</u>	<u>250</u>		<u>22,727</u>

$$\text{Total ceded losses \& ALAE (\$000)} = 250 + 22.727 = 272.727$$

$$\text{LR} = \frac{272,727}{900,000} = 0.303$$

$$\begin{aligned} \text{Technical ratio} &= 0.303 + 0.15 \\ &= 0.453 \end{aligned}$$

Sample Solutions
Exam 06, 2010, Question 27

Solution 1

a) treaty 1 = \$150,000 xs \$200,000 per occ.

<u>Loss</u>	<u>Occur #</u>	<u>Loss Amount</u>
1	1	100,000
2	1	200,000
3	1	300,000
4	2	200,000
5	2	100,000
6	3	400,000

<u>Occur #</u>	<u>Occur loss amount</u>	<u>Treaty 1 covers</u>
1	600,000	150,000 -> 600,000-200,000=400,000, but capped at 150K
2	300,000	100,000 -> 300,000 - 200,000 = 100,000
3	450,000	150,000 -> similar to occur 1
		400,000

b) treaty 2 = \$500,000 xs \$250,000 per occ.

<u>Occur number</u>	<u>Occur loss remaining after treaty 1</u>	<u>Treaty 2 covers</u>
1	450,000	200,000 -> 450K-250K = 200,000
2	200,000	0 -> less than \$250K
3	300,000	50,000 -> 300K - 250K = 50,000
		250,000

c) Treaty 2 premium = (1,500,000 - 200,000)(.075) = 97,500

Treaty 2 ceded loss ratio = 250,000/97,500 = 2.564

Solution 2

a)

<u>Loss Occurrence</u>	<u>Total Loss</u>	<u>Covered by Treaty 1</u>
1	600,000	150,000
2	300,000	100,000
3	450,000	<u>150,000</u>
		400,000

b)

<u>Loss Occurrence</u>	<u>Loss After Treaty 1</u>	<u>Covered by Treaty 2</u>
1	450,000	200,000
2	200,000	0
3	300,000	<u>50,000</u>
		250,000

c) Net subject premium = $1,500,000 - 200,000 = 1,300,000$

Treaty 2 prem = $(1,300,000)(0.075) = 97,500$

Ceded loss ratio for treaty 2 = $250,000/97,500 = 256\%$

Sample Solutions
Exam 06, 2010, Question 28

Solution 1

Policy	Ground Up	Retention	XOL	Clash
1	200,000	200,000	0	0
2	1,500,000	300,000	1,200,000	0
3	2,000,000	200,000	1,800,000	0
4	1,000,000	300,000	0	700,000
Total	4,700,000	1,000,000	3,000,000	700,000

- a) Ceded to XOL = \$3,000,000
- b) Ceded to Clash = \$700,000

Solution 2

- a) Total losses from occurrence = 4.7 M. Excess Treaty will pay 3M
- b) Primary would retain 1.7M. Since they have the clash treaty, they can cede 0.7M.
Primary retains 1M

Sample Solutions
Exam 06, 2010, Question 29

Solution 1

- assume GAAP accounting
 - assume Quota share on risks attaching basis
 - assume 50% of losses on prior policies not subject to treaty and 50% on new policies from 2010
- a) Earned Premium = EP from prior years (not subject to QS treaty, see UEP of 500 at end of year on 1,000 WP from 2010) + EP from 2010 WP subject to QS
- $EP = 500 + 500 \times 50\% = 750$
 - $IL = 700 \times .5 + 700 \times .5 \times 50\% = 525$
 - $E = 250 - 25\% \times (1,000 \times 50\%) = 125$
 - $NUI = 750 - 525 - 125 = 100$
- b) Assets
- Bonds/Cash = $1,475 - (1,000 - 100) \times .5$ (ceded premium collected) + 125 (ceding commission) = 1,150
 - Agents Bal = 100
 - Reins Recoverable = $700 \times .5 \times .5 = 175$
 - Prepaid reinsurance premium = $UEP \times QS\% = 500 \times .5 = 250$
 - Total = $1,150 + 100 + 175 + 250 = 1,675$
- Liabilities
- Gross LR = 700
 - Gross UEP = 500
 - Ceded AB = 50
 - Total = $700 + 500 + 50 = 1,250$
- Surplus = $1,675 - 1,250 = 425$
- c) Prev NWP/Surplus = $1,000 / 375 = 2.67$
New NWP/Surplus = $500 / 425 = 1.18$
Change = -1.49
- d) Prev Net Res/Surplus = $700 / 375 = 1.87$
New Net Res/Surplus = 525 (Gross LR – Reins Rec) / $425 = 1.24$
Change = -.63
- e) Surplus increased, reinsurance is providing surplus relief and leverage ratio is decreasing.

Solution 2

a)

- $EP = 1,000 \times 50\% = 500$
- $IL = 700 \times 50\% = 350$
- $E = 250 - 25\% \times 500 = 125$
- $NUI = 500 - 350 - 125 = 25$
- $II = 0$
- $TI = 25$

b) Assets

- Bonds/Cash = $1,475 - (1,000 - 100) \times .5$ (ceded premium collected) + 125 (ceding commission) = 1,150
- Agents Bal = $1,000 \times 10\% = 100$
- Reins Recoverable = $700 \times .5 \times .5 = 175$
- PP reinsurance premium = $UEP \times QS\% = 500 \times .5 = 250$
- Total = $1,150 + 100 + 175 + 250 = 1,675$

Liabilities

- Gross LR = 700
- Gross UEP = 500
- Ceded AB = $100 \times 50\% = 50$
- Total = $700 + 500 + 50 = 1,250$

Surplus = 425

c) Prev NWP/Surplus = $1,000 / 375 = 2.67$

New NWP/Surplus = $500 / 350 = 1.43$

d) Prev Net Res/Surplus = $700 / 375 = 1.87$

New Net Res/Surplus = $350 / 350 = 1.00$

e) The leverage ratio of Net WP to surplus is greatly improved, thus the reinsurance provides surplus relief.

Sample Solutions
Exam 06, 2010, Question 30

Solution 1

- a) The 10-10 rule essentially says that in order to consider that significant insurance risk has been transferred to the reinsurer, the reinsurer must have at least a 10% chance of sustaining a loss that is at least 10% of premiums. If this rule is not satisfied the contract may not qualify for reinsurance accounting and may instead have to use deposit accounting.
- b) It does not pass. At the 90th percentile (10% chance of loss), the reinsurer's return on premium is 79.8%.
- c) The shortcoming of the 10-10 rule is that there may be a possibility of very significant losses just under 10% of the time. For example, at the 95th percentile the reinsurer's return on premium is -167.3%. Above the 99th percentile the reinsure's return on premium is -1379.3%. The reinsure clearly has significant risk of substantial loss even though it does not pass the 10-10 rule.

Solution 2

- a) The 10-10 rule states that a reinsurer must demonstrate a VaR of 10% at the 90th percentile in order to satisfy requirement of being considered reinsurance. In other words, a reinsurer must suffer 10% loss, 10% of the time. The 10-10 rule is a test to make sure that both significant insurance risk has been transferred and there is a reasonable possibility that a reinsurer will realize a significant loss.
- b) The model does not pass the 10-10 rule. At the 90th percentile the return on premium is 79.8%, not less than -10%. It looks like it reaches the critical value between the 90th and 95th percentile.
- c) The 10-10 rule only looks at one point. It is clear that there is significant risk being assumed and there is reasonable possibility that the reinsurer will suffer a significant loss, but because it just misses the threshold of the 10-10 rule it would not be considered reinsurance. It is evident that it should, judging by the extremely negative returns on premium that happen right after the 90th percentile.

Sample Solutions
Exam 06, 2010, Question 31

Solution 1

- a) An existing condition involving uncertainty as to a loss or a gain to an enterprise that will ultimately be resolved when one or more event occur or fail to occur.

- b) Two conditions are:
 - Information available before the issuance of financial statements indicates that it is probable that an asset has been impaired or a liability incurred.
 - The amount of the loss can be reasonably estimated.

- c) Two situations are:
 - When there is a reasonable possibility that an asset has been impaired or a liability incurred (not probable).
 - The amount can't be estimated but it is probable the liability was incurred.

Solution 2

- a) A loss contingency is a set of circumstances involving uncertainty as to gain or loss to the ultimately be resolved when one or more event occur or fail to occur.

- b) Two conditions are:
 - It must be probable that a loss has occurred or an asset has been impaired.
 - The amount of the loss or impairment must be reasonably estimable.

- c) Disclosure of loss contingency would be required if:
 - The amount of the loss were not yet reasonably estimable – if no estimate in range is best, book lowest value and disclose the rest or
 - If there is a possibility of the loss occurring but it's not yet probable.

Sample Solutions
Exam 06, 2010, Question 32

Solution 1

<u>Accident Month</u>	<u>Acct Month</u>	(1) <u>Rpt Claims</u>	(2) <u>Claims Paid</u>	(3) <u>Case Res.</u>	(4) <u>IBNR</u>	(5) <u>Beg Res.</u>	(6) <u>End Res.</u>	(7) <u>Inc. Loss</u>
1/10	1/10	3	$3 \times 5,000 = 15,000$	30,000	$0.2 \times 100,000 = 20,000$	0	50,000	65,000
1/10	2/10	2	$30,000 + 2 \times 5,000 = 40,000$	20,000	10,000	50,000	30,000	20,000
1/10	3/10	0	20,000	0	0	30,000	0	-10,000

(6) = (3) + (4)
 (7) = (2) + (6) - (5)

Solution 2

Earned Premium = 100,000
 5 Claims occurred in Jan 2010, 3 reported in Jan, 2 reported in Feb
 Case Reserve: 15,000/claim when reported
 Paid: 5,000 in report month, 10,000 in subsequent month
 IBNR: 20% EP in 1/31/2010, evenly next 2 months

1/31/2010

3 Case reserves set → $15,000 \times 3 = 45,000$
 3 payments → $5,000 \times 3 = 15,000$
 IBNR set up → 20% of 100,000 = 20,000
 3 payments lead to 3 drops in case → $3 \times 5,000 = -15,000$
 Incurred = 65,000

2/28/2010

2 case reserves set → $2 \times 15,000 = 30,000$
 2 payments 5,000 → 10,000
 2 5,000 case reserve drops → -10,000
 3 payments 10,000 → 30,000
 3 10,000 case reserve drops → -30,000
 IBNR Release → $-20,000 / 2 = -10,000$
 Incurred = 20,000

3/31/2010

2 payments of 10,000 → 20,000
 2 10,000 case reserve drops → -20,000
 IBNR Release → $-20,000 / 2 = -10,000$
 Incurred = -10,000

Sample Solutions
Exam 06, 2010, Question 33

Solution 1

a) As of 03/31/2010

<u>Assets</u>		<u>Liabilities</u>	
Cash	\$1,200	Deposit Liability	\$1,200

b) As of 12/31/2010

<u>Assets</u>		<u>Liabilities</u>	
Cash	\$1,200	Unearned Premium Reserve	\$350

$$\begin{aligned} \text{Unearned Premium Reserve} &= \text{WP} \times (1.00 - \text{Months Earned} / 12) \\ &= \$1,200 \times (1.00 - 3.5 / 12) = \$350 \end{aligned}$$

Solution 2

a)

<u>Assets</u>		<u>Liabilities</u>	
Cash	\$1,200	Deposit Premium	\$1,200

b)

<u>Assets</u>		<u>Liabilities</u>	
Cash	\$1,200	UEPR = $1200 \times (3.5/12) =$	\$350

Sample Solutions
Exam 06, 2010, Question 34

Solution 1

- a)
1. Hazard Risk
 2. Strategic Risk
 3. Financial Risk
 4. Operational Risk
- b)
1. Risk that a hurricane happens in the town where the firm has its offices and destroys everything (office, computers, etc.)
 2. The risk to lose all of its clients because they charge 15% more than the competition
 3. The firm collects 90% of the bill 30 days after the delivery of the product. A financial risk would be the inability to collect those fees from the clients.
 4. The risk that more employees stop working there and go working for a competitor

Solution 2

- a)
1. Hazard Risk
 2. Operational Risk
 3. Financial Risk
 4. Strategic Risk
- b)
1. Office space is subject to weather/storm damage losses
 2. Operational risk – lost 2 highly qualified employees, more could leave given the trend
 3. Financial risk – possibility of non-payment after work product completed
 4. 15% higher billing rate could be a strategy that results in a smaller client base (lose business to competition)

Sample Solutions
Exam 06, 2010, Question 35

Solution 1

- 1) Systems Dynamics Simulation
 - a. Simulate cause / effect relationship of operational risks on dynamics of underlying system
 - b. Adv - fill gaps in data systematically, with expert input
- 2) Fuzzy Logic
 - a. Model a process which is complex due to uncertainty, ambiguity and undecided variables of system
 - b. Adv - non-linear problem spaces
- 3) Preference Among Bets
 - a. Ask expert which way he/she would bet
 - b. Adjust outcomes until expert is indifferent
- 4) Decomposition in Aid for Probability Assessment
 - a. Decompose event into conditional causal events
 - b. Use "influence diagrams" to display results visually

Solution 2

- 1) System Dynamics - analysis of cause / effect relationship underlying dynamics of the system. Advantages include ability to see how operational risks change as a function of operational change, ability to fill in gaps in data with expert input, and ability to combine input from different functions of enterprise
- 2) Fuzzy Logic - addresses situation where problems are complex due to incomplete or undefined variables of systems. Works well when problem spaces are non-linear, information is incomplete or unreliable, or when words are used to define logic rules.
- 3) Preference among bets - given a set of possible outcomes, establishes changes around each outcome by structuring changes as odds in a bet. Ask experts which side of the bet they prefer; adjust odds until experts are indifferent
- 4) Decomposition to aid - breaks down probability of an outcome into conditional causal events. Use Bayesian procedures to construct the outcome of the event based on the probabilities of the conditional events