CASUALTY ACTUARIAL SOCIETY
AND THE
CANADIAN INSTITUTE OF ACTUARIES

May 9, 2012

Exam 5

Basic Techniques for Ratemaking and Estimating Claim Liabilities

4 HOURS

INSTRUCTIONS TO CANDIDATES

1. This 66.25 point examination consists of 30 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.

   - 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 May 28, 2012.

END OF INSTRUCTIONS

1. (2.5 points)

Given the following information for personal automobile policy:

- Principal operator is a 35-year-old male.
- Operator just obtained his driver's license, and has no prior driving experience or accidents.
- The only vehicle is a 2011 Honda Accord sedan.
  - Vehicle is equipped with anti-theft passive disabling device and anti-lock braking system.
  - The physical damage rating symbol for this car is 13.
- The current model year is 2012.
- Operator drives 10 miles to work every weekday.
- The policy expense fee is $60.
- Selected coverage:
  - The bodily Injury limits are $100,000/$300,000.
  - The property damage limit is $100,000.
  - $1,000 deductible for both Collision and Comprehensive.

Primary Classification	Factor
Pleasure Use	1.00
Less Than 15 Miles	1.05
15 or More Miles	1.15
Business Use	1.20
Farm Use	0.85

Secondary Classification	Factor
0	0.00
1A	0.40
1B	0.50
2	0.90
3	1.50
4	2.20

	Collision Relativities		Comprehensive Relativities	
Symbol	2012	2011	2012	2011
13	1.11	1.05	1.06	1.00

Bodily Injury Limit	Factor
$25,000/$50,000	1.00
$50,000/$100,000	1.25
$100,000/$300,000	1.54

Property Damage Limit	Factor
$25,000	1.00
$50,000	1.06
$100,000	1.12

Coverage	Base Rate
Bodily Injury	$88
Property Damage	$109
Collision	$231
Comprehensive	$60

Collision Deductible	Factor
$100	118%
$500	100%
$1,000	83%

Comprehensive Deductible	Factor
Full Coverage	157%
$500	100%
$1,000	73%

Calculate the premium for this policy using the ISO Personal Automobile Manual.

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2. (1.5 points)

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

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3. (1.5 points)

Given the following information:

- An insurance company started writing business on January 1, 2011.
- All policies are one-year term.

Policy Effective Dates	Exposures
January 1 through March 31	100
April 1 through June 30	200
July 1 through September 30	300
October 1 through December 31	400

a. (1 point)

Calculate the 2011 earned exposures assuming policies are written uniformly during each quarter.

b. (0.5 point)

Discuss the appropriateness of the assumption in part a. above given the exposure data.

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4. (2 points)

Explain whether the following statements are correct or incorrect.

a. (0.5 point)

Calendar year 2011 written premium will be fixed (i.e. not change) at December 31, 2011.

b. (0.5 point)

Calendar year 2011 earned premium will be fully earned (i.e. not change) at December 31, 2011.

c. (0.5 point)

Policy year 2011 written premium will be fixed (i.e. not change) at December 31, 2011.

d. (0.5 point)

Policy year 2011 earned premium will be fully earned (i.e. not change) at December 31, 2011.

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5. (1 point)

   a. (0.5 point)

      Discuss whether or not it is appropriate to perform a classification ratemaking analysis using premiums adjusted with aggregate on-level factors.

   b. (0.5 point)

      State one advantage and one disadvantage of the parallelogram method relative to the extension of exposures method.

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6. (2 points)

Given the following information for a Homeowners company:

- The 4th Calendar Quarter of 2011 (4Q11) Average Written Premium is $560.
- The proposed effective date of the next rate change is July 1, 2012.
- Assume a +5% prospective annual premium trend.
- Rate review is performed every 2 years.

Calendar Year Ending	Earned Exposures (House-Years)	Earned Premium at Current Rates
December 31, 2009	10,000	$5,000,000
December 31, 2010	10,000	$5,250,000
December 31, 2011	10,000	$5,512,500

a. (1 point)

Use the two-step trending method to calculate the projected earned premium for the calendar year ending December 31, 2009.

b. (1 point)

After completing the analysis, the actuary determines that the assumed annual increase in the amount of insurance to account for inflation was materially reduced post-January 1, 2012. Discuss any necessary adjustments to the completed analysis in part a. above.

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7. (5.75 points)

An actuary is preparing a rate filing in a state that requires full supporting documentation of the rate level indication. The actuary is given the following information:

- A single trend percentage is used to trend the losses.
- There are no law or benefit changes.
- All policies are annual.
- Rate change effective date is April 1, 2013.
- Rates are reviewed annually.

Accident Year	Reported Losses and ALAE as of December 31, 2010
2010	$50,000

Accident Year	Reported Loss and ALAE Age-to-Age Development Factors					
	12-24	24-36	36-48	48-60	60-72	72-ult
2004	1.58	1.35	1.05	1.06	0.98	1.00
2005	1.75	1.31	1.05	1.01	1.01	
2006	2.63	1.20	1.08	1.04		
2007	1.82	1.23	1.02			
2008	1.46	1.18				
2009	1.66					

All-year Average	1.82	1.25	1.05	1.04	1.00	1.00
Average ex-hi/lo	1.70	1.26	1.05	1.04	---	---
Average last 3 years	1.65	1.20	1.05	1.04	---	---

Calendar Year Ending	Reported Loss and ALAE		
	Frequency	Severity	Pure Premium
March 2008	0.082	$2,410	$197.62
June 2008	0.077	$3,650	$281.05
September 2008	0.073	$3,700	$270.10
December 2008	0.070	$3,710	$259.70
March 2009	0.069	$3,685	$254.27
June 2009	0.068	$2,525	$171.70
September 2009	0.070	$2,580	$180.60
December 2009	0.065	$2,565	$166.73
March 2010	0.065	$2,605	$169.33
June 2010	0.065	$2,675	$173.88
September 2010	0.065	$2,715	$176.48
December 2010	0.065	$2,730	$177.45

# of Points	Annual Frequency Exponential Fit	Annual Severity Exponential Fit	Annual Pure Premium Exponential Fit
12	-7.3%	-8.6%	-15.2%
8	-4.0%	-7.4%	-11.1%
6	-4.1%	5.6%	1.3%
4	0.0%	6.4%	6.4%

Calendar Year	Paid Loss & ALAE	Paid ULAE	ULAE Ratio
2008	$48,000	$6,960	14.5%
2009	$42,000	$6,300	15.0%
2010	$44,000	$6,860	15.6%
Total	$134,000	$20,120	15.0%

Develop the projected ultimate loss and LAE for accident year 2010 losses using the data above. In order to satisfy the state requirements, fully describe the rationale for the selections for loss development, loss trend, and ULAE.

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8. (2 points)

A physician maintained medical malpractice coverage with occurrence policies through 2011. Effective January 1, 2012, the physician switched to claims-made coverage. The physician will retire on December 31, 2014. The last claims-made policy to be issued prior to the physician's retirement date will be effective from January 1, 2014 to December 31, 2014.

The following table contains anticipated loss costs used to evaluate pricing for the physician's policy. All claims are reported within 3 years.

Report Year	Report Year Lag			
	0	1	2	3
2011	$350	$300	$250	$100
2012	$368	$315	$263	$105
2013	$386	$331	$276	$110
2014	$405	$347	$290	$116
2015	$426	$365	$304	$122
2016	$447	$383	$319	$128
2017	$469	$402	$335	$134

a. (0.5 point)

Briefly describe two advantages that claims-made coverage has over occurrence coverage for a medical malpractice insurer.

b. (1 point)

Calculate the loss costs associated with a 2011 occurrence policy and the loss costs associated with a mature 2012 claims-made policy. Briefly describe the overlap in loss costs between the two and the mechanism used to prevent it.

c. (0.5 point)

Identify the loss costs in the table above for which the physician would still have exposure at the time of retirement, and the coverage that the physician would need to purchase to transfer that exposure to the insurer.

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9. (1.75 points)

Given the following information:

- Projected Loss and LAE Ratio = 58.5%.
- Projected Fixed Expense Provision = 11.5%.
- Variable Expense Provision = 15%.
- Underwriting Profit Provision = 5%.
- Credibility of the indicated rate change = 0.7.
- Last rate change was taken January 1, 2012, the entire indicated change was implemented.
- Proposed effective date of next rate change is July 1, 2013.
- Annual Loss Ratio Trend = +2.5%.

Calculate the credibility-weighted indicated rate change.

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10. (2.5 points)

The fundamental insurance equation is:

Premium = Losses + Loss Adjustment Expense + Underwriting Expenses + Underwriting Profit

a. (1 point)

Werner and Modlin state that "It is important to consider the [fundamental insurance] equation at the individual or segment level" in addition to the aggregate level. Discuss two reasons it would be acceptable to maintain an imbalance in the fundamental insurance equation at the individual or segment level.

b. (1.5 points)

Reconcile an imbalance in the fundamental insurance equation with the following quote from the *Statement of Principles Regarding Property & Casualty Insurance Ratemaking*: "A rate provides for the costs associated with an individual risk transfer."

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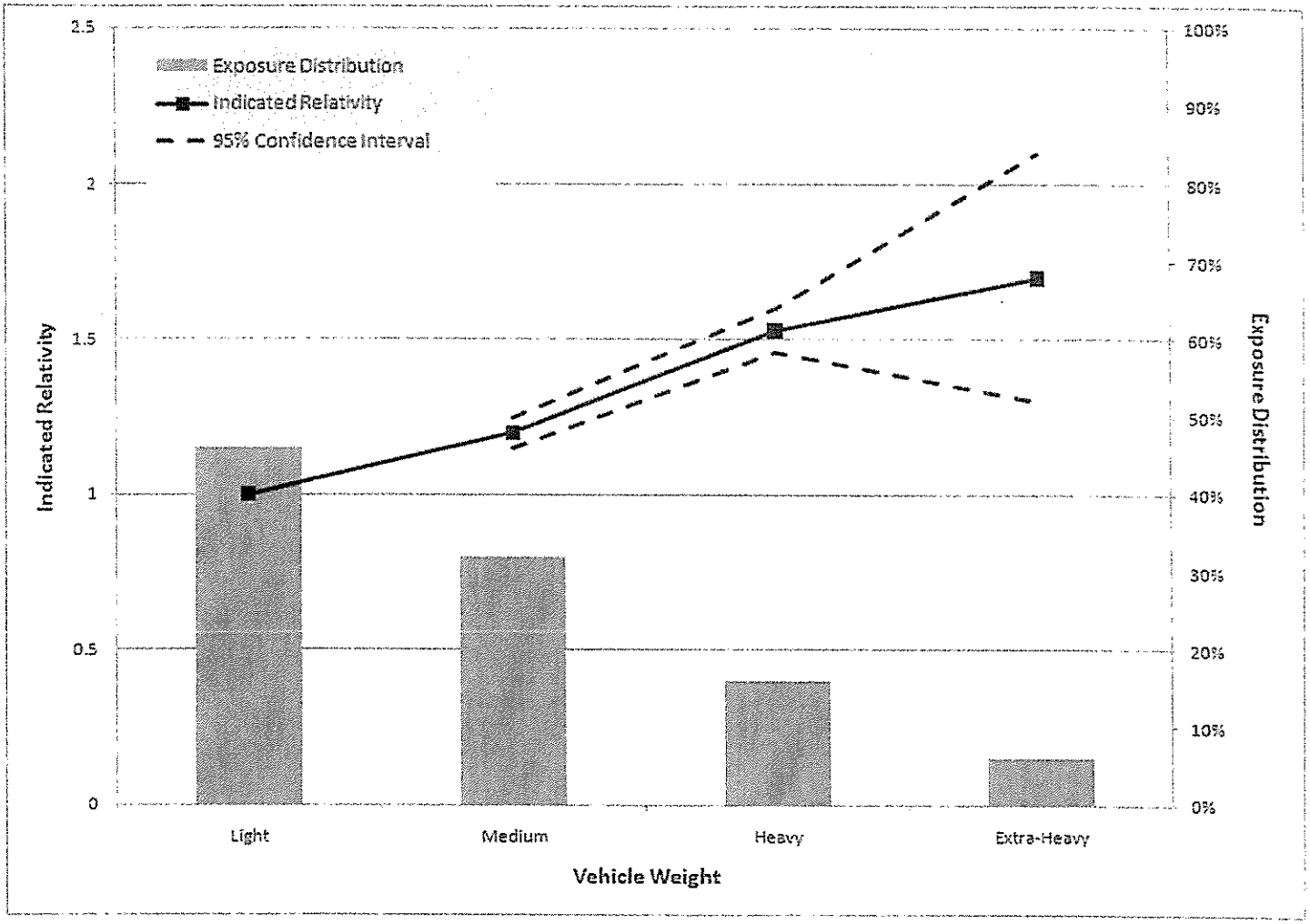
11. (1.5 points)

An insurer uses several rating variables, including vehicle weight, to determine premium charges for commercial automobiles. Your manager has requested a review of the vehicle weight rating relativities. The following diagnostic chart displays the results for vehicle weight from a generalized linear model.



Company management plans to expand its commercial auto market share with an emphasis on writing more businesses that operate with extra-heavy weight vehicles. Management wants to charge the same rates for both heavy and extra-heavy weight vehicles.

Based on the model results, provide your recommendation to management and explain the considerations supporting your position. Include a discussion of any potential risks associated with it.

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12. (1.25 points)

Given the following information:

Paid Losses	Claim Counts by Policy Limit		
	$100,000	$300,000	$500,000
$50,000	30	25	80
$100,000	150	60	120
$300,000		35	50
$500,000			30
Total	180	120	280

Calculate an indicated increased limit factor for the $300,000 policy limit, assuming a basic limit of $100,000.

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13. (1.75 points)

Given the following information:

	As of January 1, 2011	As of July 1, 2011
Base Rate	$200	$250
Good Driver Discount Factor	0.85	0.75
Territory 1 Factor	1.00	1.00
Territory 2 Factor	1.10	1.10

Exposures	Good Driver Discount	
	Yes	No
Territory 1	750	250
Territory 2	600	150

Loss and ALAE	Good Driver Discount	
	Yes	No
Territory 1	$90,000	$40,000
Territory 2	$80,000	$20,000

- The rating algorithm is base rate x good driver discount factor x territory factor.
- Territory 1 and No Good Driver Discount remain the base classification.

Use the loss ratio method to calculate indicated territorial relativities.

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14. (4 points)

An insurance company sells auto insurance where the premium for each car is the same, equal to the current statewide average pure premium. The company is considering developing a more sophisticated rating structure to better compete in the marketplace and has determined the following information about three potential rating variables for its existing book of business.

Garaging Location	Exposures	Losses	Base Class
Urban	800	$430,000	Yes
Rural	200	$70,000	No

Driver Skill	Exposures	Losses	Base Class
High	950	$476,000	Yes
Low	50	$24,000	No

Marital Status	Exposures	Losses	Base Class
Married	500	$210,000	No
Single	500	$290,000	Yes

- The garaging location is determined by the garaging zip code of the vehicle being insured.
- Driver skill is determined by self-assessment when the policy is originally issued.
- Marital status of the principal operator determined as of the policy's effective date.
- Assume that each variable is independent.

a. (2.25 points)

For each potential rating variable, recommend whether the variable should be used and justify the recommendation.

b. (1.75 points)

Develop a base rate and rating factors for the rating plan structure recommended in part a. above.

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15. (2.25 points)

You are given the following information on expected claim payment distribution for properties with a replacement cost of $350,000.

Claim Payment	Probability
$0	97.0%
$10,000	1.5%
$50,000	0.8%
$200,000	0.5%
$350,000	0.2%

- Assume no expenses or profit.

a. (0.5 point)

Assuming all homeowners purchase full coverage, calculate the pure premium per $1,000 of insurance.

b. (0.75 point)

Demonstrate with an example that the use of a fixed rate per $1,000 of insurance is inequitable if a subset of the insured group purchases only partial coverage.

c. (1 point)

Describe two insurer initiatives that would reduce the inequity from part b. above, including an explanation of how the inequity would be reduced.

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16. (2 points)

Below are four independent scenarios for estimating ultimate losses as of December 31, 2011. For each, briefly explain why the actuary should not use the data described and identify a more appropriate alternative.

a. (0.5 point)

Prior to 2010, all policies for a property insurer had a $1,000 deductible. Effective January 1, 2010, all policies were written with a $5,000 deductible. The actuary intends to use accident year data.

b. (0.5 point)

The insurer writes general liability coverage in one state only. The average severity of litigated claims reported after January 1, 2010 is twice the value of claims reported prior to January 1, 2010. The actuary intends to use accident year data.

c. (0.5 point)

A general liability claim with both bodily injury and property damage case estimates would have counted as one claim count prior to 2010 and is now recorded as two. The actuary intends to use claim counts as an exposure base.

d. (0.5 point)

The rate of growth of earned exposures has increased dramatically over the past two years, which has changed the average accident date significantly. The actuary intends to use accident year data.

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17. (1.5 points)

Given the following:

Age in Months	Incremental % Paid Claims	Incremental % Reported Claims
0-12	50.0%	40.0%
12-24	25.0%	30.0%
24-36	15.0%	20.0%
36-48	2.5%	10.0%

- Assume all outstanding claims are reported and paid by the 60th month.

a. (1 point)

Calculate the paid age-to-age factors for ages 12-24, 24-36, 36-48, and 48-60.

b. (0.5 point)

Provide two observations that may indicate a problem with the data.

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18. (3.25 points)

Given the following information evaluated as of December 31, 2011:

Accident Year	Earned Premium	On-Level Earned Premium	Claims Reported	Reported CDF to Ultimate
2009	$950,000	$978,500	$510,000	1.05
2010	$975,000	$1,023,750	$520,000	1.12
2011	$1,000,000	$1,000,000	$465,000	1.30

a. (0.75 point)

Use the Bornheutter-Ferguson technique and an expected claims ratio of 60.0% to estimate the IBNR for accident year 2010.

b. (2 points)

Use the Cape Cod technique to calculate the IBNR for accident year 2010.

c. (0.5 point)

Describe the difference in the underlying assumption between the two techniques.

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19. (2 points)

Given the following data as of December 31, 2011:

Accident Year	Case Outstanding Claims ($000s)	Paid Claims ($000s)
2009	$450	$3,200
2010	$1,350	$2,850
2011	$1,650	$1,900

- Selected ratio of case outstanding to previous case outstanding:

24 Months	36 Months	48 Months
0.90	0.30	0.00

- Selected ratio of incremental paid claims to previous case outstanding:

24 Months	36 Months	48 Months
0.80	0.60	1.05

- Assume no further closed claim development after 48 months.

a. (1.5 points)

Use the case outstanding development technique to estimate unpaid claims for accident year 2011.

b. (0.5 point)

Briefly describe two assumptions of this technique.

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20. (3 points)

Given the following:

Cumulative Reported Claim Counts

Accident Year	12 Months	24 Months	36 Months
2009	210	312	320
2010	221	340	
2011	212		

Cumulative Reported Claims ($000s)

Accident Year	12 Months	24 Months	36 Months
2009	$1,175	$2,100	$2,375
2010	$1,210	$2,305	
2011	$1,215		

- Assume no reported claim count development or claim development after 36 months.

Use a frequency-severity technique to estimate the ultimate claim amount for accident year 2011.

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21. (3 points)

Given the following as of December 31, 2011:

Accident Year	Earned Premium	On-Level Earned Premium
2008	$2,491	$2,616
2009	$2,853	$2,853
2010	$2,898	$2,753
2011	$2,800	$2,800

Cumulative Paid Claims ($000s)

Accident Year	12 Months	24 Months	36 Months	48 Months
2008	$1,100	$1,430	$1,573	$1,652
2009	$1,200	$1,560	$1,716	
2010	$1,100	$1,430		
2011	$1,000			

Cumulative Paid Claim Development Factors

12-Ult	24-Ult	36-Ult	48-Ult
1.502	1.155	1.050	1.000

- Tort reform effective January 1, 2010 reduced expected losses by 5% for accident year 2010 and subsequent years.
- Loss trend is 0%.
- Case outstanding for accident year 2011 as of December 31, 2011 is $780.

a. (2.5 points)

Use the expected claim technique to estimate IBNR for accident year 2011.

b. (0.5 point)

Evaluate the reasonableness of negative IBNR.

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22. (4.25 points)

Given the following data as of December 31, 2011:

Cumulative Reported Claims ($000s)

Accident Year	12 Months	24 Months	36 Months
2009	$9,931	$11,583	$13,053
2010	$12,967	$17,391	
2011	$12,924		

Cumulative Paid Claims ($000s)

Accident Year	12 Months	24 Months	36 Months
2009	$3,711	$8,747	$12,358
2010	$3,464	$8,996	
2011	$3,128		

Open Claim Counts

Accident Year	12 Months	24 Months	36 Months
2009	345	167	30
2010	499	350	
2011	435		

- Assume no reported or paid development after 36 months.
- The annual severity trend is 8%.

a. (0.75 point)

Estimate the ultimate claims for accident year 2011 using the reported development technique.

b. (3 points)

Estimate the ultimate claims for accident year 2011 using the Berquist-Sherman case outstanding adjustment technique.

c. (0.5 point)

Discuss the difference between the two estimates.

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23. (1.5 points)

An insurance company faces the following scenarios:

- For property claims, a new claims processing system is implemented that will result in claims closing faster.
- For liability claims, a tort reform change is passed that will reduce the statute of limitations on reporting a claim.

a. (1 point)

For each scenario above, explain the effect on the average case outstanding triangle.

b. (0.5 point)

Briefly describe two additional scenarios that could cause a change in the ratio of closed to reported claim counts.

24. (3.5 points)

Given the following information:

Cumulative Closed Claim Counts

Accident Year	12 Months	24 Months	36 Months
2009	500	1,200	1,695
2010	750	1,325	
2011	825		

Cumulative Paid Claims ($000s)

Accident Year	12 Months	24 Months	36 Months
2009	$2,893	$8,727	$12,919
2010	$4,339	$9,636	
2011	$4,773		

Cumulative Reported Claim Counts

Accident Year	12 Months	24 Months	36 Months
2009	1,500	1,900	2,050
2010	1,650	2,100	
2011	1,600		

Case Outstanding Claims ($000s)

Accident Year	12 Months	24 Months	36 Months
2009	$8,715	$9,211	$3,944
2010	$7,844	$10,197	
2011	$6,755		

- There are no partial payments.
- Assume no reported development after 36 months.

a. (2 points)

Evaluate whether a Berquist-Sherman Case Outstanding Adjustment would be appropriate.

b. (1.5 points)

Use disposal rates to evaluate whether a Berquist-Sherman Paid Claim Development Adjustment would be appropriate.

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25. (1.75 points)

Given the following data as of December 31, 2011:

Cumulative Paid Claims Gross of Salvage and Subrogation ($000s)

Accident Year	12 Months	24 Months	36 Months
2009	$15,117	$16,953	$16,953
2010	$15,092	$16,862	
2011	$14,727		

Cumulative Received Salvage and Subrogation ($000s)

Accident Year	12 Months	24 Months	36 Months
2009	$2,104	$4,493	$4,605
2010	$1,995	$4,657	
2011	$2,025		

- Selected cumulative development factors for ratio of received salvage and subrogation to paid claims:

Age (months)	CDF to Ultimate
36	1.000
24	1.025
12	2.047

- Assume no development after 36 months.

Use a ratio approach to estimate the ultimate salvage and subrogation for accident year 2011.

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26. (1.25 points)

Given the following information for a self-insured pool as of December 31, 2011:

Policy Year	Reported Claims Gross of Excess of Loss ($000s)	Reported Claims Net of Excess of Loss ($000s)	Gross Cumulative Development Factors	Net Cumulative Development Factors	Stop Loss Limit ($000s)
2008	$1,635	$634	1.440	1.380	$1,000
2009	$3,109	$625	1.760	1.620	$1,250
2010	$2,358	$728	2.140	1.940	$1,250
2011	$1,897	$674	2.710	2.450	$1,500

- The pool has maintained $1 million per occurrence excess of loss reinsurance since inception.
- The pool has also maintained stop loss coverage over limits that vary over time shown above.

Estimate the pool's ultimate claims net of both excess of loss and stop loss for policy years 2008 through 2011.

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27. (2 points)

Given the following information for a line of business as of December 31, 2011:

Ratio of Paid ALAE to Paid Claims Only

Accident Year	12 Months	24 Months	36 Months	48 Months
2008	0.0052	0.0057	0.0061	0.0064
2009	0.0054	0.0058	0.0061	
2010	0.0068	0.0074		
2011	0.0074			

Accident Year	Ultimate Claims Only (000s)
2008	$152
2009	$160
2010	$170
2011	$185

- Assume no development after 48 months.

Estimate the ultimate ALAE for accident year 2011.

CONTINUED ON NEXT PAGE

28. (1.5 points)

Given the following data:

Calendar Year	Paid ULAE ($000s)	Paid Claims ($000s)	Reported Claims ($000s)
2009	$11,000	$56,000	$125,600
2010	$12,000	$85,500	$145,000
2011	$14,000	$102,000	$162,500

- The case outstanding as of December 31, 2011 is $150,000,000
- The IBNR estimate as of December 31, 2011 is $50,000,000

Use the Kittel technique to estimate unpaid unallocated loss adjustment expenses (ULAE).

CONTINUED ON NEXT PAGE

29. (1 point)

Given the following accident year 2011 information as of December 31, 2011:

Initial Expected Losses	$50,000,000
Reported Losses	$10,000,000
Paid Losses	$2,000,000
Selected 12-Ult Reported Development Factor	10.000
Selected 12-Ult Paid Development Factor	22.500

Technique	Unpaid Claim Estimate
Development – Reported	$98,000,000
Development – Paid	$43,000,000
Expected Claims	$48,000,000
Bornheutter-Ferguson – Reported	$53,000,000
Bornheutter-Ferguson – Paid	$47,777,778

- According to the claims department, an extraordinarily large claim has been reported but not yet paid.

Determine and fully justify a reasonable unpaid claim estimate for accident year 2011 claims as of December 31, 2011.

CONTINUED ON NEXT PAGE

30. (1.5 points)

Given the following information as of December 31, 2010:

Cumulative Reported Claims ($000s)

Accident Year	12 Months	24 Months	36 Months	48 Months	60 Months
2006					$147,194
2007				$148,459	
2008			$135,337		
2009		$140,800			
2010	$115,050				

Reported Claim Development Factors

	12-Ult	24-Ult	36-Ult	48-Ult
Pattern I	1.502	1.155	1.050	1.000
Pattern II	1.452	1.134	1.060	1.000

The following claims are reported during calendar year 2011 ($000s):

Claims Reported in Calendar Year 2011 ($000s)

	Accident Year					
	2011	2010	2009	2008	2007	Total
CY 2011	$114,800	$34,200	$10,100	$8,104	$1,000	$168,204

Determine which of the two reported claim development patterns shown above best reflect the actual emergence of claims. Justify your selection.

END OF EXAMINATION

Exam 5
May 2012

Examiners' Report
with Sample Solutions

Exam 5 Question 1 (Exam 5A Question 1)

1.
Inexperienced operator = subclass 1B
10mi commute everyday = work less than 15mi
Passive disabling device = 15% discount on comp
Anti lock braking = 5% discount on BI PD
2011 model => use 2011 relativities

BI
88 x 1.54 x (1.05 + 0.5) x 0.95 = 199.55

Property
109 x 1.12 x (1.05 + 0.5) x 0.95 = 179.76

Collision
231 x 0.83 x 1.05 x (1.05 + 0.5) = 312.04

Comprehensive
60 x 0.73 x 1.00 x (1.05 + 0.5) x (0.85) = 57.71

Total Prem
(57.71 +312.04 + 179.76 +199.55) + 60 expense fee = $809

A very small number of candidates received full credit. Most candidates did sum the 4 components and add the expense fee correctly. Most candidates made mistakes in calculating and applying the primary and secondary classification factor. Many multiplied the primary and secondary classification factors, instead of adding them together. Some candidates did not correctly calculate other components (beyond the primary and secondary classification factor) of the premium (base rate, ILF and other factors and discounts).

Exam 5 Question 2 (Exam 5A Question 2)

1) Directly proportional to expected loss:
Number of employees does reflect exposure to loss, but payroll is more reflective of exposure loss. For example, having twice as many employees does not mean that the expected losses will double, but only that frequency of loss would double (severity would depend on the payroll distribution). Payroll is responsive to changes in both frequency and severity.

2) Practical:
Numbers of employees is a well-defined and objective measure. However, it may not be as easy to obtain as payroll information because payroll is tracked for numerous

financial reports whereas number of employees is not. It may be harder to administer because insured could manipulate information regarding number of employees more easily than that regarding payroll.

3) Considers historical precedence:

Number of employees does not meet this criteria because payroll has been used historically as the exposure base for WC. Changing to numbers of employees may lead to the following issues:

1) Lead to large premium swings.
2) Require significant systems changes.
3) Require a change in rating algorithm.
4) Necessitate significant data adjustments for future ratemaking analysis.

=>CONCLUSION: Given these constraints, I would NOT recommend changing the exposure base to number of employees.

Candidates scored well on this question. Some candidates lost points for either not supporting the reason or restating the criteria as the reason.

Exam 5 Question 3 (Exam 5A Question 3)

a) Pol Eff dates	Avg eff date	% yr rem	exp	EE
1/1 thru 3/31	2/15	0.875	100	87.5
4/1 thru 6/30	5/15	0.675	200	125.0
7/1 thru 9/30	8/15	0.375	300	112.5
10/1 thru 12/31	11/15	0.125	400	50.0
				375.0

2011 Earned Exposures: 375.0

b) The assumption of uniform writings throughout the quarter seems inappropriate, given that there is such a dramatic increase in writings from one quarter to the next. It's more likely that writings increase throughout the quarter as well.

Exam 5 Question 3 (Exam 5A Question 3)

Proportion Earned	Use 15th of month rate to estimate earned for each month
Jan - 23/24	
F - 21/24	100
M - 19/24	

A	- 17/24	
M	- 15/24	200
J	- 13/24	
J	- 11/24	
A	- 9/24	300
S	- 7/24	
O	- 5/24	
N	- 3/24	400
D	- 1/24	

2011 Earned Exposure

= 100/3 [(23 +21+19) / 24] + 200/3 [(17+15+13)/24] + 300/3 [(11+9+7)/24]

+ 400/3 [(5+3+1)/24] = 87.5 + 125 + 112.5 + 50
= 375

b) Exposure is increasing each Quarter. It is likely that this is the case within quarter ie March has more exposure than January. We assume uniform exposure which does not appear correct with this increasing observed exposure trend.

Exam 5 Question 3 (Exam 5A Question 3)

a)

policy eff dates	exposures	average written date	earned year	earned exposure
1/1 – 3/31	100	2/15	10.5/12	87.5
4/1 – 6/30	200	5/15	7.5/12	125
7/1 – 9/30	300	8/15	4.5/12	112.5
10/1 – 12/31	400	11/15	1.5/12	50.
				375

(Answer for (a))

b) Appropriate to assume that policies are written uniformly during each quarter

→ As written exposures are steadily increasing
It won't be appropriate to assume policies are uniformly written during the year.

→ Quarter period is fairly granular enough to assume that polices are written uniformly in the period.

Candidates scored well on this question. Some candidates used the same assumptions but applied/calculated on a monthly basis. This was given full credit as well. Common mistakes include making the exposures uniform throughout the year and effective at the beginning of the month instead of uniform throughout the quarter.

Exam 5 Question 4 (Exam 5A Question 4)

(a): True, because calendar year written premium is based off of transactions that occur in that year. For example, if a policy that was effective in 2011 is cancelled sometime in 2012 before expiration, this would not impact calendar year 2011 written premium, but would be reflected in calendar year 2012 written premium.

(b): True, because calendar year earned premium comes from policy transactions that are effective before 1/1/2012. Similar to part (a), if a policy that was effective in 2011 is cancelled in 2012 (prior to expiration), this would not impact CY 2011 Earned Premium, but would be reflected in CY 2012 Earned Premium.
(c): False, because Policy Year 2011 written premium is based off all transactions for policies that were effective in 2011. So, if a policy written in 2011 is cancelled in 2012 prior to expiration, this would be reflected in PY 2011 written premium (it would not impact PY 2012 written premium).

(d): False, because Policy Year 2011 earned premium accounts for all transactions for policies that were effective in 2011 (regardless of transaction date). Same would hold true for Earned Prem as holds true for written premium in the example from part (c).

Exam 5 Question 4 (Exam 5A Question 4)

a) True – CY WP is fixed at year end.
CY WP includes all transactions in the calendar period.

b) True – CY EP is fixed at year end.
CY EP = CY WP + Starting UEPR – Ending UEPR
All these are fixed at year end.

c) False – PY11 WP is not fixed @ 12/31/2011.
Endorsements and audit premiums in CY2012 and (possibly) beyond will change WP.

d) False – PY11 EP cannot be fully earned at 12/31/2011.
A policy written 12/1/2011 is only 1/12 earned a/o 12/31/11.

Exam 5 Question 4 (Exam 5A Question 4)

a) Yes. Includes new prem written + midterm adjustments during calendar year 2011.

b) True, calendar year earned premium is premium associated with coverage provided during calendar year 2011.

c) Policy year 2011 written premium will not be fixed as of 12/31/2011, because any midterm changes associated with policies effective during 2011, even if change happens in 2012 or later, should be included. Eg policy effective 7/1/2011, add a new vehicle on 4/1/2012, this contributes to PY 2011 written.

d) PY 2011 earned prem will not be fixed as of 12/31/11. This is the earned premium associate with all policies with effective dates in 2011. If they are annual policies, all coverage has not been provided as of 12/31/11. Premium could be earned until one policy term after the last effective date in the policy year, or 12/31/12 for annual policies.

a. Many candidates answered this correctly. However, some just repeated the question explaining that calendar year 2011 written premium will be fixed at 12/31/11, which isn't enough for the explanation. There were also candidates who mentioned this includes premium written in 2011 and any cancellations, which isn't enough of an explanation as need to give some indication as to when cancellation occurred to differentiate from policy year premium. Many candidates mentioned that any transactions occurring for in 2012 will count towards calendar year 2012 written premium, which is enough of an explanation.

b. Many candidates answered this correctly. However, some just repeated the question explaining that calendar year 2011 earned premium will be fixed at 12/31/11, which isn't enough for the explanation. Some candidates mentioned what is earned afterwards in 2012 will go towards calendar year 2012 earned premium, which is enough of an explanation. Similar to a), occasionally a candidate would explain that calendar year data is fixed, which is not enough of an explanation, because need to indicate when it is fixed (i.e. at end of year).

c. Of all the parts, part c. was the one most frequently answered incorrectly. Many candidates answered this correctly. However, there were also a significant amount of candidates who did not indicate when the cancellation or midterm adjustment occurred, which is not enough of an explanation as it does not differentiate from calendar year premium. Many times a candidate would say this part is correct because it only includes premium written during the year, which receives 0 points. Occasionally a candidate would say this is fixed at 12/31/12, which isn't enough of an explanation to receive full credit as it is not necessarily true (i.e. audits).

d. Many candidates answered this correctly. Some candidates said this was incorrect because any cancellation or mid-term adjustments would change policy year 2011 earned premium, which is not enough of an explanation to receive full credit as it does not differentiate from calendar year premium (need to mention when cancellation or mid-term adjustment occurs).

Exam 5 Question 5a (Exam 5A Question 5a)

a.) No. If a rate change disproportionately effects a certain class more than others, the on-level factors will vary by class. Therefore aggregate OLF should not be used.

Exam 5 Question 5a (Exam 5A Question 5a)

a.) It would be appropriate only if all classes have had the same rate change history. If not, then we need rate change info for each class, so that the true rate adjustment for each class can be determined.

a. The answers to part (a) often lacked sufficient detail to demonstrate the candidates understanding of why the aggregate on level factors may/may not be appropriate for class ratemaking.

Exam 5 Question 5b (Exam 5A Question 5b)

b.) Advantage: Parallelogram method is much simpler + requires much less calculations + computing power. It is much quicker to use.

Disadvantage: It assumes uniform premium writings throughout the year. When this assumption does not hold, it is not accurate. Extension of exposures is more accurate.

Exam 5 Question 5b (Exam 5A Question 5b)

b.) Advantage: Easy to calculate.
Disadvantage: Not so accurate.

Exam 5 Question 5b (Exam 5A Question 5b)

b.) Parallelogram
Advantage: Does not require individual policies, only need aggregate data.

Disadvantage: If different classes have different rate changes over time, then applying aggregate on level factors to aggregate premium will likely not produce the correct on-level premium.

b. The majority of the candidates answered part (b) of the question well.

Exam 5 Question 6 (Exam 5A Question 6)

(a): Step 1 factor = latest average written premium @ CRL (current rate level)
Calendar year 2009 average earned premium @ CRL
= 560/(5,000,000/10,000) = 560/500 = 1.12

Step 2 => trend from = 11/15/2011 <-midpoint of latest period.
trend to = 7/1/ 2013 <-average written date in projected period = proposed effective date + ½ the time rates are expected to be in effect.

⇨ trend period = 1.625
Step 2 trend factor = (1.05) ^ 1.625
=>Projected Earned Premium for CY 2009 = EP @ CRL x Step 1 factor x Step 2 factor
= 5,000,000 x (1.12) x (1.05) ^ 1.625
= $6,062,066.

(b.): The assumed annual increase in the amount of insurance to account for inflation is an ongoing and gradual change, and is reflected in the prospective annual premium trend. So it would be necessary to adjust the prospective annual premium trend of +5% downwards to reflect this reduction, which would resultantly adjust the Step 2 factor. Note that since 2-step trending is used in part (a), it will be appropriate to only adjust the Step 2 factor since this change means trend expected in the future will be different from historical trend.

Exam 5 Question 6 (Exam 5A Question 6)

a) Step 1 560/ (5,000,000/10,000) =1.12

Step 2 from 11/15/2011 to 7/1/2013

From avg. of latest period (4Q11) to avg. written date of prospective period (7/1/2012 t0 6/30/2014) <-2 years

⇨ 1.05 ^ (1.625) = 1.0825

Total Projected EP = 5,000,000 x 1.12 .x 1.0825 = 6,062,065.69

b) You would need to re-calculate your selected prospective trend in step 2. Step 1 can be left alone, however the step 2 trend would be less than 5%, and would lower the projected premium.

Exam 5 Question 6 (Exam 5A Question 6)

a) Average written date in 4Q11 is Nov. 15, 2011
Average written date for 2 year effective period starting July 1, 2012 is July 1, 2013. Prospective Trend period is 1.625 years
Average earned premium for CY2009 is 5,000,000 ÷ 10,000 = 500
Projected Earned Premium for CY2009 is 5,000,000 (560/500) (1.05 ^ 1.625) = 6,062,065.69

b) The 5% prospective premium trend is likely too high and should be reduced in the analysis from a

a. The majority of candidates received full credit. Those that didn't receive full credit typically lost points for calculating the trend period incorrectly.
b. Most candidates either identified both or only one of the other elements needed for full credit. Some candidates identified that the first step in two step trending would not be affected, but this was not necessary for full credit.

Exam 5 Question 7 (Exam 5A Question 7)

Loss Development

The '06 12-24 factor is a one-off high valve indicating a one time event. This should be excluded from the selection. Also, the past 3 yrs. 24-36 avg. is stable and has decreased by an absolute 0.1 value from the '04 and 05 levels. All other period are stable and relatively consistent. Based on this I select the Avg. last 3 yrs. as my LDF.

Loss Trend:

Frequency: The frequency over the past 12 quarters has been decreasing and leveled off in the final year. I would check w/management about any initiatives they took to decrease the frequency. I would think, based on the data, a process was taken and was effective at bringing freq down to the 0.065 level, but we can expect the stable value going forward.

Freq trend = 0%

Severity : The book went through a shift in Pure premium, freq, and severity after March 2009. The PP is significantly less implying smaller risks were written which brought down severity. After the pure premium stabilized in June '09 we see an increasing trend in severity. To recognize this trend, but not include the seventy values from prior '09 June, I would use the 6pt severity trend.

Sev Trend = 5.6%

ULAE: The book went through a shift after ’08 and saw a reduction in freq/sev of claims. I would consult the claims dept about how this is effecting their operations w/the change in the type of claims going forward. Since ’08 is considerably different than ’09 and ’10 I would take an average of the ULAE ratio for these years as they reflect the environment going forward. Selecting only ’10 would be based on the results of my conversations w/claim & could overstate the true ULAE ratio.

ULAE = 15+ 15.6 / 2 = 15.3%

Ult Loss & LAE = 50k x (1.65 x 1.2 x 1.05 x 1.04) Dev
x (1 + 0 + .056) ^ 3.75 trend
x 1.153 ULAE

Trend period:

7/1/2010 -> 4/1/2014 3.75

Ult = 152.907

Exam 5 Question 7 (Exam 5A Question 7)

Loss Development: Notice that from 36-48 and onward, the link ratio are the same. So focus on 12-24 first. Notice that the all year average is high because of Accident Year 2006 in this maturity. This is likely an anomaly- due to a large loss. The other years in the maturity do not seem substantially different, so select the ex-hi/lo average.
Now consider the 24-36 category. There is steady decrease in age-to-age factors here. Given this, I would select the Average 1st 3 years average.
So selected link ratio are

12-24	24-36	36-48	48-60	60-72	72-ult
1.7	1.2	1.05	1.04	1.	1

Freq

Loss Trend: Over the last year, frequency is very stable. However, it is declining in all other years. To balance stability of selections (represent the decreasing trend) but also be responsive (recognize that the trend has leveled off some) I would select -2% (between the 4 and 8 point fits).

Sev

Since June 2009, severity trend has been increasing at about +6%. The negative trends appear to be the result of the June 2008 -> March 2009 year, which has much higher severity than all other years. Therefore, adjusting or excluding the year is appropriate. Here, I choose to exclude. Since the 6-point and 4-pt fits are so similar, I feel a 6% is well supported.

Pure prem
Our selections imply a (1.06) * .98 = 1.0388 => 3.88% pure premium trend. Looking at the pure premium and excluding the data points from June 2008 to March 2009, we can see that a 3.88% will balance stability and reasonableness - it falls between the 6 and 4 point fits. Thus, a 3.88% pure premium trend is appropriate.

ULAE No compelling reason is seen in regards to differences in paid.
Loss and ALAE by year. The ULAE ratio does seem to be going, but it could be skewed by the fact that ULAE is more responsive to claim volume growth than Paid loss is (since paid loss is often from accidents occurring in prior years).
So, 15.6% is not appropriate, but 14.5% would not be either without more information on the claims dept. So we select on all-year average of 15% ULAE ratio, which has the added benefit of being explainable to regulators.

	Avg. date of loss		Avg. date of future loss
Our trend paired is from	7/1/2010	->	4/1/2014, 3.75 years

Ultimate projected loss of LAE = 50,000 x 1.7 x 1.2 x 1.05 x 1.04 x 1.0388 ^ (3.75) x 1.15
= 147745.90

Candidates generally justified the loss development factor selections well. Some candidates did lose credit for not including justification. Occasionally candidates' factors did not match the justification, resulting in the loss of points. Most candidates were able to identify the flat frequency trend and picked a four-point trend. The most common error was selecting a longer projection period without justification of why a decreasing trend was reasonable given the latest points. Many candidates failed to mention either the shock loss or the increasing pattern for severity in recent periods. Some candidates incorrectly calculated the trend period. Some candidates failed to provide justification for the ULAE selection. Most candidates projected ultimate loss and LAE correctly.

Exam 5 Question 8 (Exam 5A Question 8)

a. 1. Med Mal has a very long tail, so for occurrence policies it takse a very long time to develop. For claims made policies losses are known at the end of the year. No Pure IBNR component needed.
   2. Since CM policies have a shorter time frame, they would be less subject to changes in trend or inflation than occurrence policies.
b. 2011 Occurrence = 350 + 315 + 276 + 116 = 1057
   2012 Mature CM = 368 + 315 +263 + 105 = 1051
   Overlap would be for RY2012 Lag 1- the 315 would be covered by both. To prevent this, CM policies have retro dates which signal the beginning of coverage (losses that occurred before retro date would not be covered, only losses that

occurred after). So after the occurrence policy in 2011, the CM policy in 2012 should have a retro date of 1/1/2012 + be a first year CM policy.

c. Loss costs after would be 365 + 304 + 122 + 319 +128 +134 = 1372
There would be losses that occurred while the CM policies were still in place but were reported after the physician retired. Physician would need to purchase a tail coverage to cover these losses.

a. Many candidates received full credit on this part. Some candidates did not provide enough detail to receive credit, using statements like "less pricing risk" and "less reserving risk". Other candidates provided slightly different variations on the same item.

b. Most candidates did identify the correct loss costs. Full credit was given for identifying the overlap graphically. Some candidates lost credit for not addressing the specific overlap for this question.

c. Many candidates were able to identify the loss costs associated with the tail exposure. Some responses were not able to indentify tail coverage, instead listing some combination of claims made or occurrence policies that did not match the exposure.

Exam 5 Question 9 (Exam 5A Question 9)

Complement of credibility
Trended present rate
(indicated/approved) (loss trend)^ t -1
t = from 1/1/12 last date to 7/1/13 next date

(1) (1.025)^1.5 -1 = 3.7733%

Ind Rate Change -> LR Method = (.585+ .115 / 1- .15 - .05) -1 = -12.5%

(.7) (-12.5%) + (1-.7)(3.7733%) = -7.618%

Candidates typically lost points on the compliment of credibility. Given the information in the question, using 0 was determined to not be worth full credit. Candidates lost varying amount of points for using 0 as a compliment depending on the completeness of the explanation. Other candidates trended a projected loss ratio that was already trended.

Exam 5 Question 10a (Exam 5A Question 10a)

a) 1. Maintain competitive position. If changing rates would hurt your competitive position then is may be acceptable to take less of a change and have an unbalanced Fund. Ins Equation -> In other words hurting retention enough to offset increase.

2. If the relative cost of the change outweighs the benefit. If the operational cost of changing rating algorithms or data collection processes out weigh the change in prems associated with the change then it could be appropriate to have an unbalanced Fund Ins Equation

Exam 5 Question 10a (Exam 5A Question 10a)

(a) (i). it might due to the regulation constraint
The regulator restrict the rate change (e.g. capped at +/- 25%)

(ii.) Marketing Constraint
If the company's marketing objective is to increase the market share on age group 50-55 drivers. It may reduce rate to attract this group of insureds. Company may have look at the long term profitability of the book. Using asset share pricing technique.

a. This part of question was generally answered well. Common answers that received credit included marketing considerations (riding the market cycle, competitor pressure), regulatory considerations (e.g. cap on rate changes, restrictions on rating variables), and an asset share pricing approach that anticipates future profits at the expense of initial costs.

Exam 5 Question 10b (Exam 5A Question 10b)

b. An actuarially sound indication many not always be implemented since the insurance company needs to balance other objections, such as marketing, then actuarially balancing premium and loss. The actuary is allowed to deviate from this principle under influence of management, with the proper disclosure.

Additionally asset sharing pricing techniques have demonstrated that under certain circumstances, it is ultimately profitable to write business that currently produce a net loss.

b. Part b was not answered well. By far the most common response was a mathematical balancing of the fundamental insurance equation, either by raising the premium or lowering expenses. However, the question was asking candidates to justify their reasoning for an imbalanced fundamental insurance equation from part A in light of the actuarial standards of practice. Successful candidates acknowledged that actuarial rate indications can balance the fundamental insurance equation but that management may decide to choose premiums that differ from actuarial indications, or that regulatory restrictions supersede all actuarial standards of practice.

Exam 5 Question 11 (Exam 5A Question 11)

- The error bars are fairly wide around the relativity for the extra-heavy vehicles due to low volume of data for this level.

- The relativity for heavy vehicles, of about 1.55 is found in the 95% confidence interval for extra heavy vehicles.

- Finally, since management wants to expand its comm. auto market share, and given the two facts above, I suggest we charge the same relativities for heavy and extra-heavy.

- The risk is that when we gather enough data over time, we may realize that the rate for extra-heavy vehicles turns out to be insufficient. At this point we can adjust the rate accordingly.

Many candidates lost points for not including any discussion of potential risks or for incomplete considerations supporting the recommendation.

Exam 5 Question 12 (Exam 5A Question 12)

Limited Average Severity (100,000)

$$= \frac{(30 + 25 + 80)\cdot 50000 + (150 + 60 + 120)\cdot 100000 + (35 + 50 + 30)\cdot 100000}{180 + 120 + 280}$$

$$= 88362.07$$

Limited Average Severity (Layer 100k -300k)

$$= \frac{(35 + 50) \cdot 200000 + 30 \cdot 200000}{35 + 50 + 30}$$

$$=200{,}000$$

$$P\{\text{Claim has a loss in layer / claim has a policy limit entering layer }\} = \frac{35 + 50 + 30}{120 + 280} = 0.2875$$

LAS (300k) = LAS (100k) + LAS (Layer 100k -300k) · Probability on eligible claim reaches the layer

$$= 88362.07 + 200000 \cdot 0.2875$$

$$= 145862.07$$

$$\text{Increased Limit Factor (300k)} = \frac{\text{LAS (300k)}}{\text{LAS (100k)}} = \frac{145862.07}{88362.07} = 1.651$$

*I'm assuming that frequency is the same for both limits.

A majority of candidates received full credit. Some candidates used the data available incorrectly, either including data that shouldn't be used (100K limit data to calculated losses in the 100K-300K range) or not using enough data (ignoring the 500K data).

Exam 5 Question 13 (Exam 5A Question 13)

First, calculate current premium for both territories.

- ⇨ Territory 1 = 250(1)(.75)(750) [prem for good drivers]
  + 250(1)(1.00)(250) [prem for remaining drivers]
  = $203,125

- ⇨ Territory 2 = 250 (1.1)(.75)(600) + 250 (1.1)(1.00)(150)
  = $165,000

Territory	Current relativity	(A) Loss& ALAE	(B) Current Prem	(C)=(A)/(B) Loss Ratio	(D)= (C)/(C) for (1) indicated change factor
1	1.00	$130,000	$203,125	0.64	1.000
2	1.10	$100,000	$165,000	0.606	0.947

Total

Territory	Proposed relativity = current relativity x (D)
1	1.000
2	1.042

Exam 5 Question 13 (Exam 5A Question 13)

Terr Curr Var Prem
1 750 x 250 x 0.75 + 250 x 250 = 203 125
2 600 x 250 x 0.75 x 1.1 + 150 x 250 x 1.1 = 165000

Terr	OLEP	L+ALAE	LR	Indic Rd to Base
1	203125	90k + 40k = 130 k	0.64	1 (base)
2	165000	80k + 20k = 100 k	0.60606	1.0417
	368125	230k		

0.60606 x 1.1 = 1.0417
0.64

Candidates in general performed well on this question. Most frequently candidates failed to use current rate level premium, which in this question is calculated via the extension of

exposures method. Candidates also frequently calculated only the indicated change factors to the current relativities, as opposed to calculating the final indicated relativity. A subset of candidates misinterpreted the class plan and used the loss ratio method to solve for 4 different relativities concurrently (each combination of territory/good driver), as opposed to solving for the requested indicated territorial relativities. A small group of candidates solved for indicated territory relativities by using a pure premium approach as opposed to the requested loss ratio approach. Some candidates made adjustments to the exposure bases to reflect the class plan relativities.

Exam 5 Question 14a (Exam 5A Question 14a)

a) Urban	537.5	High	501	Married	420
Rural	350	Low	480	Single	580

-Garaging location should be used because loss costs differ significantly, the variable is easy to identify and "measureable" based on zip code, and it is also easy to verify.
-Driver skill should not be used. The fact that it is self-identified by the insured and very open to interpretation means it is not measureable and open to moral hazard. Further, it obviously does not work based on experience. It makes no sense that loss costs for highly skilled drivers would be higher.
-Marital status should be used. It can be verified by public records and is straight-forward categorization. Loss costs also differ significantly.

a. *A variety of reasons whether a characteristic should be included were accepted. However, we didn't expect the candidate to identify all critical pieces of evidence as long as there was sufficient justification for including or excluding a variable.*

Exam 5 Question 14b (Exam 5A Question 14b)

Garaging	Pure Prem=loss exp	PP Rel	ARF=wtd avg of exp+factor
Urban	537.5	1.00	
Rural	350.0	0.65	
TOTAL	500.0		0.93

Marital Status	Pure Prem	PP rel	ARF
Married	420	0.72	
Single	580	1.00	
TOTAL	500		0.86

Assume this data is representative of SW Avg PP => $500

$$Bp = \frac{500}{0.7998} = 625.16$$

b. Candidates lost points for various reasons like: used the wrong characteristic as the base class, calculating separate base rates for marital status and garaging location, and calculating the base rate as a simple average of the pure premiums for single policyholders and urban policyholders.

Exam 5 Question 15 (Exam 5A Question 15)

a) Expected loss = (0) (97%) + 10k(1.5%) + 50 k (.8%) + 200k (.5%) + 350k (.2%)
= 2,250

PP = $\frac{2,250}{(350k/1k)}$ = 6.43

b) Assume purchase 10k coverage

expected loss = 0 (97%) + 10k (1-97%) = 300
if used fixed rate, prem = 6.43 x $\frac{10k}{1k}$ = 64.3
prem is inequitable 64.3 vs 300

c) –Offer incentive for higher ITV (guaranteed replacement cost @ 100% ITV)

- More insureds purchase high ITV reducing inequity

-Coinsurance clause

- Reduces amount of loss paid (by ratio of face/requirement) and keeps the prem to loss adequate

Exam 5 Question 15 (Exam 5A Question 15)

a) PP = .015 x 10k + .008 x 50k + .005 x 200k + .002 x 350k
= 2,250
PP rate = 2250/ (350k /1000) = $6.429

b) example: insured w/ 80% ITV Face Value is 80% x 2250 = 280k

PP = .015 x 10k +.008 x 50k + .005 x 200k + .002 x 280k
= 2110
PP rate = 2110/ (280k/1000) = $7.536

If charge the rate from (a) assuming insured to full value, the home will be undercharged by 7.536-6.429 = $1.107 per $1000 of coverage

c) (1) a coinsurance clause would reduce the indemnity payments by the proportion of selected coverage out of the required coverage. This would reduce the loss ratios for underinsured homes to the same loss ratio as fully insured homes.

(2) could begin initiatives to increase ITV through home inspections, etc, forcing underinsured homes to purchase the right amount. This would increase premiums for underinsured homes and equalize loss ratios.

a. This question was generally well-answered by candidates. A common mistake was to forget to divide by the amount of insurance. Another common mistake was to divide by 1000s of premium instead of amount of insurance.

b. Many amounts of insurance were commonly used by candidates and were deemed acceptable. A common demonstration by candidates was to calculate the premium that would be charged with the rate in A) and compare this with the expected loss of underinsured risk to demonstrate the inadequacy. Some candidates calculated loss ratios or compared the fixed rates that should be charged in a) with b) to demonstrate an inequity. All those solutions were accepted and received full marks. Many candidates demonstrated poorly the inequity created by the situation in b). Some only calculated the rate per $1000 of insurance for underinsured risks and did not explain why there was an inequity.

c. A common mistake for candidates was to simply list and describe initiatives to increase insurance to value. However, the question clearly asked for an explanation of how the measure reduces inequity. Another common mistake was to identify an ITV initiative that would have no impact on the example in b). For example, the indexing of amounts of insurance at each renewal for all risks would not reduce inequity over time caused by a subset buying partial coverage.

Exam 5 Question 16 (Exam 5B Question 1)

a) Using AY data is not appropriate because of the shift in the mix of business (changing deductibles). An analysis using Policy year data is more appropriate.

b) Use of Report year data is better than AY data because of the shift in severity. The change in severity will likely cause the occurrence data to better be correlated with the report data so RY data is best.

c) Using earned exposure instead of the claim counts would be better to use because of the change in the definition of a claim count. Using claim counts would distort the analysis because of the change.

d) Use of accident quarter would be better used then AY data because of the shift in growth over the past two years. AY data will be distorted because of the growth distribution change.

Exam 5 Question 16 (Exam 5B Question 1)

a) Because there is a change in deductible, policy year data should be used.

b) Average severity is more correlated to when the claim was reported so report year data would be more appropriate.

c) There is a change in claim count definition so the actuary should use earned exposures instead.

d) Because the average accident data has changed, the actuary should use accident quarter data.

Overall, the candidates did well on this question. Many candidates have no problem stating the alternative to use. Some had trouble explaining the inappropriateness of using accident year data (for 3 of the 4 parts in the question). Sometimes candidates provided explanation that either would have rendered accident year data inappropriate even before the change, or would have continued to be a problem even with their suggested alternative. Candidates with the better answers were able to point out the essence of the change described in the question and explain how accident year data/claim count fails to continue to be appropriate.

Exam 5 Question 17 (Exam 5B Question 2)

Age	Cum. Paid %	Cum. Reported %
0-12	50%	40%
12-24	75%	70%
24-36	90%	90%
36-48	92.5%	100%
48-60	100%	100%

92.5% = 50% + 25% + 15% + 2.5%

Age	Implied paid CDF	Reported CDF	Incr. paid LDF	Incr. Rep LDF

12-ult.	2	2.5	1.5	1.749
24-ult.	1.333	1.429	1.1998	1.286
36-ult.	1.111	1.111	1.028	1.111
48-ult.	1.081	1	1.081	1
60-ult.	1	1	1	1

2 = 1/0.5
1.5 = 2/1.333

b) (i) Reported CDFs are usually less than paid CDF. Here, at ages 12 and 24, Reported CDF are higher.

(ii) There should be a smooth decrease of incremental LDF across dev. period. Here, paid LDF 36-48 is 1.028 and 48-60 is 1.081.

Exam 5 Question 17 (Exam 5B Question 2)

a)

Age	% paid	1/% paid = CDF
12	50%	2
24	75%	1.333
36	90%	1.111
48	92.5%	1.081
60	100%	1.000

Age to Age	Age to Age factors
12-24	2/1.333=1.5
24-36	1.333/1.111=1.2
36-48	1.111/1.081=1.028
48-60	1.081/1.00=1.081

60-ult= 1.00

b) 1. After 1 year we see that half of claims are paid, but only 40% are reported. This implies negative case outstanding, which doesn't make much sense.

2. The 48-60 age-to-age factor is larger than the 36-48 age-to-age factor.

Generally, age-to-age factors should steadily decrease as the experience matures.

a. Most candidates received full credit on this part.
b. Most candidates were able to indentify one observation but not both. Some candidates restated the same observation in a slightly different manner.

Exam 5 Question 18 (Exam 5B Question 3)

a) IBNR 2010 = 975,000 · 60% (1-1/1.12) = 62,679 as of 2010

b) cape cod

$$ECR = \frac{\sum rpt}{\sum \text{use-up prem}} = \frac{(510{,}000+520{,}000+465{,}000)}{(978{,}500 \cdot 1/1.05+1{,}023{,}750 \cdot 1/1.12+1{,}000{,}000 \cdot 1/1.3)} = 57.166\%$$

Unadj ECR for 2010 = 57.166%·1,023,750/975,000 = 60%

IBNR 2010 = 60% · 975,000 (1-1/1.12) = 62,704

c) the difference is the expected claim ratio. In B-F expected claim ratio is usually from independent analysis or judgmentally selected. In cape cod ECR is derived from experience period.

Exam 5 Question 18 (Exam 5B Question 3)

a) BF IBNR = EP x LR x (1-%RPT)
= 975,000 x 60% x (1 – 1/1.12) = 62678.57

b) Cape cod method

$$ECR = \frac{\sum rpt}{\sum AdjEP \times \% Rpt}$$

$$= \frac{(510+520+465) \times 1000}{(978.5 \times 1/1.05 + 1023.75/1.12 + 1.000/1.3) \times 1000}$$

$$= 0.5717$$

$$ECR\ 2010 = \frac{1023750}{975000} \times 0.5717 = 0.6$$

IBNR= 0.6 x 975000 x (1-1/1.12) = 62678.57

c) For BF method the underlying assumption is future claim ratio will be the same as the prior selected ratio which is independent from loss experience. Cape cod method estimate selected loss ratio from historical loss experience and apply it to estimate reserves.

a. Candidates generally understood the problem and calculation. Half the candidates used earned premium, the other half used on level earned premium. Both answers were accepted.

b. Generally candidates did well on this part as well. Most candidates were very close to the concept of calculating a different expected claims ratio to apply in a fashion similar to the BF method. Some common mistakes included not calculating Used Up Premium in order to derive the Cape Cod ECR, not completing the ECR calculations using all years of data, selecting a simple average instead of a weighted average, or incorrectly using EP instead of OLEP.

c. Most candidates received full credit.

Exam 5 Question 19 (Exam 5B Question 4)

a) Projected case outstanding for 2011 (000s)

	12	24	36	48
AY 2011	1650	1485 =1650 x 0.9	4455	= 1485 x 0.3

Paid Claims (000s)

	12	24	36	48
AY 2011	1800	1320	891	467.78
		= 1650 x 0.8	= 1485 x 0.6	= 445.5 x 1.05

Unpaid claims for AY 2011

= 1320 + 891 + 467.78 = 2678.78

b) –reported claims to date will continue to develop in a similar manner in future
-IBNR related to claims is consistently related to claims already reported.

Exam 5 Question 19 (Exam 5B Question 4)

Case outstanding$_{12}$ x ratio to paid$_{24}$ + case$_{24}$ x ratio$_{36}$ + case$_{36}$ x ratio$_{48}$

a) 1000 x 1650 (0.8+0.9(0.6+0.3(1.05))=2678.775 x 1000 = 2,678,775

b) (i) stable payment or claim settlement patterns
(ii) stable case reserving level

a. This part was generally well-answered. Some candidates incorrectly gave the projected ultimate (not unpaid) claims as the answer. Some candidates incorrectly calculated the project unpaid claims for all three years, not just AY 2011.

b. Candidates came up with a wide variety of answers to this question. The candidates did not score the full credits if their answers were too vague or inaccurate. No credit if a candidate used the common uses of the method (such as for lines of insurance for which most of the claims are reported in the first accident period or for claims-made coverages) as the answer since the question was asking the assumptions not the common uses of the method.

Exam 5 Question 20 (Exam 5B Question 5)

	Reported Claim Count Age-to-age			
	12-24	24-36		36-ult.
2009:	1.486	1.026		
2010:	1.538			
Selected:	1.512	1.026	1.000	=> selected = straight average
Cumulative:	1.551	1.026	1.000	

Ultimate claim count 2011 = 212* 1.551=329

Severities= Cum. Reported Claims/Cum Reported Counts

	12	24	36
2009:	5595	6731	7422
2010:	5475	6779	
2011:	5731		

5731 = 1215000/212

Severities
Age-to-Age

	12-24	24-36	36-ult
2009:	1.203	1.103	
2010:	1.238		
Average=Selected:	1.221	1.103	1.000
Cumulative:	1.346	1.103	1.000

Ult Severities
2009: 7422*1.000=7422
2010: 6779*1.103=7477
2011: 5731*1.346=7414

*Ultimate claims 2011=7714*329
=2,537,906

Exam 5 Question 20 (Exam 5B Question 5)

Link Ratios (claim counts)

	12-24	24-36	36-ult
Selected (vol wtd)	1.5128	1.0256	1.000
CDF Ult	1.5515	1.0256	1.000

Ult claims (AY11) = 1.5515 x 212 = 329

Disposal Rates = Cumulative Rptd/ Proj ult

AY	@12	@24	@36	ult
09	0.65625 = 210/330	0.975	1.0000	320
10	0.6332	0.9742		349=340x1.0256
11	0.6444			329
Selected	0.6446	0.975	1.000	

Projected Rptd Counts: (AY11)
@12 = 212
@24 = (.975-.6446/1-.6446) (329-212) = 109
@36 = 329 – 109 – 212 =8

Avg Severity = Incremental Rptd Claim/ Incremental closed counts

AY	@12	@24	@36	
09	5595	9069	34375	* = (2305000-1210000)
10	5475	*9202		340-221
11	5731			

Selected (Simple Avg)

5600	9136	34375	

Ult Claims AY 2011 = 1,215,000 + 109 (9136) + 8 (34375)
= 2,485,824

The question was straightforward with a majority of candidates receiving full credit. Candidates lost points for: using 12-24 age-to-age factor (as opposed to 12-ultimate factor) to derive ultimate counts or ultimate severity, mixing incremental approach with cumulative approach, using just the reported claim (loss) dollars triangle given in the question as severity triangle as opposed to the approach of deriving the severity triangle, or derive 2011 ultimate counts by taking average of 2009 and 2010 (and sometimes also 2011) ultimate counts.

Exam 5 Question 21 (Exam 5B Question 6)

a) on level earned premium paid losses at 12/31/2011 paid CDF to ultimate trend to* 7/1/2011 tort reform adjustments developed loss projected ratio

						losses	
2008:	2616	1652	1.000	1.0^3	0.95	1569.40	0.60
2009:	2853	1716	1.050	1.0^2	0.95	1711.71	0.60
2010:	2753	1430	1.155	1.0	1.00	1651.65	0.60
2011:	2800	1000	1.502	1.0	1.00	1502.00	0.54
Total	11022					6434.76	0.58

*: Trend from 7/1 of each accident year to 7/1/2011

Select = 60% based on average of accident years 2008-2010

Accident year 2011 IBNR = Expected Ultimate Claims – Reported Claims
= 2800 (0.6)-(1000+780) = -100

b) For certain lines of business, negative IBNR can be possible if case reserves are historically set too strong in early maturities and develop downwards over time, or it is common in lines of business expecting future salvage and subrogation recoveries such as auto physical damage. Without knowing the specifics at the line of business in part A, it is difficult to tell if negative IBNR is reasonable. However, since the line of business involves tort reform, I would expect it to be a liability line which makes me believe negative IBNR for this line, especially since 2011 is only at 12 months of development, is inappropriate.

Exam 5 Question 21 (Exam 5B Question 6)

(a)

AY	Ult. Claims (trend is 0)	Est. Ult Claim Ratio = Ult Claims/on-level EP
08	1,652k	63.15%
09	1,716k (1.05) = 1,801.8k	63.15%
10	1,430k (1.155) = 1,651.65k	59.999% (which is 5% below ‘08&’09)

Expected claim ratio for AY11= 59.99%

- ⇨ Ult. Claims for AY11=2800k(.5999) = 1,679,720
- ⇨ IBNR for AY11= 1,679,720-1,000,000-780,000
  = -100,280

b) Negative IBNR could be reasonable if this is reflecting anticipated recoveries such as salvage and subrogation. In this case, it seems likely that case reserves are excessive given the tort reforms recently taking hold.

a. This part of the question was generally well-answered. However, there were certain steps at which points were frequently lost. A number of candidates made no adjustment for tort reform. Among those that did, some calculated incorrect adjustment factors and/or applied the factors to the wrong years. Many candidates

wrongly included AY 2011 in the calculation of the expected claim ratio. There were also a fair number who explicitly excluded it, but for the wrong reasons (e.g., "immature," "leveraged," "outlier"). One area of ambiguity in the question that was identified by some candidates was whether or not the case o/s of $780 was expressed, as were paid losses, in thousands of dollars. Some assumed that they were, while others assumed they were not. Though the expectation was that the former would be assumed, no points were deducted for assuming the latter.

b. *Most candidates received partial credit for this part of the question, as either general or AY 2011 specific comments were made, but not both.*

Exam 5 Question 22 (Exam 5B Question 7)

(a) => Age-to-age factors for reported claims:

AY	12-24	24-36	Selected factors:
09	1.1663	1.1269	
10	1.3412		12-24 = 1.2538 <-straight avg.
			24-36 = 1.1269
			36-ult = 1.00
Straight avg. = 1.2538, 1.1269			
Volume weighted avg. = 1.2654, 1.1269			12-to-ultimate= 1.4129

AY2011 Ultimate claims = 12,924 (1.4129) = $18,260

(b) => Case O/S triangle ($000) = Cumulative Reported- Cumulative Paid

AY	12 mths	24mths	36mths
09	6220	2836	695
10	9503	8395	
11	9796		

=> Average Case O/S triangle = Case O/S / open claim counts

AY	12	24	36
09	18,029	16,982	23,167
10	19,044	23,986	
11	22,520		

=> Adjusted average case O/S triangle (using 8% trend and trending back from latest diagonal):

AY	12	24	36
09	19,307	22,209	23,167
10	20,852	23,986	

11	22,520

=>Adjusted Reported Triangle ($000):=(Adjusted average case O/S * open claim counts) + Cumulative Paid Claims

AY	12	24	36
09	10,372	12,456	13,053
10	13,869	17,391	
11	12,924		

Age-to-age factors:

AY	12-24	24-36
09	1.201	1.048
10	1.254	
Selected straight avg. =>	1.228	1.048

⇨ Ultimate claims ($000) = 12,924 (1.228 x 1.048)
= $16,632

(c) The development method from part (a) overestimates ultimate claims because it does not recognize the increase in case adequacy that can be seen when the annual change in average case O/S is analyzed (at 12 months). That is 18.3% is much greater than 5.6%

AY	12	Change
09	18,029	
10	19,044	5.6%
11	22,520	18.3%

The method from part (b) restates historical data at the curr case adequacy level, whereas the development factors in part (a) are too high.

Overall, the candidates did well on this question. For many candidates, only a minor omission in the discussion or a computation error in the methods kept them from achieving full marks.

a. Most candidates appropriately demonstrated the reported development method. The most common errors found were computation errors. A few candidates opted to use the latest 12-24 age-to-age factor rather than some sort of average. Although this exacerbated the problem for the method, this selection was accepted where clearly indicated.

b. The candidates are generally able to demonstrate the Berquist-Sherman method, with computation errors being the most common type of error. Where candidates struggled with the methodology, they generally recognized the method makes adjustments at the average case outstanding level. The struggle is usually with the application of the trend to the average outstanding and with the process to go from the adjusted average case outstanding back to the adjusted reported claims.

c. *A common mistake found in the discussion is the claim that the reported development method does not account for trend. This is imprecise. The reported development method is a reasonable method in a stable environment, including stable trends. It is the change in the pattern that causes problems with the reported development method, and some candidates failed to make this distinction. The candidates were expected to highlight the changing patterns and make the connection this causes issues for the reported development method, which the Berquist-Sherman method attempts to address.*

Exam 5 Question 23 (Exam 5B Question 7)

a) Property- We will likely see an increase in average case outstanding. Often an increase in settlement rate means small claims are being closed quicker. A higher percentage of open claims will likely be large claims.
Liability- This will result in a speed up in reporting rate as people need to file claims sooner. Its effect on average case is difficult to tell. It could lower average case at early maturities if we see a lot of claims filed that we believe will result in no payment. When statute of limitations decreases, we may see more filing claim first ask questions later behavior.

b) 1. Change in claims department strategy to fight more claims in court will result is a decrease of closed to reported claim counts.
2. Increase in average case load per claims adjuster due to staff cuts could also result in decrease of closed to reported ratio.

Exam 5 Question 23 (Exam 5B Question 7)

a) Claims closing faster: both case reserves and open counts should be lower at each age, since as payments are made, claims close and case is reduced. As such it is unclear how the ratio of these two will react to the denominator and numerator changing. For example, if it is small claims being closed more quickly, then average case will go up, and vice versa.

Tort Reform: we would see an influx of claims reported as people try to get their claims in before the new cap on reporting date. This would increase open counts and case O/S. If these new claims have higher severity than the old average claim, we would see average case rise as the reserves put up would outpace the number of new open counts in the denominator.

b)1. CAT hits an insurer creating a backlog of reported claims -> ratio goes down
2. Focus on closing small claims quickly -> ratio goes up.

a. *Any reasonable explanation was accepted, including explanations of an increase, decrease, or no change to average case outstanding for either scenario. Many candidates did not "explain" the effect to average case outstanding, and instead limited their answer to either stating an effect or only explaining what would happen to case outstanding (not average case outstanding). These candidates received no credit. Candidates often confused tort reform vs. statue of limitations and assumed there would be a reduction in severity rather than the claim reporting impact due to the change in statue of limitations.*
b. *Most candidates offered reasonable scenarios which were accepted for full credit. Explanations were not required for full credit. Common mistakes not receiving credit include: stating "changes in settlement rates" without identifying a scenario, offering scenarios that affect "case reserve adequacy" instead of claim reporting or settlement rates, and identifying the same scenario from Part a) and not offering a new scenario.*

Exam 5 Question 24 (Exam 5B Question 8)

a) Open claim count

	12	24	36
09	1000	700	355
10	900	715	
11	775		

Avg o/s

	12	24	36
09	8.718	13.159	11.110
10	8.716	13.157	
11	8.716		

Note: Observed trend of close to 0%

Avg paid over closed claim count:

	12	24	36
09	5.786	7.272	7.622
10	5.788	7.272	
11	5.788		

Observed trend of close to 0%.

Since both avg paid and avg o/s are stable with similar trend, it does not seem necessary to adjust historical case o/s w/ Berquist Sherman method.

b) DF on reported claim count:

	12-24	24-36
09	1.2667	1.0789
10	1.2727	

ult claim count w/ reported dev

09	2050
10	2100 * 1.0789 = 2266
11	1600 * 1.2697 * 1.0789 = 2192

Select All yr. avg: 1.2697, 1.0789

Disposal rate (closed claim count over ult claim count):

	12	24	36
09	0.2439	0.5854	0.8268
10	0.3310	0.0847	
11	0.3764		

From the disposal rate, there appears to be a speeding up in settlement rate in the first 12 months, so it is appropriate to adjust w/ Berquist Sherman paid claim adj. method.

a. Many candidates correctly calculated case outstanding and observed no trend, but failed to calculate trend in paid severity for comparison. Some candidates calculated both case outstanding and paid severity and to correctly state than no adjustment was needed, but then failed to explain why no adjustment was needed.

b. Candidates who failed to receive full credit commonly did 1 of 3 things:

- *Calculated ultimate claims by developing paid claim counts to 36 months*
- *Calculated disposal rates as (reported claim counts / ultimate claim counts)*
- *Instead of disposal rates, calculated the ratio of closed claims to reported claims.*

Exam 5 Question 25 (Exam 5B Question 10)

Cum paid claim gross of S+S dev factors

	12-24	24-36	36- ult
09	1.1215	1.000	1.00
10	1.1173		
Sel Agc	1.1194	1.000	1.00
Sel Ult	1.1194	1.000	1.000

2011 ult gross paid + S+S=14.727*1.194
16,485,403.8

Ratio of S+S received to gross paid

	12	24	36
09	.1386	.26503	.27163
10	.1322	.2762	
11	.1375		

2011 ratio * S+S Agc to ult = .1375 * 2.047 = .28147 * Ult gross = 4,640,108.9

Exam 5 Question 25 (Exam 5B Question 10)

Development of cumulative paid claims gross.

AY	12-24	24-36	36-ult

09	1.1215 = 16,953/15,119	1.0000	
10	1.1173		
11			

Simple all-year average.

ATA	1.1194	1.0000	1.0000
LDF	1.1194	1.0000	1.0000

Ratio: s/s to paid claims

AY	12	24	36
09	0.1392 = 2104/15,117	0.265	0.2716
10	0.1322	0.2762	
11	0.1375		

AY	(1) Ratio	(2) Ratio CDF	(3) Cumul. Paid claims	(4) Paid CDF	(5)=(1)(2)(3)(4) Ult S/S
11	0.1375	2.047	14,727,000	1.1194	4,640,023

This was a fairly simple and straightforward question. A majority of candidates achieved full credit on this problem. Some candidates failed to project claims to ultimate value and as a result salvage and subrogation (S&S) to ultimate. Other candidates lost credit by taking the average ratio of S&S to paid claims at 12 months, then applying a development factor to that average. This ignored older accident year data and was felt to be inappropriate.

Exam 5 Question 26 (Exam 5B Question 11)

	(1) Rept claims net	(2) Net LDF	(3) 1x2 Net Ult	(4) Stop loss	(5) Min((3),(4)) Net Ult final
08	634	1.380	874.9	1000	874.9
09	625	1.62	1012.5	1250	1012.5
10	728	1.94	1412.3	1250	1250
11	674	2.45	1651.3	1500	1500
					4637.4

4637.42 * 1000 = 4,637,420

Exam 5 Question 26 (Exam 5B Question 11)

634 * 1.38 = 875
012.5 1000

1412 > 1250
1651 > 1500

total = 4637.5

Exam 5 Question 26 (Exam 5B Question 11)

Assume stop loss applies to each PY independently.
Assume stop loss applies to loss net of XOL.

PY	(1) Ult Loss Net Of XOL	(2) Stop Loss cessions	(3) Loss Net XOL & Stop Loss
08	874.92	0	874.92
09	1012.5	0	1012.5
10	1412.32	162.32	1250
11	1651.3	151.3	1500
∑	4951.4	313.62	4637.42

(1) = Rpt Loss Net XOL * Net LOP
(2) = (1) – min((1), stop loss limit)
(3) = (1) – (2)

A little over half of the candidates received full credit and about a third received no credit, most of which completely skipped the question. Those who received partial credit received some credit for demonstrating some understanding of reserving and reinsurance, but did not apply stop gap correctly, did not use reported claims net of XOL and net development factors, and/or made math errors.

Exam 5 Question 27 (Exam 5B Question 12)

Ratio

	12-24	24-36	36-48
08	1.096	1.070	1.049
09	1.074	1.052	
10	1.088		
Avg.	1.086	1.061	1.049
CDF to Ult	1.209	1.113	1.049

Ult 2011 ratio = (.0074)(1.209) = .0089
Ult 2011 ALAE = Ult ratio * Ult claims
= (.0089)(185,000)

= 1646.5

Exam 5 Question 27 (Exam 5B Question 12)

Using the additive approach:
Additive ALAE a-t-a factors

AY	12-24	24-36	36-48	
2008	0.0005	0.0004	0.0003	= .0064 - .0061
2009	0.0004	0.0003		
2010	0.0006			

Simple average

Selection:	0.0005	0.00035	0.0003
Cumulative factors:	0.00115	0.00065	0.0003
	=0.0005+0.00065		

AY 2011 ultimate ALAE = (0.0074 + 0.00115)* 185,000 = 1581.75

Most candidates used the development of the paid ALAE to paid claims only approach to arrive at a reasonable answer. Of those candidates who attempted the problem, the most common error involved simple calculation mistakes.

Exam 5 Question 28 (Exam 5B Question 13)

Ratio of paid ULAE to avg. (rept. + paid)

	Pd ULAE	Avg pd + rept	Ratio	
09	11,000	90,800	.1211	
10	12,000	115,250	.1041	
11	14,000	132,250	.1059	
Total	37,000	338,300	.1094	← Selected – not enough data to say Clear downward trend

Ratio = (.5 * case + IBNR)
= (1.094)[(.5)(150,000,000) + (50,000,000)]
= 13,675,000

Most candidates that attempted the question received full credit. The most common deductions were for candidates that incorrectly calculated the ULAE ratio (did not recognize that the ratio should be Paid ULAE/avg [paid claims, reported claims]), or

that calculated the unpaid ULAE but treated it in the wrong fashion, for example as total ULAE and then subtracted paid ULAE.

Exam 5 Question 29 (Exam 5B Question 14)

Given our expected loses and reported LDF, our expected reported claims at 12m would be $50m /10,000 = $5m. that implies the impact of the large claim is also $5m (10-5 = 5). Therefore a reasonable approach would be to separate the large claim impact and apply it to a paid claim based development method

Since the paid IDF is so highly leveraged, the BF paid method would probably be more suitable. Therefore BF paid estimate + impact of large claim = unpaid estimate
$47,777,778 + $5m = 52,777,778

Exam 5 Question 29 (Exam 5B Question 14)

This extraordinary large claim will skew any method relying on reported claims without proper removal and separate handling. So we will not use reported development or B/F reported.

The paid development factor is 22.5, which is very leveraged and it is sensitive to initial paid losses. Se we will not use paid development.

The remaining methods are expected claims and B/F-paid. Since B/F-paid is not sensitive to volatility in early maturities, I think it is appropriate to use it since it is essentially a credibility weighting of paid development and expected claims. I believe this to be slightly preferable to the expected claims method, which is not sensitive to changing conditions. Also, our volume of data seems high enough to obtain some weight.

Select B/F-paid $47,777,778

Exam 5 Question 29 (Exam 5B Question 14)

Use the reported BF technique, estimate is $53M.
Paid development is not appropriate because the large claim is not in the data.
Also has highly leveraged factor for 12-ult.
Reported development is not appropriate because the extraordinarily large claim is in reported data, but should not be expected to have similar claims throughout the year, so reported experience @ 12 mos. is not predictive of unreported claims.
Expected claims tech. doesn't account for the large claim, nor does paid B-F.
REPORTED B-F accounts for the large claim, but uses expected claims to determine the unreported portion, which is a reasonable estimate of unreported claims.

Candidates who understood the theory of each of the reserving methods tended to score well on this question as they were able to structure their answers to provide pros and/or cons of each method to support their final selection. A small number of

candidates proposed an alternative method to the five methods presented in the question and were awarded credit based on the support provided for their proposal. Candidates sometimes failed to: address the impact of the large loss, address all of the methods presented in the question, fully support an alternately proposed method. Candidates sometimes incorrectly stated that: the large loss would distort the loss development factors used in the paid and/or reported development methods, highly leveraged loss development factors were a reason not to use the Bornhuetter-Ferguson methods, or the large loss would distort the a priori loss ratio used in the Bornhuetter-Ferguson methods.

Exam 5 Question 30 (Exam 5B Question 15)

Expected emergence:

			Difference from actual	
CY	Pattern 2	Pattern 1	Part 1	Part 2
2007	0	0	-1000	-1000
2008	8,120	6,767	-1337	16
2009	9,829	14,080	3980	-271
2010	32,263	34,365	365	-1937
Total			2,008	-3,192

I would select pattern 1, since it is closer to actual emergence overall.

Exam 5 Question 30 (Exam 5B Question 15)

Expected emergence = IBNR (%rept – prior % rept/starting % unrept)

	Patt 1	Patt 2	IBNR	IBNR
	% rept	% rept	patt 1	patt 2
06	100%	100%	0	0
07	100%	100%	0	0
08	95.2%	94.3%	6767	8120
09	86.6%	88.2%	21824	18867
10	66.6%	68.9%	57755	52003
		↑		↑
		1/1.452		0.452*115050

	Patt 1	patt 2
	exp'd emergence	exp'd emergence
06	0	0
07	0	0
08	6767	8120
09	14006	9753 = 18867 * 0.943-0.882/1-0.882
10	34584	32272

Total	55357	50145

Actual emergence was 53,404. Pattern 1 was much better at predicting most recent but worse for other periods. To be conservative and since it was a bit closer to actual estimate, choose pattern 1.

Exam 5 Question 30 (Exam 5B Question 15)

AY	Pattern 1 IBNR	2011 emergence	Pattern 2 IBNR	2011 emergence
06	0	0	0	0
07	0	0	0	0
08	6769	6769	8120	8120
09	21,824	14,080	18,867	9,829
10	57,775	34,565	52,003	32,263

Pattern 2 is more predictably closer to actual claim emergence. 1 is too erratic.

Pattern	2010	2009	2008	2007	2006
1	34,565	14,080	6769	0	0
2	32,263	9,829	8,120	0	0
Actual	34,200	10,100	8,104	1000	0

Diff			
1	+1.07%	+39.4%	-16.5%
2	-5.7%	-2.7%	-2%

The majority of candidates were able to put the expected and/or actual values in a comparable form, and make a valid selection based on those values with some justification. Candidates lost points for:

- *Using the wrong formula for the loss emergence % or applying it incorrectly to ultimate IBNR, ultimate loss or cumulative reported loss*
- *Describing the selected method as "closer" without supplying numeric justification for the response*
- *Including 2011 in the total expected loss emergence when comparing to actual*
- *Only compared the emergence for 1 or 2 accident years to draw the conclusion*