CASUALTY ACTUARIAL SOCIETY
AND THE
CANADIAN INSTITUTE OF ACTUARIES

Exam 5

Basic Techniques for Ratemaking and Estimating Claim Liabilities

October 29, 2013

4 HOURS

INSTRUCTIONS TO CANDIDATES

1. This 58.5 point examination consists of 24 problem and essay questions.

2. For the problem and essay questions, the number of points for each full question and part of a question is indicated at the beginning of the question or part. Answer these questions on the lined sheets provided in your Examination Envelope. Use dark pencil or ink. Do not use multiple colors or correction fluid.

   - Write your Candidate ID number and the examination number, 5, at the top of each answer sheet. Your name, or any other identifying mark, must not appear.
   - Do not answer more than one question on a single sheet of paper. Write only on the front lined side of the paper – **DO NOT WRITE ON THE BACK OF THE PAPER**. Be careful to give the number of the question you are answering on each sheet. If your response cannot be confined to one page, please use additional sheets of paper as necessary. Clearly mark the question number on each page of the response in addition to using a label such as "Page 1 of 2" on the first sheet of paper and then "Page 2 of 2" on the second sheet of paper.
   - The answer should be concise and confined to the question as posed. When a specified number of items are requested, do not offer more items than requested. For example, if you are requested to provide three items, only the first three responses will be graded.
   - In order to receive full credit or to maximize partial credit on mathematical and computational questions, you must clearly outline your approach in either verbal or mathematical form, showing calculations where necessary. Also, you must clearly specify any additional assumptions you have made to answer the question.

3. Do all problems until you reach the last page of the examination where "END OF EXAMINATION" is marked.

CONTINUE TO NEXT PAGE OF INSTRUCTIONS

4. Prior to the start of the exam you will have a **fifteen-minute reading period** in which you can silently read the questions and check the exam booklet for missing or defective pages. A chart indicating the point value for each question is attached to the back of the examination. Writing will NOT be permitted during this time and you will not be permitted to hold pens or pencils. You will also not be allowed to use calculators. The supervisor has additional exams for those candidates who have defective exam booklets.

   - Verify that you have received the reference materials:

     Insurance Services Office, Inc., Personal Automobile Manual (Effective 6-98), General Rules 1-6.

5. Your Examination Envelope is pre-labeled with your Candidate ID number, name, exam number and test center. Do not remove this label. Keep a record of your Candidate ID number for future inquiries regarding this exam.

6. Candidates must remain in the examination center until two hours after the start of the examination. The examination starts after the reading period is complete. You may leave the examination room to use the restroom with permission from the supervisor. To avoid excessive noise during the end of the examination, candidates may not leave the exam room during the last fifteen minutes of the examination.

7. At the end of the examination, place all answer sheets in the Examination Envelope. Please insert your answer sheets in your envelope in question number order. Insert a numbered page for each question, even if you have not attempted to answer that question. Nothing written in the examination booklet will be graded. Only the answer sheets will be graded. Also place any included reference materials in the Examination Envelope. BEFORE YOU TURN THE EXAMINATION ENVELOPE IN TO THE SUPERVISOR, BE SURE TO SIGN IT IN THE SPACE PROVIDED ABOVE THE CUT-OUT WINDOW.

8. If you have brought a self-addressed, stamped envelope, you may put the examination booklet and scrap paper inside and submit it separately to the supervisor. It will be mailed to you. Do not put the self-addressed stamped envelope inside the Examination Envelope.

   If you do not have a self-addressed, stamped envelope, please place the examination booklet in the Examination Envelope and seal the envelope. You may not take it with you. Do not put scrap paper in the Examination Envelope. The supervisor will collect your scrap paper.

   Candidates may obtain a copy of the examination from the CAS Web Site.

   All extra answer sheets, scrap paper, etc. must be returned to the supervisor for disposal.

9. Candidates must not give or receive assistance of any kind during the examination. Any cheating, any attempt to cheat, assisting others to cheat, or participating therein, or other improper conduct will result in the Casualty Actuarial Society and the Canadian Institute of Actuaries disqualifying the candidate's paper, and such other disciplinary action as may be deemed appropriate within the guidelines of the CAS Policy on Examination Discipline.

10. The exam survey is available on the CAS Web Site in the "Admissions/Exams" section. Please submit your survey by November 18, 2013.

END OF INSTRUCTIONS

1. (1.5 points)

   An insurance company is considering changing its exposure base for workers compensation from payroll to hours worked. Evaluate the merits of this change based on three different criteria of a good exposure base.

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2. (2 points)

Given the following information:

- All policies have six-month terms.
- Policies are written uniformly during each six-month period and cannot be cancelled.
- The rating algorithm is base rate x class factor + expense fee.
- The proposed effective date of the next rate change is July 1, 2013.
- A rate review is performed every six months.

Effective Date of Rates	Base Rate Per Exposure	Class Factor		Expense Fee
		A	B	
January 1, 2011	$480	1.00	0.70	$45
July 1, 2011	$488	1.00	0.70	$45
January 1, 2012	$504	1.00	0.70	$50
July 1, 2012	$500	1.00	0.75	$50
January 1, 2013	$500	1.00	0.80	$55

Policy Effective Dates	Written Exposures (000)	
	Class A	Class B
January 1, 2011 – June 30, 2011	125	50
July 1, 2011 – December 31, 2011	150	100
January 1, 2012 – June 30, 2012	175	150
July 1, 2012 – December 31, 2012	200	200

Using the extension of exposures method, calculate the calendar year 2012 earned premium at current rate level.

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3. (1.5 points)

When aggregating data for ratemaking purposes, two of the three general objectives are:

- To accurately match losses and premiums for the policy.
- To use the most recent data available.

Briefly discuss how well the following methods of data aggregation achieve these two general objectives.

a. (0.5 point)

Calendar year

b. (0.5 point)

Calendar/accident year

c. (0.5 point)

Policy year

4. (7.5 points)

Given the following information:

- The insurance company entered the market in State X at the beginning of 2008.
- All policies are annual.
- Rates will be in effect for 12 months beginning on July 1, 2014.
- Rate change history:
  - +5% effective July 1, 2010.
  - +7% effective April 1, 2012.
- Premiums are expected to increase at an inflationary rate of 2% annually.
- Annual loss cost trend = +4%.
- ULAE provision = 12% of loss and ALAE.
- Fixed expense ratio= 7%.
- Variable expense ratio = 21%.
- Underwriting profit and contingencies provision = 8%.
- To simplify calculations, assume premium is earned evenly throughout the year.
- Assume no loss development after 48 months.

Calendar Year	State X Earned Premium	State X Earned Exposures	State X Written Premium	State X Written Exposures
2010	$400,000	400	$630,000	600
2011	$2,200,000	2,000	$3,105,000	2,700
2012	$16,800,000	14,000	$18,750,000	15,000

	State X Incurred Losses and ALAE			
Accident Year	12 Months	24 Months	36 Months	48 Months
2008	$0	$200	$800	$1,000
2009	$50,000	$61,300	$78,200	$80,000
2010	$380,500	$587,000	$624,486	
2011	$671,600	$1,316,239		
2012	$9,706,667			

	Countrywide Incurred Losses and ALAE			
Accident Year	12 Months	24 Months	36 Months	48 Months
2007			$123,600,000	$125,000,000
2008		$62,700,000	$68,600,000	$70,000,000
2009	$75,000,000	$83,300,000	$88,200,000	$90,000,000
2010	$80,500,000	$87,000,000	$93,000,000	
2011	$71,600,000	$78,800,000		
2012	$86,900,000			

<QUESTION 4 CONTINUED ON NEXT PAGE>

4. (continued)

   a. (6.25 points)

      Calculate the indicated rate level change for State X using the loss ratio method. Use two-step trending to project premiums.

   b. (0.5 point)

      The assumption that the premium is earned evenly should not hold for State X given that it is a new book of business. Briefly describe two alternatives to the traditional parallelogram method that would improve the accuracy of the estimated projected premiums.

   c. (0.75 point)

      Fully discuss the impact to the rate level indication for State X by assuming the premium is earned evenly. Include the directional change to the rate level indication that would result if adjusting for the actual earning of the premium.

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5. (2.75 points)

Given the following information:

- All policies are annual, and rate level is reviewed annually.
- Rate change takes effect on January 1, 2013.
- Unlimited annual loss frequency trend = -1%.
- Unlimited annual loss severity trend = +5%.
- Annual average written premium trend per exposure = 0%.
- Assume the exposures are inflation sensitive.
- Annual exposure trend = +1%.

Calendar/Accident Year	On-Level Earned Premium ($000s)	Reported Losses as of December 31, 2012 ($000s)	Reported Losses Excess of $1 Million as of December 31, 2012 ($000s)	Unlimited Loss Development Factor
2003	$60,612	$34,054	$456	1.00
2004	$61,941	$44,617	$4,888	1.00
2005	$66,893	$41,086	$5,348	1.00
2006	$67,092	$39,025	$8,774	1.00
2007	$65,960	$45,646	$8,134	1.00
2008	$65,037	$36,383	$0	1.00
2009	$65,242	$38,487	$1,398	1.00
2010	$67,732	$36,799	$0	1.03
2011	$69,450	$38,608	$2,002	1.08
2012	$67,213	$45,295	$9,000	1.20
Total	**$657,172**	**$400,000**	**$40,000**	**N/A**

a. (1.5 points)

For accident year 2012, determine the trended ultimate loss ratio to use in the January 1, 2013 rate level analysis incorporating a large loss adjustment for claims above $1 million.

b. (0.5 point)

Discuss the appropriateness of using a large loss adjustment in part a. above.

c. (0.75 point)

Assume the rate associated with the first $1 million of coverage is analyzed using only the data above. Briefly discuss three modifications to loss and premium elements that would produce a more accurate rate analysis.

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6. (3.25 points)

Given the following information:

- All policies have six-month terms.
- New rates will take effect on January 1, 2014.
- Rates will be in effect for one year.
- Selected frequency trend = 0%.
- Selected severity trend = +5%.
- Selected ULAE provision = 10% of loss and ALAE.
- Two accident years with equal weights are used to calculate the pure premium.
- Assume no further development after 36 months.

	Cumulative Paid Loss and ALAE ($000s)		
Accident Year	12 Months	24 Months	36 Months
2009	$6,000	$17,200	$25,800
2010	$4,500	$12,200	
2011	$7,900		

	Open Claim Counts		
Accident Year	12 Months	24 Months	36 Months
2009	190	160	75
2010	120	110	
2011	165		

	Outstanding Case Loss and ALAE Reserves ($000)		
Accident Year	12 Months	24 Months	36 Months
2009	$16,500	$13,000	$5,500
2010	$10,000	$6,500	
2011	$9,000		

Calendar Year	Earned Exposures (000s)
2010	200
2011	300

Use the Berquist-Sherman case outstanding adjustment technique to calculate the projected ultimate loss and LAE pure premium of the rate level indication.

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7. (1.5 points)

Two methods of deriving expense provisions in ratemaking include the Premium-Based Projection Method and the Exposure/Policy-Based Projection Method.

a. (1 point)

For each method, briefly describe how both fixed and variable expenses are treated.

b. (0.5 point)

Briefly describe one shortcoming (or distortion) of each method.

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8. (2 points)

Given the following information:

Calendar/Accident Year	Earned Exposures	Non-Catastrophe Number of Claims	Non-Catastrophe Reported Losses and ALAE ($000s)	Reported Loss and ALAE Development Factor	Loss Trend Factor
2010	20,725	350	$11,446	1.000	1.145
2011	21,220	310	$12,757	1.006	1.121
2012	23,015	320	$11,295	1.068	1.080

- ULAE = 2% of loss and ALAE.
- Regional non-catastrophe pure premium (including LAE) = $602.
- Non-modeled catastrophe pure premium (including LAE) = $30.
- Modeled catastrophe pure premium (including LAE) = $75.
- Projected net reinsurance cost per exposure = $22.
- Projected fixed expense per exposure = $35.
- Profit and contingency provision = 5.0%.
- Variable expense provision = 16.0%.
- Projected on-level average premium = $945.
- Claims required for full credibility for all three years combined = 1,082.
- The insurer uses the square root rule to determine partial credibility.

Calculate the credibility-weighted indicated rate change.

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9. (2.5 points)

Given the following information:

Territory	Premium	Current Relativity	Indicated Relativity
1	$195,000	0.85	0.75
2	$475,000	1.00	1.00
3	$330,000	1.30	1.20
Total	$1,000,000		

Management is requiring that both of the following objectives are achieved with the upcoming rate change:

- Target an overall rate level increase of 20%.
- Revise territorial relativities to the indicated relativity, while capping any territory rate impact at 25% overall.

Calculate the territorial relativities that will be implemented with the rate change.

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10. (2 points)

An insurance company develops territorial indications using a univariate pure premium analysis and has the following experience:

Territory	Earned Exposures	Reported Loss & ALAE ($000s)	Current Relativity
A	100,000	$60,000	1.00
B	250,000	$300,000	1.40
Total	350,000	$360,000	

Amount of Insurance Group	Charged Factor	Exposures	
		Territory A	Territory B
Low	0.75	50,000	25,000
Medium	1.00	30,000	75,000
High	1.50	20,000	150,000
Total		100,000	250,000

a. (0.5 point)

Describe how distortion can occur using a univariate approach.

b. (1.5 points)

Calculate the indicated pure premium relativities, while accounting for distortion that may be occurring due to amount of insurance differences by territory.

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11. (2.25 points)

Given the following information:

	Policies with a $100,000 Limit		Policies with a $250,000 Limit		Policies with a $500,000 Limit	
Size of Loss	Claims	Losses	Claims	Losses	Claims	Losses
X <= $100,000	100	$8,000,000	35	$1,800,000	35	$1,800,000
$100,000 < X <= $250,000			40	$7,400,000	25	$3,900,000
$250,000 < X <= $500,000					15	$5,200,000

Limit	Indicated factor (pure premium generalized linear model analysis)
$100,000	1.00
$250,000	0.95
$500,000	1.15

For the $250,000 policy limit:

a. (1.25 points)

Calculate the indicated increased limits factor, assuming a basic limit of $100,000.

b. (0.5 point)

Explain the difference between the indicated increased limits factor calculated in part a. above and the generalized linear model results.

c. (0.5 point)

Select an increased limit factor and briefly explain the rationale for the selection.

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12. (2 points)

An insurance company has recently entered a new state and plans to invest heavily on marketing in an attempt to aggressively grow its homeowners book of business. Relative to the low initial premium in the state, these marketing expenses will be significant.

The company's senior management proposes that the actuary develop a rate level where the expense provisions reflect only the typical variable costs. Construct a thorough argument in support of this proposal.

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13. (1.5 points)

The chief underwriter of a company offering homeowners insurance informs the chief actuary that an analysis has been performed on the replacement costs of all properties in the book of business. The book of business contains only two territories, A and B.

The analysis indicates that for the past 10 years, all properties in territory A have been uniformly underinsured by 20% while all properties in territory B have been adequately insured. The current insurance contract at the insurance company does not include any guaranteed cost replacement endorsement or coinsurance clause. The chief actuary is aware that the rating structure has been fully reviewed in the past year.

Discuss the overall premium adequacy, territorial premium adequacy, and the premium equity among the insureds.

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14. (2 points)

Given the following information:

Claim ID	Accident Date	Report Date	Incremental Payments in Calendar Year		
			2010	2011	2012
1	June 15, 2010	July 1, 2010	$100	$400	$0
2	December 15, 2010	January 15, 2011	$0	$300	$150
3	April 1, 2011	May 1, 2011		$200	$200
4	November 15, 2011	January 1, 2012		$0	$500
5	April 1, 2012	May 1, 2012			$200

a. (0.5 point)

Construct an annual incremental accident year paid loss triangle as of December 31, 2012.

b. (0.5 point)

Construct an annual cumulative report year paid loss triangle as of December 31, 2012.

c. (0.5 point)

Assess whether an accident year approach or a report year approach is more appropriate for reserving auto liability insurance.

d. (0.5 point)

Assess whether annual or quarterly triangles are more appropriate for a small company selling a long-tailed line of business.

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15. (4.5 points)

Given the following information:

COMPANY A

Paid Losses ($000s)

AY	12	24	36	48
2009	$400	$2,400	$9,600	$12,000
2010	$400	$2,400	$9,600	
2011	$400	$2,400		
2012	$400			

Reported Losses ($000s)

AY	12	24	36	48
2009	$800	$4,800	$12,800	$14,400
2010	$800	$4,800	$12,800	
2011	$800	$4,800		
2012	$800			

Reported Counts

AY	12	24	36	48
2009	2,000	3,000	3,000	3,000
2010	2,000	3,000	3,000	
2011	2,000	3,000		
2012	2,000			

Closed Counts

AY	12	24	36	48
2009	1,000	1,500	2,000	2,500
2010	1,000	1,500	2,000	
2011	1,000	1,500		
2012	1,000			

COMPANY B

Paid Losses ($000s)

AY	12	24	36	48
2009	$12	$45	$176	$230
2010	$4	$39	$192	
2011	$6	$51		
2012	$8			

Reported Losses ($000s)

AY	12	24	36	48
2009	$50	$144	$264	$278
2010	$34	$144	$288	
2011	$34	$147		
2012	$40			

Reported Counts

AY	12	24	36	48
2009	40	60	60	60
2010	40	60	60	
2011	40	60		
2012	40			

Closed Counts

AY	12	24	36	48
2009	20	30	40	50
2010	20	30	40	
2011	20	30		
2012	20			

- Both Company A and Company B write primary auto liability policies.
- On December 31, 2012, the two merge to form Company C.

a. (1 point)

According to the *Statement of Principles Regarding Property and Casualty Loss and Loss Adjustment Expense Reserves*, discuss two actuarial considerations for designing a reserve study for Company C.

b. (1.5 points)

Calculate three key diagnostics that an actuary would review to determine whether to combine historical data for Company A and Company B.

<QUESTION 15 CONTINUED ON NEXT PAGE>

15. (continued)

c. (1 point)

Assume the mix of business is comparable (i.e. similar limits, classes, territories, etc.) for Company A and Company B. Argue whether or not it is appropriate to combine the historical data to estimate unpaid claims for accident years 2012 and prior as of December 31, 2012 for Company C.

d. (1 point)

Assume that Company C's claims department will adopt Company A's claims practices. Argue whether or not it is appropriate to combine historical data to estimate unpaid claims for accident year 2013 as of December 31, 2013 for Company C.

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16. (2 points)

Given the following information:

Accident	Reported Claim Counts (excluding closed with no payment)		
Year	12 Months	24 Months	36 Months
2010	291	274	273
2011	301	289	
2012	254		

Accident	Reported Claims ($000)		
Year	12 Months	24 Months	36 Months
2010	$11,058	$12,330	$12,375
2011	$11,739	$13,005	
2012	$13,970		

Assume no further development after 36 months.

Using a frequency-severity technique, estimate the IBNR for all accident years.

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17. (2 points)

Given the following information:

Accident Year	Earned Premium	Expected Claim Ratio	Reported Claims	Reported CDF to Ultimate
2010	$19,800	50%	$6,900	1.400
2011	$18,900	50%	$5,800	1.700
2012	$21,200	50%	$3,200	3.100

a. (1.75 points)

Estimate the unpaid claim amount as of December 31, 2012 using the Benktander technique for accident years 2010 through 2012.

b. (0.25 point)

Estimate the unpaid claim amount as of December 31, 2012 using the Benktander technique with 1,000 iterations for accident year 2012.

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18. (2 points)

For each scenario described below, justify an appropriate reserving technique for estimating the unpaid claim liabilities at 12 months maturity.

a. (0.5 point)

Excess of loss reinsurance with an average attachment point of $100 million on product liability policies.

b. (0.5 point)

Basic limits auto liability for an insurer that has recently implemented a new claims processing system to make faster payments to insureds without changing the company's reserving methodology.

c. (0.5 point)

Self-insured workers compensation for a large corporation in a state where the statute of limitations for filing a claim has been recently reduced.

d. (0.5 point)

Property catastrophe coverage in a year with higher-than-expected catastrophe losses reported to the insurer but not yet paid.

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19. (2 points)

Within the last year, an insurer implemented a new claims processing system that resulted in faster payment of claims. However, the claims department failed to communicate this change to the actuarial department, and the actuary continues to use the paid loss development method to select the insurer's ultimate losses.

For each item below, discuss the impact of using the actuary's calculation of ultimate losses on the following estimates.

a. (0.5 point)

Ultimate ALAE calculated using a paid ALAE to paid claims ratio method.

b. (0.5 point)

Ultimate ULAE calculated using the Wendy Johnson method.

c. (0.5 point)

Rates calculated for the upcoming policy year using the pure premium method.

d. (0.5 point)

The reinsurance recoverable for the underlying business on an excess-of-loss reinsurance contract where the retention has been exceeded but the limit has not yet been exhausted.

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20. (2 points)

Given the following information:

Accident Year	Earned Premium	On-Level Adjustment	Reported Claims	Pure Premium Trend Factors	Tort Reform Factors	Reported CDF to Ultimate
2010	$50,000	0.900	$25,000	1.061	0.750	1.250
2011	$52,000	0.950	$20,000	1.030	0.900	1.750
2012	$54,000	1.000	$10,000	1.000	1.000	2.500

Using the Cape Cod technique, estimate the IBNR for accident year 2011.

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21. (2.75 points)

Given the following information:

Accident	Cumulative Closed Claim Counts			
Year	12 Months	24 Months	36 Months	48 Months
2009	250	400	450	500
2010	225	360	405	
2011	250	500		
2012	175			

Accident	Cumulative Paid Claims ($000)			
Year	12 Months	24 Months	36 Months	48 Months
2009	$2,000	$2,800	$4,340	$5,425
2010	$2,100	$3,360	$4,872	
2011	$2,000	$3,750		
2012	$1,600			

Accident	Ultimate
Year	Claim Counts
2009	500
2010	450
2011	625
2012	700

Assume no further development after 48 months.

Using the Berquist-Sherman paid adjustment to the paid claim development technique, estimate the ultimate claims for accident year 2012 as of December 31, 2012. Use linear interpolation to calculate adjusted paid claims.

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22. (2 points)

Given the following information:

Reported Losses Gross of Reinsurance ($000,000)			
	Age		
Accident Year	12	24	36
2010	$20	$40	$60
2011	$15	$30	
2012	$18		

Reported Losses Net of Reinsurance ($000,000)			
	Age		
Accident Year	12	24	36
2010	$16	$32	$30
2011	$14	$24	
2012	$11		

- Each accident year has a 20% quota share reinsurance treaty.
- Each accident year has an aggregate stop loss treaty attaching at $30 million applied after quota share.
- Assume the gross data is correct.

a. (0.5 point)

Review the loss triangles above and briefly discuss whether the net data is reasonable based on both reinsurance treaties.

b. (0.75 point)

Explain and justify an approach for estimating gross, ceded, and net ultimate claim estimates.

c. (0.75 point)

Predict the relationship between the gross reported loss tail factor and the ceded reported loss tail factor. Explain the impact of both the quota share agreement and the stop loss agreement.

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23. (2 points)

The following table summarizes the results of various ultimate claim projection techniques as of December 31, 2012 in total for all accident years:

Technique	Ultimate Claims
Reported Development	$10,000
Paid Development	$8,000
Expected Loss	$8,300
Reported Bornhuetter-Ferguson	$9,500
Paid Bornhuetter-Ferguson	$8,100
Reported Berquist-Sherman	$8,350
Paid Berquist-Sherman	$8,150

a. (0.5 point)

Describe a potential operational change that explains the results above.

b. (0.75 point)

Identify three questions that the reserving actuary should ask the claims department to better understand the impact of the operational change identified in part a. above on the unpaid claims estimate.

c. (0.75 point)

Briefly define three diagnostic tools that can be used to test the reasonability of ultimate claim selections.

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24. (3 points)

Given the following information:

Accident Year	Selected Ultimate Claims as of December 31, 2011	Actual Reported Claims as of December 31, 2011	Actual Reported Claims as of December 31, 2012
2009	$5,000	$5,000	$5,500
2010	$5,000	$3,333	$5,033
2011	$5,000	$2,500	$4,000

The selected ultimate claims as of December 31, 2011 were determined using the reported development technique.

a. (1.25 points)

For accident years 2009 through 2011, compare actual claim emergence to expected reported claim emergence between December 31, 2011 and December 31, 2012.

b. (0.25 point)

Briefly discuss what change, if any, the actuary should make to the reported claim development factors based on the actual claim emergence as of December 31, 2012.

c. (1.5 points)

For each accident year, justify what changes, if any, the actuary should make to the ultimate claim selections based on the actual claim emergence as of December 31, 2012.

END OF EXAMINATION

Exam 5
Basic Techniques for Ratemaking and Estimating Claim Liabilities
October 29, 2013

POINT VALUE OF QUESTIONS

QUESTION	VALUE OF QUESTON	SUB-PART OF QUESTION (a)	(b)	(c)	(d)	(e)	(f)	(g)
1	1.50							
2	2.00							
3	1.50	0.50	0.50	0.50				
4	7.50	6.25	0.50	0.75				
5	2.75	1.50	0.50	0.75				
6	3.25							
7	1.50	1.00	0.50					
8	2.00							
9	2.50							
10	2.00	0.50	1.50					
11	2.25	1.25	0.50	0.50				
12	2.00							
13	1.50							
14	2.00	0.50	0.50	0.50	0.50			
15	4.50	1.00	1.50	1.00	1.00			
16	2.00							
17	2.00	1.75	0.25					
18	2.00	0.50	0.50	0.50	0.50			
19	2.00	0.50	0.50	0.50	0.50			
20	2.00							
21	2.75							
22	2.00	0.50	0.75	0.75				
23	2.00	0.50	0.75	0.75				
24	3.00	1.25	0.25	1.50				
TOTAL	58.50							

Exam 5 Examiner's Report
Fall 2013

The pass score for this exam was set at 41 points, or 70.1% of the total available points.

1.

Nearly all candidates were able to name three criteria for an exposure base. When candidates lost points, it was typically due to only evaluating hours worked as an exposure base, without comparison to payroll. Others lost credit for not supporting the reason, or for simply restating the criteria as the reason. For example, with the proportionality criteria, simply stating that 'hours worked is proportional to expected loss' without further explanation was not given full credit. Given justification, candidates could argue for either exposure base for any particular criteria.

2.

Most candidates correctly used the current rates and calculated the on-level premium accurately. For candidates that incorrectly calculated the on-level premium, there were various errors related to using older rates.

About half the candidates calculated the earnings percentage correctly. Some common errors were assuming the latest 2 years exposures were fully earned or assuming the expense fee is fully earned immediately.

Some candidates forced the calculation into a parallelogram method. The question explicitly said to use the extension of exposures method. This would cause significant amount of additional work and would result in lost points since it was not the appropriate method.

3.

Candidates generally answered this question correctly. Some candidates did not provide any explanation of why or how the data aggregation method achieved the objective and in those cases were not afforded full credit.

a. The majority of candidates provided comprehensive answers for this part.

b. Some candidates struggled to articulate how the calendar/accident year aggregation method met the objective of matching premium to loss.

c. The majority of candidates provided comprehensive answers for this part

4.

a. Most candidates correctly calculated the current rate level factors. Candidates did struggle with the premium trend, with common mistakes of missing the trend period or applying to written premium. Most candidates did well with the loss component, receiving full credit on the loss development and loss trend portion of the question. Candidates could get full credit for using either state specific development factors or countrywide as long as the selections were reasonable.

b. Candidates were often able to identify alternatives like extension of exposure or using more refined time periods, but some did lose points for lack of description.

c. Most candidates received partial credit. Candidates were often able to identify the impact on the indication given a premium change, but lacked the discussion leading up to the reason behind the premium change. Credit was also given for a complete discussion of the impact of changing trend periods due to different average earned and average accident dates.

5.

Many candidates skipped this question or received little partial credit with very few receiving full credit.

a. Candidates most often determined the appropriate trend period of 1.5 years. Candidates received credit for knowing the components of the loss ratio trend. Candidates did receive credit whether they treated the loss development factors given in the problem as either cumulative or incremental factors. Candidates struggled with the large loss factor. Many did not calculate it correctly and others did not apply it correctly. An example of incorrect application was not subtracting excess losses from reported losses in 2012 before applying the excess loss factor.

b. Candidates needed to identify the volatility in the data and the benefit of stability in the indications. Multiple responses were acceptable for each piece, but candidates often were able to elaborate on only one component.

c. Candidates often were able to identify 3 different enhancements, receiving full credit.

6.

Candidates did very well on this question. Most candidates successfully applied the Berquist-Sherman case outstanding adjustment technique and set up the steps for calculating the projected ultimate loss and LAE pure premium of the rate level indication. When candidates did lose points it was usually for: not trending the losses and LAE to the effective period, using an incorrect trend period, or not applying the ULAE provision.

7.

a. More than half of the candidates received full credit for this part. Some common mistakes were stating that both fixed and variable expenses were treated as one ratio and stating that variable expenses are related to exposures/policy counts instead of premium for the Exposure/Policy Based method.

b. A majority of candidates were able to correctly describe a shortcoming for the Premium Based method, while many had difficulty doing the same for the Exposure/Policy Based method. A common mistake was referencing a shortcoming of the pure premium or loss ratio methods, which aren't necessarily shortcomings of the methods for deriving expense provisions.

8.

Most candidates received full or nearly full credit. Some common errors include: incorrectly utilizing both the non-modeled and modeled CAT Pure Premiums, incorrectly applying credibility by year and not in total, incorrectly utilizing the ULAE factor, and incorrectly using the complement of credibility. Some candidates applied the ULAE factor to provisions that already included LAE.

9.

In general, most candidates were able to correctly calculate the weighted impact of the proposed relativity changes and recognize the need for an off-balance in order to neutralize the overall premium back to the starting premium. Most candidates were also able to then apply the targeted rate change of 20% in order to derive a total uncapped change for each territory.

Some candidates only showed that territory 2 would exceed the maximum rate cap of 25% without explicitly demonstrating that territories 1 and 3 would *not*. When attempting to calculate the premium shortfall due to the cap on territory 2, some candidates failed to identify the correct premium to which the excess ratio should be applied. Another common error involved candidates capping the rate change at the overall targeted change of 20%. Most candidates struggled with the final step of the calculation – either by not correctly identifying the denominator of premiums to which the excess premium should be applied or by forgetting to make an adjustment to compensate for the base rate cap.

10.

a. Most candidates received full credit. When candidates did lose points they correctly identified key ideas regarding exposure distributions or correlation of variables but misstated the concept in some way.

b. Most candidates received full credit. Most common mistakes for this calculation were: using the Loss Ratio method instead of Pure Premium or incorporating the current relativities, possible typos/miscalculations with no work shown.

11.

a. The majority of candidates scored well on this part. This question involved a straightforward calculation.

b. Almost half of all candidates received full credit on this part for indicating that, unlike the traditional ILF approach used in part a., the GLM approach does not assume frequency is the same for all limits, or that the GLM approach recognizes behavioral differences among insureds at different limits.

   A small group of candidates received partial credit for indicating that the GLM approach considers correlations between rating variables or for making a less-than-fully-formulated attempt to explain that the GLM method is influenced by frequency or behavioral differences.

   A large group of candidates received no credit for stating that the GLM-indicated ILF considers all variables simultaneously , considers other variables, considers correlation between limits, is distorted due to low volume, is distorted due to low credibility, considers variability in higher layers, etc. While these statements may be true, they are not the correct explanation for the difference between the two indicated ILFs in this problem. Certain arguments, such as sparse data and low credibility were pointed out to critique one of the methods without addressing that this issue would in fact impact both methods and addressing the degree to which each of the methods would be impacted. Some candidates assumed the GLM used a curve-fitting procedure and thus better dealt with sparse data, which does not appear consistent with the indicated ILFs from the GLM.

c. The majority of candidates received full credit on this part, providing both an acceptable selection and rationale for that selection. Candidates received full credit for selecting the traditionally-calculated ILF and citing that the GLM-indicated ILF results in a counterintuitive/unreasonable/nonsensical factor relative to the factors for the $100K and $500K limit, or in discontinuities/reversals. However, candidates who selected the GLM-indicated factor, due to its recognition of frequency or behavioral differences, its sophistication/comprehensiveness, or its recognition of correlations between rating variables also received full credit. Similarly, weightings of the two, if appropriately determined, were awarded full credit.

   Another large group of candidates received partial credit, typically for providing a reasonable selection as discussed above, though without any supporting explanation, or with inapplicable support.

12.

In general, candidates did not provide a thorough argument in support of the proposal. Often, candidates provided either one thought out point or only briefly touched on two or three points. To provide a thorough argument, candidates needed to have at least two well vetted points or at least four basically discussed points. There were many points that were acceptable points, with varying level of discussion leading to different amount of points earned on the question.

When candidates did not receive points for their discussion it was usually for: not supporting the proposal when the question specifically asks to support it, misinterpreting the question to mean that all expenses should be treated as variable or including the unusually large marketing expense, or offering arguments that were not clear or not thorough.

13.

Many candidates did not discuss the impact of the rating structure reviews in discussing overall and territorial premium adequacy. Partial credit was given for stating overall premium inadequacy due to the underinsurance/inadequate rate in Territory A.

Candidates also struggled with addressing equity. Many did not understand the concept of equity, confusing it for equality in premium.

Several candidates did not recognize the loss cost differential between territories resulting in subsidization or unfairness.

14.

a. The vast majority of candidates correctly answered this question. A small number made a calculation mistake or wrote a cumulative triangle instead of incremental.

b. The vast majority of candidates correctly answered this question. A small number made a calculation mistake or wrote an incremental triangle instead of cumulative.

c. Candidates generally answered this question correctly. Some responded that accident year is more appropriate because auto claims are typically reported quickly which was not accepted. Another common incorrect answer was that report year should be used since auto has a long tail or large reporting lag.

d. Candidates generally answered this question correctly. Some responded that quarterly is more appropriate because there can be seasonality in the claims which was not accepted. Since the question was asking for a reason that is specific to small companies, credit was not awarded for that response.

15.

a. The question asked for a discussion, but many candidates simple stated a consideration. Candidates needed both the consideration and something to tie it to either the data or an explanation of why it was important. The considerations had to relate in some way to a reserving study, and the candidate's logic and reasoning had to be valid.

   Candidates received only partial credit for lack of explanation. Some examples would be: (credibility) the data needs to be credible or (case reserve adequacy) case reserve adequacy should be considered.

   Very rarely did a candidate get zero credit on this part, unless the question was skipped. The majority of candidates got at least half credit.

b. Very few candidates lost credit on this part. Most candidates who showed three calculations got full credit. Simply listing three valid diagnostics received some credit, with some dialog on how each related to the data receiving more credit (but not full credit). Some common reasons for losing points:

   - Did not do three calculations
   - Only describing a calculation and not actually doing it
   - Calculations that didn't add any diagnostic value:
     - Case reserves (total not average)
     - Open claim counts
     - Loss ratios

c. Candidates generally did well on this question. Arguments either for or against combining the data were accepted, provided they were valid and logical. Some candidates lost points for not actually recommending to combine or not combine, but the most common reason for losing points was not explaining why whatever reasons from part b. were relevant (or not relevant).

d. Candidates did not do as well on this part. Simply re-stating the reasons from part c. did not get any credit. The arguments needed to be logical. Some candidates may not have read the question correctly, arguing why B should or should not use A's case reserving philosophy. Some candidates did not provide enough detail behind size difference implications which resulted in some lost credit.

16.

Many candidates received full credit on this question. Full credit was given for considering the claims as either incremental or cumulative as long as both the counts and dollars were both used as either cumulative or incremental.

Many candidates knew very well how the method works but were short of getting full credit because they did not show the derivation of Ultimate Claim Counts and Ultimate Severities as two essential components of the method. In the majority of cases, when graders were able to follow the candidate's logic, the candidate still received the full credit for listing components of the Ultimate Claim Counts and Ultimate Severities.

Some common mistakes that were made on this problem:

- Reported Claim Counts and Reported Claims ($000) (a.k.a. Reported Losses) can be interpreted as Incremental or Cumulative but this interpretation should be consistent between both data triangles.
- Applying age-to-age factors (a.k.a. link ratios) instead of age-to-ultimate factors (a.k.a. cumulative development factors) to develop severity and claims count.
- Forgetting that the question asked about IBNR for all years and just calculate Ultimate Claims ($000).

17.

Candidates did well on this question. Full credit for this question was given for calculating ultimate losses instead of IBNR. Candidates could also receive full credit for making assumption about the amount of paid losses to then calculate IBNR.

a. A majority of the candidates received full credit on this part. Some candidates did apply the Bornhuetter-Ferguson method instead of the Benktander method, resulting in loss of some credit.

b. Roughly half of the candidates received full credit on this part. With high level of iterations, the result will converge to the development technique. If candidates did not know that they did not receive credit on this part.

18.

a. Many candidates acknowledged that data at this attachment point would be thin and volatile. In addition, about half the candidates received either partial or full credit on this question. The most common method listed that did not receive credit was the Cape Cod method. This was not accepted because the expected loss ratio used in the method is based off the experience and at such a high attachment point there is little to no experience.

b. A large portion of candidates received no credit for using the reported development method with justification that this method will not be impacted by the change. Both the paid and reported development methods are distorted by the new claims processing system. For full credit, the candidate needed to acknowledge there would be a change in the claim reporting pattern and select a method that would account for this appropriately, such as the paid Berquist-Sherman method. Some responses said case reserves would be impacted and to use an incurred Berquist-Sherman method - no credit was awarded as the reserving philosophy did not change.

c. Some candidates incorrectly interpreted the change in statute of limitations as a change in benefit limits (instead of a reduction in the time to file a claim). Thus, some candidates said ultimate losses would increase/decrease as a result. In addition, a portion of the candidates that acknowledged there would be a speed up in claims filed stated that the paid development or paid BF methods would be suitable. No credit was awarded for this as there would be a change in the payment pattern. Some candidates listed the case outstanding method as an appropriate method as it works well with self- insurers. However, the case outstanding is best for claims made coverage which workers compensation is not.

d. Many candidates mistook property catastrophe coverage for property coverage. Thus, this led to candidates selecting a method more fit for property coverage instead of property catastrophe coverage. For instance, many answered separating out the catastrophe portion and completing a separate analysis on this piece as a method, which received no credit. For points to be awarded for justification, the candidate needed to demonstrate that they understood that there was a distortion due to the higher than normal catastrophe activity but at the same time incorporate that into the method. Also, a fair amount of responses suggesting using the paid development method with a catastrophe load. This was not an acceptable method as the development method is inappropriate for this type of coverage. Lastly, catastrophe modeling was listed as a method. No credit was awarded for this method because catastrophe modeling is not a reserving technique, but rather a prospective pricing tool.

19.

Candidates did not do well on this question, often providing insufficient detail to receive full credit.

a. Many candidates did mention that the ultimate losses would increase. However, a common mistake was not to explain appropriately how this would lead to higher ALAE (it is the application of the historical paid to paid ratio to the overstated ultimate that produces the overstated ALAE result). Another common error was to focus just on the paid to paid ratio, but neglect that the paid ultimate is going to be significantly higher.

b. Most candidates did not receive credit for this part.

c. This part was generally answered quite well. The most common error was to indicate that the ultimate losses/ pure premium increased, but not mention anything about the rates themselves increasing.

d. This was also answered quite well. A common error was a lack of detail, with credit lost if candidates did not mention the fact that the retention was exceeded or that the limit had not yet been reached.

20.

Candidates were able to handle the basic component of the Cape Cod method but struggled with the adjustments. Some common mistakes were:

- Forgot to adjust the estimated claim ratio to bring it to the 2011 level.
- Used the reported CDF to ultimate factor to adjust the reported claims to ultimate, which produces the same yearly adjusted ECRs but causes an error in the volume weighting in the total.
- Not utilizing the concept of used-up premium which is central to this method.
- Candidates misapplied the pure premium trend and tort reform factors to the earned premium instead of the claims or didn't apply them at all.
- Providing expected ultimate claims as the answer instead of IBNR or provided IBNR for an accident year other than 2011.
- Not calculating IBNR by applying the unreported percentage to the expected ultimate claims. The typical error was subtracting the reported claims or adjusted claims from the expected ultimate claims instead.

21.

Most candidates correctly calculated the disposal rate as well as implementing the LDF method (link ratios, selecting LDFs, calculating CDF, and applying it to the appropriate paid dollars). Candidates had trouble with interpolating for age 12, while many candidates realized that ages 24-48 did not need to be adjusted. The most common errors were:

- Incorrectly interpolating age 12.
- Calculating incremental paids and adding periods together to get to the ultimate.

22.

a. Many candidates answered this question correctly. Most candidates who did not receive full credit missed either the stop loss error in 2010 or both of the quota share errors in 2011 & 2012. A small amount of candidates received no credit on this question.

b. Most candidates answered this question correctly or received almost full credit. The majority of the points were taken off for not correcting the net data provided. Most candidates knew to develop gross losses and were able to explain the relationship between gross, net and ceded.

c. Few candidates received full credit on this question. A majority of candidates misread the question and assumed that it asked them to compare gross and net tail factors. Of those that did compare the ceded and gross tails, many got the relationship wrong. For the candidates that correctly explained the relationship between the gross and ceded tails, some were not able to explain the impact of the quota share and stop loss.

23.

a. The majority of candidates scored well on this part. This part involved describing a potential operational change (case reserve strengthening, but alternatively slower settlement of claims is acceptable) which required an explanation using the data for full credit. Some common errors were:

   - Candidates just stated "change in reserve adequacy" without clear rationale for this conclusion.
   - Candidates stated "all reported are higher than paid". However, it is necessary to distinguish among the reported methods as Berquist-Sherman was a critical element.

b. The majority of candidates scored well on this part. This part requires candidates to provided three questions to claim department regarding the operational change noted in part a. Some common errors were:

   - A simple repeat of the operational change.
   - Questions that are not related to the operational change.
   - Asking if there was a recent large loss that was reported but not paid. The reported Berquist-Sherman method would not have been in line with the paid methods if this was the case.
   - Repeating the questions with minor alterations.

c. The majority of candidates scored very poorly on this part. This part requires candidates to provide three diagnostics for ultimate claim estimate. Most candidates attempted the question as if it is a continuation of previous parts and tried to explain the answers of the previous parts. The common errors include stating disposal rates, statistics related to paid, reported, case. They do not provide direct diagnostic to ultimate claim reasonability.

24.

a. Many candidates received full credit. Credit was given if comparison based on Age-to-Age factors (actual vs expected). Some common mistakes included:

   - Miscalculation of 2010 actual
   - Not offering comparison of actual and expected
   - Calculating 2011 expected emergence incorrectly

b. Slightly more than half of the candidates received full credit on this part. Full credit responses ranged from a simple "increase factors" to a more specific increase for 12-24 and 36-Ult. Other acceptable responses included suggestion to perform a Berquist-Sherman adjustment if warranted by the data and use adjusted data to re-calculate factors. There was no partial credit for this part.

c. Candidates that did not receive full credit were those who either specified a change in the ultimate or justified how to make a change to the ultimate, but not both. Typical full credit response included adjusting the ultimates based on the new reporting pattern. Credit was given for selecting reporting patterns. Credit also given for descriptive responses with no values specified. Some candidates mistakenly used prior reported when developing ultimates.

Exam 5 – Question #1 (example 1)

1. Proportional to expected loss. Hours worked is proportional to expected loss but only in terms of frequency input. Payroll is better at being proportional to loss because is better related to both frequency and severity because the benefits based on wages.

2. Practical: well-defined objective and easy to verify. Both payroll and hours worked are objective and well defined, but hours worked is harder to verify then payroll (W-2 tax forms).

3. Historical Precedence. Payroll is already used in the industry while hours worked is not. Changing to hours worked could cause costly changes to IT systems, rating algorithms, and lead to large premium swings.

   I would not switch to hours worked because the cost of verifiable and implementation outweigh any benefits. Payroll is better at meeting all three objectives above.

Exam 5 – Question # 1 (example 2)

A good exposure should fulfill these criteria.

1. Proportional to expected losses. Payroll does a better job for indemnity because the benefit paid is not dependent on how many hours a worker worked. However, hours worked is more related to medical payment because longer work hours gives more time/chance an accident may happen.

2. Practical, easy to obtain, objectively measurable. Payroll is more practical because it is easily verifiable in many financial reports but hours worked is subject to employer manipulation in self reporting.

3. Has historical precedence. Payroll has historically been used so there may be premium swing, changes to rating algorithm and data requirement in systems when we change to hours worked.

Overall, do not recommend the change because partial gain in (1) is not worth the costs in (2) and (3).

Exam 5 – Question #2 (example 1)

Latest rate @ 1/1/2013

A: 500(1) + 55=555

B: 500(0.8) + 55=455

Half year	% earned in 2012	Avg. dates	Earned exp: A	Earned exp: B
1H, 2011	0	4/1/2011	0	0
2H, 2011	½	11/1/2011	75	50
1H, 2012	1	4/1/2012	175	150
2H, 2012	½	11/1/2012	100	100
			350	300

CY 2012 earned prem @ CRL

= 350(555) + 300(455) = 330750

Exam 5 – Question #2 (example 2)

Assume avg. written dates midway through periods ("written uniformly during")

10/1/2011: 150(500 x 555 + 55) = 83,250

100(500 x 455 +55) = 45,500] X .5 = 64375

4/1/2012: 175(500 x 1 + 55) = 97125

150(500 x .8 + 55) = 68250] X 1 = 165375

10/1/2012: 200(500 x 1 + 55) = 111,000

200(500 x .8 + 55) = 91,000] X .5 = 101,000

Total = 330,750

Exam 5 – Question #2 (example 3)

Rating algorithm = base rate x class factor + expense fee

Extension of exposures method is to re-rate each policy at current level.

Written	Period Midpoint
500(125,000)(1) + 500(50,000)(.8) + 55 = 82,500,055	4/1/2011
500(150,000)(1) + 500(100,000)(.8) + 55 = 115,000,055	10/1/2011
500(175,000)(1) + 500(150,000)(.8) + 55 = 147,500,055	4/1/2012
500(200,000)(1) + 500(200,000)(.8) + 55 = 180,000,055	10/1/2012

<u>% earned in 2012</u>
0%
50%
100%
50%

Earned premium at CRL = 115,000,055 (.5)
+147,500,055 (1)
+ 180,000,055 (.5)
= 295,000,110

Exam 5 – Question 3

A. Calendar year data is the most responsive as it uses very recent data and is fixed at the end of the calendar year.

   Calendar year data doesn't do a good job matching premium and losses; we could have losses from written in one calendar year being matched with premium from policies written in another.

   Or

A. Least match premium and losses as it only aggregate data based on transactions data regardless the effective or loss data, thus mismatch. Readily available as premium/losses are fixed as soon as CY ends. No development, thus data readily available.

B. Calendar/Accident year uses the same premium as calendar year, but uses losses that occur in a given year. This does a better job at matching premium and losses than calendar year, but there is still a mismatch. Data is also not fixed at the end of the accident year as losses are not fully developed; therefore, it does not use as recent data as calendar year.

   Or

B. Better match than CY aggregate, as it aggregate losses based on accident date in the 12-mos period, and premium based on transaction date. Not readily available, as the losses data is subject to development due to pure IBNR and IBNER.

C. Policy year provides a perfect match between premiums and loses as it contains losses and premium for policies written in a given year. The drawback is that it can take a while for this data to fully develop and therefore it is not as responsive as calendar or accident year data and doesn't use the most recent data available.

   Or

C. Most match as premium and losses are all from the same policies issued in the 12-mos period. Least available. It takes extended time period to develop to ultimate for both premium and losses.

   Or

C. Best match for premium and losses. It is the exact amount. If it was written in the policy year it will look at all the losses in that policy year regardless if it happened in another accident year. Not the most recent data because it is extended over 24 months. Policy year has an extended time frame to account for all policies written within a 1 year policy period.

Exam 5 – Question #4 Part A (example 1)

A.

Avg. factor	Adj. factor for earned
2010: 1/8(1.05) + 7/8(1) = 1.00625	1.1165
2011: 1/8(1) + 7/8(1.05) = 1.04375	1.0764
2012: 9/32(1.1235) + 23/32(1.05) = 1.070672	1.04934

Adj. for 2012 written = $\frac{1.1235}{\frac{1}{4}(1.05) + \frac{3}{4}(1.1235)} = 1.016627078$

2012 avg. written @ CRL = 18.75(1.016627078)/1500 = 1270.78

Year	Step 1 Prem = earned exp. 1270.78	Step 2 Trend	Final Prem
10	508313.54	$(1.02)^{2.5}$	534111.72
11	2541567.70	$(1.02)^{2.5}$	2670558.60
12	17790973.87	$(1.02)^{2.5}$	13593910.16
			Total = 21898580.48

Trend from 1/1/2010 – 7/1/2012 – 2.5 years

State x LDFs

AY	12-24	24-36	36-48
08	X	4	1.25
09	1.226	1.277	1.023
10	1.543	1.064	
11	1.96		

CW LDFs

AY	12-24	24-36	36-48
07	X	X	1.011
08	X	1.094	1.0204
09	1.111	1.059	1.0204
10	1.081	1.069	
11	1.101		
Avg. =	1.097	1.074	1.017

Because there is exp. growth in state X, and LDFs are volatile, should use more stable CW development factors. Use state X LDFS will skew projection (most likely too low due to older LDFs)

CW CDFS	12	24	36	48
	1.198	1.0923	1.017	1

Year	Loss + ALAE	CDF	ULAE	Trend	Find loss and LAE
10	624486	1.017	1.12	$(1.04)^5$	865422.89
11	1316239	1.0923	1.12	$(1.04)^4$	18833770.83
12	9706607	1.198	1.12	$(1.04)^3$	14650248.64

Total = 17399442.16

Trend from 7/1/10	to 7/1/15	5
	11	4 years
	12	3

LR = 0.7945

Rate change = $\frac{.7945 + .07}{1-.21-.03} - 1 = 21.77\%$

Exam 5 – Question #4 Part A (example 2)

Prem

- Need to bring to CRL CRL= 1.05(1.07) = 1.1235

10 avg. rate level = 1/8(1.05) + (1-1/8)(1) = 1.00625

10 OLF = $\frac{1.1235}{1.00625}$ = 1.11652

11 avg. rate level = 1/8(1.05) + 7/8(1.05) = 1.04375

11 OLF = $\frac{1.1235}{1.04375}$ = 1.07641

12 avg. rate level = .28125(1.1235) + (1-.28125)(1.05) = 1.07067

12 OLF = $\frac{1.1235}{1.07067}$ = 1.04934

10 OLF = $\frac{1.1235}{½(1) + ½(1.05)}$ = 1.0961

11 OLF = $\frac{1.1235}{1.05}$ = 1.07

12 OLF = $\frac{1.1235}{¼(1.05) + ¾(1.1235)}$ = 1.01663

Year	EP @ CRL	Avg. EP @ CRL	WP @ CRL	Avg. WP @ CRL	Step 1 trend
10	446,608	1117	690,543	1151	1.13787
11	2,368,102	1184	3,322,350	1231	1.07348
12	17,628,912	1259	19,061,813	1271	1.00953
	EP x OLF	/ EE	WP x OLF	/ WE	

$\frac{\text{12 Avg. WP @ CRL}}{\text{Year's Avg. EP @ CRL}}$

Step 2 trend
7/1/12 trend from 1/1/15 trend to (2.5 years trend)

Earned prem
Year 10: 446,608 x 1.13787 x $1.02^{2.5}$ = 533,973
Year 11: 2,368,102 x 1.07348 x $1.02^{2.5}$ = 2,671,129
Year 12: 17,628,912 x 1.00953 x $1.02^{2.5}$ = 18,700,153
21,905,255

Loss
Dev – Use all years weighted avg. for CDFS

	12-24	24-36	36-48
	1.78254 x	1.08479 x	1.02532
To ult	1.98264	1.11225	1.02532

Loss trend: avg. date of loss in hist. period → avg. date of loss in prospective period
7/1/XX → 7/1/15 (same as prem avg. earned date)

Loss
Year 10: 624,486 x 1.02532 x 1.04^{5} x 1.12 = 872503
Year 11: 1,316,239 x 1.11225 x 1.04^{4} x 1.12 = 1918176
Year 12: 970,667 x 1.98264 x 1.04^{3} x 1.12 = 24,245,550
27,036,229

Loss ratio = 27,036,229 / 21,905,225 = 1.23424

Indication = (1.23424 + .07) / (1 - .21 - .08) - 1 = 83.695%

Exam 5 – Question #4 Part A (example 3)

CY	Earned exp.	Latest Avg. WP @ CRL	Trend factor ($1.02^{2.5}$)	EP @ CRL
2010	400 x	1270.78 x	1.0508 =	534,110
2011	2000	1270.78	"	2,670,550
2012	1400	1270.78	"	18,693,854
				21,898,514

$\frac{18750000}{15000} \times \frac{1.07}{1.0525} = 1270.78$

trend period = 7/1/2012-1/1/15
= 2.5 years

1.0(.25) + 1.07(.75) = 1.0525

AY	State x Losses	CDF ult.	Loss trend	Ult. Loss and ALAE
2010	624,486 x	1.016 x	1.04^5 =	771,939
2011	1,316,239	1.089	1.04^4	1,676,857
2012	9,706,667	1.195	1.04^3	13,047,823
				15,496,619

2010 trend period = 7/1/2010 – 7/1/2015

Countrywide LDFs

	12-24	24-36	36-48
Selected	1.097	1.072	1.016

$\frac{83.3+ 87 +78.8}{75 + 80.5 +71.6}$

ULAE

$\frac{15496619 \times 1.12}{21898514} = 0.7926$

Indicated Rate Level change = $\frac{0.7926 + 0.07}{1 - .21 - .08} - 1 = 21.5\%$

Exam 5 – Question #4 Part B

B. Use extension if exp. to rewrite each policy @ current rate levels/variables
   - Use parallelogram method on accident quarters, finer detail can better reflect changing exposures.

   Or

B. Use extension of exposures to accurately rate all policies at the current rate level.
   Use time periods of experience smaller than 1 year to allow for the growth in exposures and shift in avg. earning date/accident date.

   Or

B. The most accurate method for on-leveling premium would be the extension of exposures method. This technique requires very granular data and involves re-pricing each policy to the current rate level. A second alternative would be to break the premium data down into quarterly or monthly data. This would make for a more accurate on-leveling of a growing book of business.

Exam 5 – Question# 4 Part C

C. Assuming prem is even; avg factors would be too low since more accurate exp. is shifted @ year end as business grows.
   - Adj factor is too high → prem overstated → LR too low → rate need understated

C. Assuming that premium earns evenly assumes that less of the premium has received the benefit of the rate changes. Thus, it results in on-level premium that is too high, and the resulting indication is too low. If actual earning is used, more prem has received the rate changes, so OLFs would be lower, projected prem would be lower, and the indication would be higher.

Exam 5 – Question #5

A. Large loss Adj Factor

= 40k/(400k – 40k) – 11.1%

Assumed LDF

Trend Period = 7/1/12 – 1/1/14 = 1.5 yrs

Large Loss Factor

$$\text{A + 12 Ult. LR} = \frac{(45{,}295 - 9000)(1.20)(099 \times 1.05)^{1.5}(1.111)}{(672)(1.01)^{1.5}}$$

$$= 0.752$$

B. Given that the amount of excess losses varied considerably from year to year, it makes sense to do a large loss adjustment to smooth the losses.

C. (1) Adj. prem to reflect only 1M of limits offered; adj. may vary by year.
(2) Adj. LDF to reflect lower development due to loss capping.
(3) Adj. severity trend to reflect lower trend due to loss capping.

Exam 5 – Question #6

Average case outstanding change

	12	24	36
2009	86,842	81,250	73,333
2010	83,333	59,091	
2011	54,545		

Adjust this by trending the diagonal back at 5% per year

	12	24	36
2009	49,474	56,277	73,333
2010	51,948	59,091	
2011	54,545		

Adjust reported = adjusted case outstanding x open claim count + paid losses

	12	24	36
2009	15,400	26,204	31,300
2010	10,734	18,700	
2011	16,900		

	12-24	24-36	36-ult.
2009	1.7016	1.1945	
2010	1.7421		
Select all year simple avg.	1.7219	1.1945	1.000
CDF	2.0568	1.1945	1.000

AY 2010 loss trend = 7/1/2010 → 10/1/2014 = 4.25 years

AY 2011 loss trend = 7/1/2011 → 10/1/2014 = 3.25 years

C/AY	Rep Loss	CDF	Trend	ULAE	Proj. Ult.	EE	PP
2010	18,700,000	1.1945	$1.05^{4.25}$	1.1	30,232,583	200,000	151.16
2011	16,900,000	2.0588	$1.05^{3.25}$	1.1	44,806,052	300,000	149.35

Proj. Ult. L+LAE PP = 151.16 * .5 + 149.35 * .5 = 150.26

Exam 5

Exam 5 – Question #7

A. Premium-based: fixed expenses and variable expenses are separated then divided by either written or earned premium to get expense ratios.

   Exposure-based: Variable expenses are separated out and divided by either earned or written premium for a variable expense ratio. Fixed expenses are separated out and divided by either earned or written exposures to get an average fixed expense. This can be trended if necessary.

B. Premium-based: fixed expense ratio will be distorted if there are rate changes during or after the experience period.

   Exposure-based: Does not account for economies of scale for a growing book of business.

   Or

B. When using countrywide premiums for the prem based method, you are not accounting for the differences between states, such as regulatory environment. You may assign more fixed expense to states with large average premiums, even though fixed expenses should not vary with premium.

   Exposures may trend at a different level than fixed expenses, so it may be inappropriate to use expos/policy- based in this instance.

   Or

B. If using an all variable prem method, a shortcoming is that policies with large premium are overcharging expenses and vice versa for policies with small premium.

   A shortcoming of the fixed expense per exposure is that it doesn't take into account that fixed expenses sometime vary. For example, a renewal would have less fixed expense than a new policy.

Exam 5 – Question #8

CY/AY	EE	Trend+Dev Ult Non Cat	ULAE	PP
2010	20,725	11,446k (1)(1.145) = 13,105,670	X 1.02 = 13,367,783	645
2011	21,220	12,757k (1.006)(1.121) = 14,386,401	X 1.02 = 14,674,129	671.5
2012	23,015	11,295k (1.068)(1.08) = 13,028,105	X 1.02 = 13,288,667	577.4

3 year avg. → 637.92

Z = √(980/1082) = 0.9517

Cred wtd non-CAT PP

637.97(0.9517) + 602(1-0.9517) = 636.2366

$$\text{Ind. Rate} = \frac{636.2366 + 30 + 75 + 22 + 35}{1-0.05-0.16} = 1010.43$$

Ind. Change = 1010.43/945 = 1.0692

6.92%

Exam 5 – Question #9 (example 1)

Territory	Prem	Curr Rel	Proposed Rel	Prop/Curr	Rev Neutral Change
1	195,000	.85	.75	.88235	.927156
2	476,000	1.00	1.00	1.0000	1.05078
3	330,000	1.3	1.2	.923077	.96995
	1,000,000			.951674	

Wtd w prem

Territory	Target Overall chg	Total chg	Prem above cap
1	1.2	1.11259	-
2	1.2	1.260936	5,194.6
3	1.2	1.16394	-

Adj to base due to cap = 1.25/1.260936 = .991327
Prop prem territory 1 and 3 = 1.11259(195,000) + 1.16394 (330,000) = 601,055.25
Adj to territory 1 and 3 due to prem cap = 5194.6/601,055.25+1 = 1.008642
Total adj to territory 1 and 3 = 1/.991327 x 1.008642 = 1.017467

<u>Territory Adjusted Rel</u>

1 .75 x 1017467 = .76310
2 1.000 = 1.000
3 1.2 x 1.017467 = 1.22096

Exam 5 – Question #9 (example 2)

Territory	(1) Prem	(2) Current Rel	(3) Proposed Rel	(4) △	(5) Rev Neutral	(6) Overall
1	195,000	.85	.75	.88	.927	1.2
2	475,000	1.0	1.0	1.0	1.05077	1.2
3	330,000	1.3	1.2	.925	.9699	1.2
Total	1,000,000			.95167		

Prem wtd avg

(4) = (3) / (2)
(5) = (4) / (4 total)

Territory	Total (7)	Beyond cap (8)	Prem cap (9)
1	1.11259	-	-
2	1.26093	1.09%	5,194.46
3	1.16394	-	-
Total			5,194.46

(10) Prem from non-cap = 601,055.5344
(11) Revised base rate factor = .9913273
(12) Revise to uncap levels = 1.008
(13) Revised factor for base rate effect = 1.0087
(14) Factor to adjust non-capped levels = 1.017

(7) = (5)(6)
(8) = (7) – 1.25
(9) = (1)(7) – (1)(1.25)
(10) = (1)(7) for territory 1 & 3
(11) = 1.25/(7) for territory 2
(12) = (9)/(10)
(13) = 1/(11)
(14) = (12) (13)

Proposed Rels
1 .763
2 1.0
3 1.22

Exam 5 – Question #10

A. The univariate approach assumes uniform distribution of exposures across all other rating variables, i.e. it does not account for exposure correlation/distributional bias. This can lead to a double-counting effect.

B. Adjusted PP approach

	(1) Adjusted Earned Exposure	(2) Rept loss and ALAE	(3)=(2)/(1) PP	(4) = (3)/3T Indicated Rel	Indicated Rel to base
A	97,500	60,000	615.38	.71154	1.0
B	318,750	300,000	941.18	1.088	1.529
	416,250	360,000	864.86		

(1) → Calculation

A. 50,000 x .75 + 30,000 + 20,000 x 1.5 = 97,500

B. 25,000 x .75 +75,000 + 150,000 x 1.5 = 318,750

Exam 5 – Question #11

A. LAS(look) = 8,000,000 + 1,800,000 + 1,800,000 + 100,000 x (40 + 25 + 15) = 19,600,000

19,600,000/250 = 78400
↓
# of Claims

Avg. loss in layer 100k – 250k = 7,400,000 – 40 x 100,000 + 3900000 – 25 x 100,000 + 15 x 150,000

7,050,000/150 = 47000
↓
Claims in layers with limit ≥ 250k

ILF = $\frac{78400 + 47000}{78400}$ = 1.59949

Or

A. LAS(100k) = $\frac{8000k + 1800k + 1800k + (40 + 25 + 15) \times 100k}{100 + 35 + 35 + 60 + 25 + 15}$ = 19,600k/250 = 78,400

LAS (100k – 250k) = $\frac{7400k – 40 \times 100k + 3900k – 25 \times 100k + (250k – 100k) \times 15}{40 + 25 + 15}$ = 7050k/80 = 88,125

LAS(250k) = 78,400 + 88,125 x 80 / (80 + 35 + 35)= 125,600

ILF (250k) = 125,600/78,600 = 1.599

B. GLM does not assume that the frequency is the same for all risks. It takes into account both the limiting of losses and behavioral differences of insureds. This can result in counter intuitive results, like lower ILFs for higher policy limits.

Or

B. The calculation in part A assumes equivalent claimant behavior and frequency throughout each level whereas a GLM will account for the differences in the model. The GLM will sometimes create results that are counter intuitive.

C. Want to also look at 500K LDF
Avg loss in layer 250k – 500k = [5,200,000 – 15 x 250,000]/75 = 19,333

ILF (500k) = $\frac{78400 + 47000 + 19333}{78400} = 1.84609$

For selection, should rely on GLM output – it takes into account behavioral differences, and better handles the analysis when there are fewer claims in the larger layers. 250k ILF should be > 1 and less than 500k ILF and 1.15. I would select 1.10 since ILFs tend to increase at a decreasing rate as you hit higher layers, due to smaller probability of having a loss that large.

Or

C. Despite the fact that the GLM accounts for frequency differences between limits, the calculated ILF for 250k using the GLM analysis does not make intuitive sense. It is smaller than the ILF @ 100k – but, we'd expect more losses when moving to a higher limit. Therefore, I'll select 1.6 (which was calculated in (a) above).

Or

C. Sel 1.1

GLM output unconventional due to frequency (part b)
Doesn't make sense to charge less premium for a higher policy limit.
250k ILF should be between 100 k and 500k ILFs. 1.10

Or

C. I would select a factor of 1.09375 = (150/400)(.15) + 1
It is not reasonable to assume uniform frequency. However, due to the reversal in the GLM, I interpolated linearly between the indicated factor for $100k and $500k.

Exam 5 – Question #12 (example 1)

It makes sense to use only a typical variable expense cost in the rate level indication. The marketing expenses initially incurred will most likely not continue into the future. Also given that initial premium will be small it would be difficult to quantify based on the empirical premium what the future expense will be. This company seems to be using an asset sharing pricing model approach. Under this model the long term profitability is considered. It is understood the initial cost of obtaining business can cause losses. But as the book grows and matures it will become more profitable. Renewal business tends to have better loss ratios and maintaining a book is less expensive than growing. The company knows the current market expense will not continue.

Exam 5 – Question #12 (example 2)

Because there is a low volume of premium at the onset, marketing costs relative to premium are high. As premium volume grows, the ratio of marketing costs to premium will decline, most likely very substantially if the insurer is successful in gaining new business. Thus, including a fixed expense provision in the rate indication will wilding overstate the rate needed to charge equitable premiums.

An example to clarify:

Marketing costs in years 1-3 = 1M

Premium:	Year 1 = 1M	Fixed expense ratio = 1
	Year 2 = 10M	= .1
	Year 3 = 100M	= .001

If rates are set with a fixed expense provision of 1, the charged rate will be very high, which will a) hinder the company's ability to gain business and b) not truly reflect the expected future costs. Also, the indicated rate the next year with a fixed expense provision of .1 would be much lower than the prior year; rates should not vary so wildly. Finally, as demonstrated in the asset-share model, writing business at a loss in early years (which would be done by excluding the fixed ratio) proves to be profitable in later years as other expenses decline and renewal business has better loss experience than new business.

Exam 5 – Question #13 (example 1)

Since this situation has been ongoing for 10 years, we can expect that all rates have been calculated based on these existing levels of insurance to value. Furthermore, we can assume that each territory has a rating differential that accounts for differences in loss cost by territory, and this territory differential will capture the effect of the level of ITV in each territory (should be a higher territory factor for A all else equal).

So premium at both the overall and territory level should be adequate.

In terms of premium equity among insured, since the homes in territory in A are uniformly underinsured, their rates should be equitable with people in territory B because the higher territory differential will account for the difference in ITV.

Note* If Territory A was not uniformly underinsured, rates would not be equitable within Territory A.

Exam 5 – Question #13 (example 2)

Overall premium should be adequate since rates have been recently reviewed. However, territory A premium will be inadequate since the properties are underinsured. Further, territory B premium is likely to be excessive since it had been assumed that all properties in the book were fully insured. Insured in territory B are subsidizing insured in territory A. Premium is not equitable.

Exam 5 – Question #14

A. Paid Incremental

AY	12	24	36
10	100	700	150
11	200	700	
12	200		

B. Paid cumulative

RY	12	24	36
10	100	500	500
11	500	850	
12	700		

C. AY is more common but report year is more appropriate if a change in social or legal climate causes severity to correlate more with report date than accident date.

Or

C. Accident year more approach as it's a long tailed line of business. The reporting nature of this line of business, we need to project IBNR for this line of business. Report year method doesn't project pure IBNR.

D. Use quarterly: the change in exposures and reporting pattern will shift the average accident date within an accident year and disturb development factors.

Or

D. Annual triangle as the data is more credible (less fluctuation) because larger volume compared to quarterly data. More volatile and thin data will cause the LDF to be more volatile.

Exam 5 – Question #15 Part A

A. Differences in payment pattern: If the two company's differing structures, claims handling etc. lead to differences in how claims are paid, then combining the data for both into one reserve study could lead to distortions.

   Size of Companies (relative): If one company is much larger than the other, the distortions caused by the combined analysis could be immaterial.

   Or

A. Operational – need to look at how each company sets case reserves, rate of claim closure, emphasis in settling large vs. small claims, etc. These factors impact the results of various reserving techniques and can possibly distort them.

   Changes in book of business – look at policy limits, types of insured, etc. to determine differences between the 2 companies and changes over time that could influence how the data is combined or what reserving techniques are used.

   Or

A. Homogeneity
   We need to check if the data between Company A and B has the similar characteristics.

   Credibility
   If there are enough data in Company C to obtain credible and reliable results.

Exam 5 – Question #15 Part B (example 1)

B. Avg. paid per closed claim = paid/closed count

(A)

AY	12	24	36	48
2009	0.4	1.6	4.8	4.8
2010	0.4	1.6	4.8	
2011	0.4	1.6		
2012	0.4			

(B)

AY	12	24	36	48
2009	0.6	1.5	4.4	4.6
2010	0.2	1.3	4.8	
2011	0.3	1.7		
2012	0.4			

No trend or any other change

It seems avg. dollar paid per closed claim has a drop and during 2009 → 2008, but increase during 2010 – 2014

Paid to incurred ratio to check case adequacy = paid/reported.

(A)

AY	12	24	36	48
2009	0.5	0.5	0.75	0.833
2010	0.5	0.5	0.75	
2011	0.5	0.5		
2012	0.5			

(B)

AY	12	24	36	48
2009	0.24	0.3125	0.67	0.827
2010	0.118	0.271	0.67	
2011	0.176	0.347		
2012	0.2			

No trend or any other change

It seems there is an increase in case (may be case strengthen) in Year 2010 and 2011 @ 12 and 24 with the level drop back in latest year

Closed counts to reported counts to check settlement rates

(A)

AY	12	24	36	48
2009	0.5	0.5	0.67	0.83
2010	0.5	0.5	0.67	
2011	0.5	0.5		
2012	0.5			

(B)

AY	12	24	36	48
2009	0.5	0.5	0.67	0.83
2010	0.5	0.5	0.67	
2011	0.5	0.5		
2012	0.5			

No trend and exact match! It seems both settlement rates have not been changed

Exam 5 – Question #15 Part B (example 2)

All years weighted PP LDF's

	12-24	24-36	36-48
Comp A	6.0	4.0	1.25
Comp B	6.14	4.38	1.31

Similar PD dev.

RPTD CLM CNT

A	1.5	1.0	1.0	1.0
B	1.5	1.0	1.0	1.0

similar RPTD claim count dev.

Avg. PD

	12-24	24-36	36-48	48-ult.
A	400	1600	4800	4800
B	375	1500	4600	4600

avg. PD is slightly less @ comp. B

Exam 5 – Question #15 Part B (example 3)

B. Company A – Outstanding Sev.

AY	12	24	36	48
2009	400	1600	3200	4800
2010	400	1600	3200	
2011	400	1600		
2012	400			

Company B – Outstanding Sev.

AY	12	24	36	48
2009	1900	3300	4400	4800
2010	1500	3800	4800	
2011	1400	3200		
2012	1600			

Reported Development (A)

AY	12-24	24-36	36-48
2009	6	2.67	1.125
2010	6	2.67	
2011	6		

Reported Development (B)

AY	12-24	24-36	36-48
2009	2.88	1.83	1.053
2010	4.24	2.00	
2011	4.32		

Disposal Rate (A)

AY	12	24	36	48
2009	0.33	0.5	0.667	0.83
2010	0.33	0.8	0.667	
2011	0.33	0.5		
2012	0.33			

Disposal Rate (B)

AY	12	24	36	48
2009	0.33	0.5	0.67	0.83
2010	0.33	0.5	0.67	
2011	0.33	0.5		
2012	0.33			

E**xam 5 – Question #15 Part B (example 4)**

Company A – Average Paid

AY	12	24	36	48
2009	400	1600	4800	4800
2010	400	1600	4800	
2011	400	1600		
2012	400			

Company B – Average Paid

AY	12	24	36	48
2009	600	1500	4400	4600
2010	200	1300	4800	
2011	300	1700		
2012	400			

Avg. Case (A)

AY	12	24	36	48
2009	400	1600	3200	4800
2010	400	1600	3200	
2011	400	1600		
2012	400			

Avg. Case (B)

AY	12	24	36	48
2009	1900	3300	4400	4800
2010	1500	3500	4800	
2011	1400	3200		
2012	1600			

Paid-to-rpt. Ratio (A)

AY	12	24	36	48
2009	0.5	0.5	0.75	0.13
2010	0.5	0.5	0.75	
2011	0.5	0.5		
2012	0.5			

Paid-to-rpt. Ratio (B)

AY	12	24	36	48
2009	0.24	0.31	0.67	0.83
2010	0.12	0.27	0.67	
2011	0.18	0.35		
2012	0.2			

Exam 5 – Question #15 Part C

C. It is not appropriate to combine the historical data. Even though the counts for both companies develop in a similar pattern, losses do not. Average paid losses are increasing for company B after 2010. Average case O/S is inconsistent for company B → different practices in setting up case reserves. Development patterns for losses for AY 12 and prior will be distorted.

Or

C. Company B has very little data. It makes sense to combine it with A. From B we saw that the two companies have similar settlement patterns. Their avg. paid sev. Is also comparable. B's results were not as evident as A, but due to small size, fluctuation is expected.

Since mix of business is comparable would assume frequency patterns will also be similar. Distributional difference won't significantly distort results. Can use paid losses to estimate unpaid claims.

Or

C. From this settlement speed, each age is similar for A and B. Therefore it says that A and B can be combined. I think it is appropriate if you adjust case adequacy because severities similar, settlement patterns similar and B has little data so may not be credible to stand alone. Need to look into case adequacy though.

Exam 5 – Question # 15 Part D

D. If Company C adopts Company A's claim practices, it would be appropriate to combine A and B only if you adjust company B's historical data. Use B's case reserve to adjust along with other methods.

Or

D. It would be appropriate if we use the past development techniques. The reported development techniques we need to adjust though B's case outstanding method for the historical not enough to make an accurate estimate.

Exam 5 – Question #16 (example 1)

Cumulative Severity Triangle

AY	12	24	36
10	38,000	45,000	45,330
11	39,000	45,000	
12	55,000		

Age-to-age sev.

AY	12-24	24-36
10	1.184	1.007
11	1.154	
Selected (avg)	1.169	1.007

Age-to-Ult. Selections

12-ult.	24-ult.	36-ult.
1.177	1.007	1.000

Claim Count Age-to-Age

AY	12-24	24-36
10	.942	.996
11	.960	
Selected (avg)	.951	.996

Claim count Age-to-Ult. Selections

12-ult	24-ult	36-ult
.947	.996	1.000

AY	(1) Claim Count	(2) Reptd Severity	(3) Ult Claim Count	(4) Ult Sever.	(5) Ult. Loss	(6) Reported loss	(7) IBNR
10	273	45,330	273	45,330	12,375	12,375	0
11	289	45,000	288	45,313	13,051	13,005	46,000
12	254	55,000	241	64,735	15,601	13,970	1,631,000
							1,677,000

(3) = (1) x Age to Ult

(4) = (2) x Age to Ult

(5) = (3) x (4)

(7) = (5) – (6)

Exam 5 – Question #16 (example 2)

Claim counts LDFs

AY	12-24	24-36
2010	1.942	1.483
2011	1.96	
LDFs	1.95	1.483
CDFs	2.892	1.483

Cum. Claim Counts

AY	12	24	36
2010	291	565	838
2011	301	590	
2012	254		

Cumulative Severity

AY	12	24	36
2010	38000	41395	42677
2011	39000	41939	
2012	55000		

Severity LDFs

AY	12-24	24-36
2010	1.089	1.031
2011	1.075	
LDFs	1.082	1.031
CDFs	1.1157	1.031

2011 ult. Counts = 590 x 1.483 = 874.97
2012 ult. Counts = 254 x 2.892 = 734.57

2011 ult. Severity = 41939 x 1.031 = 43239
2012 ult. Severity = 55000 x 1.1157 = 61363.5

2011/2012 ult. Loss = 874.97 x 43239 + 734.57 x 61363.5 = 82908614

IBNR = 82908614 – 38714000 = $44194614

Exam 5 – Question #16 (example 3)

Ult. Claims = frequency x severity = (ult. Claim counts) x (ult. Avg. severity)

Determine ult. Clm. Counts:

AY	12-24	24-36	36-ult.
10	.942	.996	1.00
11	.960		
Avg.:	.951	.996	1.00
CDF:	.947	.996	1.00

AY	Counts @ 12/31/12	Count CDF	Ult. Count
10	273	1.000	273
11	289	.996	288
12	254	.947	241

Determine avg. severities = rptclms/rptclm counts

AY	12	24	36	Ult. Sev.
10	38000	45000	45330	45330
11	39000	45000		45000(1.007)=45315
12	55000			55000(1.177)=64735

Avg. Sev. Link ratios

AY	12-24	24-36
10	1.184	1.007
11	1.154	
Avg.:	1.169	1.007
CDF	1.177	1.007

AY	Rpt clms (1)	Sev (2)	Ult claim counts (3)	Ult clms(4) = 2 x 3	IBNR (5) = 4-1
10	12375	45330	273	12,375,090	90
11	13005	45315	288	13,050,720	45,720
12	13970	64735	241	15,601,135	1,631,135

Total = 1,676,945

Exam 5 – Question #17 (example 1)

A.

AY	EP (1)	ECR (2)	Rpt clms (3)	Rpt CDF (4)	Benktander Unpaid (5)
10	19800	50%	6900	1.400	2780
11	18900	50%	5800	1.700	3900
12	21200	50%	3200	3.100	7032
Total					13,802

B. Benktander after 1000 iterations ≈ Development technique estimate.
AY 2012 unpaid claims = 3200 x (3.100 – 1) = $6720

Exam 5 – Question #17 (example 2)

A. AY 2010: 6900 + 19800(.50)(1 – 1/1.400) = 9728.5714

9728.5714(1 – 1/1.400) = 2,779.592

AY 2011: 5800 + 18900(.50)(1-1/1.700) = 96911765

96911765(1 – 1/1.700) = 3,990.484

AY 2012: 322 = 21200(.50)(1 – 1/3.100) = 10380645

10380645(1 – 1/3.100) = 7,032.050

Total unpaid claims AY 2010-2012 = 13,802.126

B. Benktander is a weighting of B-F and development techniques with enough iterations, the unpaid claim amount will converge to 3200(3.10)(1 – 1/3.10) = 6720.00

Exam 5 – Question #18 (example 1)

A. Bornhuetter Ferguson method because at 12 month data will fluctuate a lot and will be thin and volatile. Unreported ultimate @ 12 months will be based on expected claims.

B. Berquist-Sherman settlement rate adjustment because it will adjust the paid triangle for faster payments.

C. Paid and reported triangle both will be affected. Using expected claim will be most appropriate as it relies on a prior than on claims observed in past.

D. Bornhuetter Ferguson paid method because you don't want to include the catastrophe effect on data because it will distort age to age factors. Because it is at 12 months want to use BF because LDF are highly leveraged. You do have to add provision for expected loss to BF paid method.

Exam 5 – Question #18 (example2)

A. Use BF technique. Because excess of loss reinsurance can be very severe. Should not let early immature loss distort the reserving.

B. Use BS paid claim technique, because the new system speed-up the closure rate. Need to adjust the paid loss pattern.

C. Use the expected claim technique as both paid and reported will be distorted by the volume of claims coming in.

D. Use BF reported loss technique. It can adjust the effect of big loss but also not distorted by it.

Exam 5 – Question #18 (example 3)

A. Use the expected method since these claims will probably not be stable or frequent. Expected method will provide a stable estimate.

B. Berquist Sherman adjustment settlement rate. This will adjust claims prior to the processing change so can be used in development method.

C. Need to adjust for change in reporting pattern. Could use Berquist Sherman case adjustment because many claims may be reported that could be expected to close with $0 payment.

D. BF paid method. Report will be distorted and BF paid will account for any large possible LDF leverage for earlier years. Add large loss load after calculating method.

Exam 5 – Question #18 (example 4)

A. Expected claim method, because $100 Million is high limit. It may take a long time for full development of liability. Recent experience is not reliable.

B. Using Berquist Sherman paid claim adjustment method to reflect recent settlement pattern change, which does not related to reserving change.

C. Frequency Severity disposal rate method to reflect expected claim frequency and severity change as a result of limitation change.

D. BF method with paid development, since the CAT loss is one time event, it should not affect the estimation in general, but we may add some additional CAT loss unpaid, or adjust expected claim ratio a little bit, into ultimate estimation claim.

Exam 5 – Question #19

A. The ultimate claims based on the paid loss development will be overstated. The ultimate paid ALAE-to-paid claims ratio will be applied to overstated ultimate claims, resulting in overstated ultimate ALAE.

B. Wendy Johnson method assumes same amount of ULAE is spent on similar transactions regardless of claim size. Because this is a count-based technique, there is no impact from the actuary's calculation of ultimate losses using the paid due technique.

C. Since ultimate losses are overstated, the pure premium method will indicate a rate that is too high.

D. Estimate of reinsurance recoverable will also be overstated because the projection of ultimate L/ALAE will be overstated. Higher L/ALAE above retention in the xs layer. The limit is not exhausted → recovery is possible for losses, retention.

Exam 5 – Question #20

Re-state to AY 2011 level

AY	GP	On-level adj	On-level GP	Used up prem
2010	50	0.9474	47.368	37.894
2011	52	1	52	29.714
2012	54	1.0526	56.84	22.736

AY	Reported	Trend	Tort	Adj reported
2010	25	1.03	0.833	21.449
2011	20	1	1	20
2012	10	0.9709	1.111	10.787
				52.287

ECR = 52.87/(37.814 + 29.714 + 22.736) = 0.5787

IBNR = 52000 x 0.5787(1 – 1/1.75) = 52000 x 0.248 = 12896.7

Exam 5 – Question #21

1. Disposal rate

AY	12	24	36	48
2009	0.5	0.8	0.9	1
2010	0.5	0.8	0.9	
2011	0.4	0.8		
2012	0.25			

Observe slow down of claim closure at 12 mos., take latest CY disposal rate.

2. Adj . cumulative paid claim

AY	12	24	36	48
2009	1000	2800	4340	48
2010	1050	3360	4872	
2011	1250	3750		
2012	1600			

Ex 1250 = (2000 – 0) / (.4 – 0) *.25

Age 24 on not adjusted cause no change in disposal rates

3. Paid development

	12-24	24-36	36-48	48-ult.
Age to age	3.003	1.495	1.25	1.0
Ult.	5.614	1.869	1.25	1.0

AY 2012 ult. = 1600 x 5.614 = 8982.4k

Exam 5 – Question #22

A. Net before stop loss treaty

AY	12	24	36
2010	20(1 - .2) = 16	40(.8) = 32	60(.8) = 48
2011	15(1 - .2) = 12	30(.8) = 24	
2012	18(1 - .2) = 14.4		

Net after applying stop loss

AY	@12	@24	@36
2010	16	30	30
2011	12	24	
2012	14.4		

Net data is not correct for AYs 2011, 2012 @ 12 months; AY 2011 @ 24 months.

Or

A. No, it is not. AY 2011 and 2012 at age 12 do not reflect a 20% quota share (lower in 2011 and higher in 2012). In addition, AY 2010 at age 24 is $32M, which is too high given the loss treaty (but correctly decreases at 36 mos.).

B. I would estimate gross of reinsurance, then apply reinsurance treaty, both quota share and stop loss on the estimate gross reinsurance to estimate the part that ceded to reinsurance. The remaining will be net ultimate claim estimate.

Or

B. Would use development method on the gross data (assume to be correct) and calculate impact of reinsurance to define net ultimate claims. Net data is defective so cannot use it. Difference between gross ult and net ult is ceded ult.

C. The quota share will not affect the tail factors, since it is proportional. The stop loss will make the ceded factor much more leveraged than the gross, since a higher % will come late once the ceded has already hit its limit.

Or

C. The ceded reported loss tail factor will be greater. The quota share will not impact the tail factor but the stop loss treaty does. As the gross increases beyond $30M, all of those losses will go into the ceded triangle. The increase pattern of losses is greater in the tail compared to gross due to this reasoning.

Exam 5 – Question #23

A. The case reserve estimation is strengthening because the reported development method and reported BF method both give high estimates. The reported BS method is close to other method. The ultimate loss seems reasonable after case outstanding adjustments.

Or

A. Reported is higher than paid so potentially a slow down in closure. This is supported by BS being more accurate.

B. Is there a change in the claims system?
Is there a change in philosophy regarding setting initial reserves?
Is there a change in focus on settling small versus large claims?

Or

B. Did you change the case outstanding philosophy?
Is there any change in the claim system (automatic case outstanding formula)?
Did you hire more experienced adjusters or change the claim adjuster team?

C. Using frequency = ultimate count/exposures, severity = ultimate claims/ultimate count and projected loss ratios to test the reasonability of ultimate claim selections.

If there are strengthening in case reserves with no deterioration of claims experience and no changes to claims settlement speed, the frequency, severity and projected loss ratios should be stable compared to historical years. Assuming the claims process is consistent over the historical years.

Or

C. Implied Avg. Severity – Resulting ult. Claims/projected claim counts
Implied avg. frequency – resulting ult. Claim counts/exposures
Monitor expected claim emergence vs. actual claim emergence to determine overall accuracy and bias.

Exam 5 – Question #24 (example 1)

A. Implied AA

	12-24	24-36	36-ult.
A-A	1.333	1.5	1
A-U	2	1.5	1

Acc year	Actual Emergence	Exp Emergence	Difference	% Diff
2009	500	0	500	∞
2010	1700	1667	33	1.02
2011	1500	833	667	1.8

B. It appears that 12-24 A-A selection may be too low and 36-ult. Needs to be increased from 1.0 as significant development occurred.

C. 2009: Increase ultimate to 5500 and assume that no more development will occur.
2010: Add in factor for 36-ult of 1.1 to reach new ult. of 5536.
2011: Maintain 24-36 factor and add 36-ult of 1.1 for new ult of (4000*1.5*1.1) = 6600.

Exam 5 – Question #24 (example 2)

A. Selected ult claim/reported as of 12/31/2011

AY	(1) LDF	(2) % unreported in 12/31/2011	(3) % unreported in 12/31/2012	(4) IBNR @ 12/31 /2011	(5) = (4)(2)-(3)(2) Expected Emergence
2009	1	0	0	0	0
2010	1.5	0.33	0	1667	1667
2011	2	0.5	0.333	2500	833.335

AY	Actual Emergence	Difference
2009	500	500
2010	1700	38
2011	1500	666.665

The total difference in the 3 yrs between actual and expected is 1199.665

B. Two changes:
   1. Incorporate a tail factor greater than 1 for ultimate less development.
   2. Increase the 12-24 age to age development factors.

C. AY changes:
   1. 2009 – Higher ultimate claim selection not to assume any further development beyond this point.
   2. 2010 – This year is fairly adequate judging by claim emergence comparisons. However, it may still require a higher selection since issues may still develop after 36 month.
   3. 2011 – This needs a higher selection as we can see that the expected emergence is greatly understated compare to actual.