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4 HOURS

# Exam 5

## Basic Techniques for Ratemaking and Estimating Claim Liabilities

### INSTRUCTIONS TO CANDIDATES

1. This 63.5 point examination consists of 26 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.

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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. Anything written in the examination booklet will not be graded. Only the answer sheets will be graded. Also place any included reference materials in the Examination Envelope. BEFORE YOU TURN THE EXAMINATION ENVELOPE IN TO THE SUPERVISOR, BE SURE TO SIGN IT IN THE SPACE PROVIDED ABOVE THE CUT-OUT WINDOW.
8. If you have brought a self-addressed, stamped envelope, you may put the examination booklet and scrap paper inside and submit it separately to the supervisor. It will be mailed to you. Do not put the self-addressed stamped envelope inside the Examination Envelope.

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

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

All extra answer sheets, scrap paper, etc. must be returned to the supervisor for disposal.
9. Candidates must not give or receive assistance of any kind during the examination. Any cheating, any attempt to cheat, assisting others to cheat, or participating therein, or other improper conduct will result in the Casualty Actuarial Society and the Canadian Institute of Actuaries disqualifying the candidate's paper, and such other disciplinary action as may be deemed appropriate within the guidelines of the CAS Policy on Examination Discipline.
10. The exam survey is available on the CAS Web Site in the "Admissions/Exams" section. Please submit your survey by May 17, 2013.

**END OF INSTRUCTIONS**

EXAM 5, SPRING 2013

1. (2 points)

Given the following information for an insurance company that writes 24-month term policies:

| Policy Group | Effective Date  | Expiration Date   | Number of Vehicles |
|--------------|-----------------|-------------------|--------------------|
| A            | January 1, 2010 | December 31, 2011 | 50                 |
| B            | July 1, 2010    | June 30, 2012     | 100                |

All policies within each group have the same effective date.

a. (0.5 point)

Calculate the earned car-years for calendar year 2011.

b. (0.5 point)

Calculate the earned car-years for policy year 2010 evaluated as of December 31, 2010 and as of December 31, 2011.

c. (0.5 point)

Assume Policy Group B cancels on January 1, 2011. Calculate the 2010 policy year written car-years evaluated as of December 31, 2010 and as of December 31, 2011 for Policy Group B.

d. (0.5 point)

Assume Policy Group B cancels on July 1, 2011. Calculate the 2010 and 2011 calendar year written car-years for Policy Group B.

2. (2 points)

Given the following information for an insurance company:

- Proposed effective date of the next rate change is January 1, 2014.
- Rates will be in effect for 1 year.
- All policies have 12-month terms and are written uniformly throughout the year.
- Calendar year 2012 earned premium at current rate level is \$114,208,050.

| 12 Month Period Ending | Written Premium at Current Rate Level | Written Exposures |
|------------------------|---------------------------------------|-------------------|
| December 31, 2011      | \$104,500,000                         | 110,000           |
| June 30, 2012          | \$113,800,500                         | 121,000           |
| December 31, 2012      | \$123,916,100                         | 133,100           |

a. (1 point)

Utilizing one-step trending, calculate the calendar year 2012 projected earned premium at current rate level for use in calculating the rate change.

b. (0.25 point)

Briefly discuss why a premium trend should be utilized in a rate level indication.

c. (0.25 point)

Briefly discuss why it is inappropriate to use written premium at historical rate levels to determine premium trends.

d. (0.5 point)

The insurance company decides to move all existing business with a \$100 deductible to a \$500 deductible upon renewal during calendar year 2013. Given this new information, discuss whether the true projected earned premium will be higher, lower, or unchanged from that in part a. above.

3. (2.5 points)

An actuary has submitted the following analysis for a rate level indication:

| Calendar/<br>Accident<br>Year | Calendar<br>Year Earned<br>Premium | Accident<br>Year<br>Reported<br>Losses and<br>Paid ALAE | Accident Year<br>Reported Loss<br>and Paid ALAE<br>Ratio |
|-------------------------------|------------------------------------|---|--|
| 2010                          | \$1,023,549                        | \$703,902   | 68.8%  |
| 2011                          | \$1,086,756                        | \$773,430   | 71.2%  |
| 2012                          | \$1,222,930                        | \$749,249   | 61.3%  |

|  |       |
|--|-------|
| Three Year Average Reported Loss and Paid ALAE Ratio | 67.1% |
| Fixed Expense Provision                              | 11.0% |
| Variable Expense Provision                           | 15.0% |
| Underwriting Profit Provision                        | 8.0%  |
| Variable Permissible Loss Ratio                      | 77.0% |
| Indicated Rate Change                                | 1.4%  |

Recommend five improvements to the analysis and briefly explain the purpose of each.

4. (3 points)

Given the following information:

- Annual loss trend rate = +4%.
- Rate change history:
  - +3% effective April 1, 2009.
  - +2% effective July 1, 2010.
- All policies have annual terms.
- Calendar year 2012 earned premium = \$50,000.
- Accident year 2012 reported losses at December 31, 2012 = \$4,200.

| Percentage of Loss Reported at: |     |
|---------------------------------|-----|
| 12 months                       | 10% |
| 24 months                       | 35% |
| 36 months                       | 65% |

| Selected Ultimate Loss Ratio |     |
|------------------------------|-----|
| Accident Year 2009           | 66% |
| Accident Year 2010           | 67% |
| Accident Year 2011           | 70% |

Use the reported Bornhuetter-Ferguson technique to estimate ultimate losses for accident year 2012.

5. (4 points)

A company is reviewing the rate level adequacy. Given the following information for a book of business:

- All policies are annual.
- Current rates have been in effect for three years.
- New rates will be in effect for 18 months beginning on July 1, 2013.
- Annual premium trend = -1%.
- Annual loss trend = +3%.
- Loss adjustment expense provision = 2.5% of loss.
- Historical expense ratios:
  - Fixed = 6%.
  - Variable = 30%.
- Underwriting profit and contingencies provision = 5%.
- Ultimate losses are estimated using the reported development technique.
- On January 1, 2014, the company will reduce agency commissions by 3% of premium.

| Calendar Year Ending | Earned Premium (\$000s) |
|----------------------|-------------------------|
| December 31, 2011    | \$2,163                 |
| December 31, 2012    | \$2,120                 |

| Accident Year | Reported Losses (\$000s) |           |           |           |           |
|---------------|--------------------------|-----------|-----------|-----------|-----------|
|               | 12 months                | 24 months | 36 months | 48 months | 60 months |
| 2008          | \$780                    | \$928     | \$1,030   | \$1,083   | \$1,094   |
| 2009          | \$765                    | \$921     | \$1,004   | \$1,053   |           |
| 2010          | \$760                    | \$920     | \$1,012   |           |           |
| 2011          | \$805                    | \$966     |           |           |           |
| 2012          | \$890                    |           |           |           |           |

Calculate the indicated rate change.

6. (2.5 points)

a. (0.5 point)

Contrast the components of IBNR for a claims-made policy and an occurrence policy.

b. (0.5 point)

Explain why a claims-made policy should cost less than an occurrence policy, provided claim costs are increasing.

c. (0.5 point)

Explain why a change in underlying trends will impact the estimated premium for an occurrence policy more than for a claims-made policy.

d. (0.5 point)

Briefly describe the provision that exists to eliminate coverage overlap if an insured switches from an occurrence policy to a claims-made policy, and why an overlap would exist without it.

e. (0.5 point)

Explain why there would be a coverage gap if an insured switches from a claims-made policy to an occurrence policy and what an insurer can do to provide coverage.



7. (3 points)

An actuary is reviewing workers compensation indemnity loss experience for a rate level indication analysis. Given the following information:

- A benefit change having an impact of +5.0% applies to all indemnity losses for accidents occurring after July 1, 2011.
- A benefit change having an impact of +2.0% applies to indemnity losses on policies written after October 1, 2012.
- No other benefit changes are expected within the next few years.
- The annual impact on benefits due to wage inflation has been +2.0% and is expected to continue.
- The proposed effective date for revised loss costs is July 1, 2013.
- Policies are annual.
- Revised loss costs would be in effect for one year.
- Losses occur uniformly throughout the year.

| Accident Year | Estimated Ultimate Losses at Pre-July 1, 2011 Benefit Levels (\$000s) |
|---------------|---|
| 2010          | \$1,875   |
| 2011          | \$1,875   |
| 2012          | \$2,000   |

Calculate the 2010, 2011, and 2012 accident year projected ultimate losses to be used in the rate level indication.

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8. (3 points)

Given the following information:

- All policies are annual and written on January 1.
- Rate change effective date is January 1, 2013.
- Rate level is reviewed annually.
- Underwriting guidelines were revised on January 1, 2011, substantially changing the composition of the book of business.

| Accident Year | Reported Loss & ALAE as of June 30, 2012 |
|---------------|--|
| 2010          | \$ 10,000,000                            |
| 2011          | \$ 6,000,000                             |
| 2012          | \$ 1,500,000                             |

| Selected Reported Loss & ALAE Age-to-Ultimate Factors |      |      |      |      |      |      |      |      |      |      |
|---|------|------|------|------|------|------|------|------|------|------|
| Month   | 6    | 12   | 18   | 24   | 30   | 36   | 42   | 48   | 54   | 60   |
| Factor  | 6.50 | 2.00 | 1.55 | 1.20 | 1.12 | 1.08 | 1.05 | 1.02 | 1.01 | 1.00 |

| Calendar Year Ending | Reported Loss & ALAE |          |              |
|----------------------|----------------------|----------|--------------|
|                      | Frequency            | Severity | Pure Premium |
| Sep 2009             | 0.058                | \$20,355 | \$1,181      |
| Dec 2009             | 0.059                | \$20,125 | \$1,187      |
| Mar 2010             | 0.062                | \$20,500 | \$1,271      |
| Jun 2010             | 0.063                | \$21,575 | \$1,359      |
| Sep 2010             | 0.063                | \$21,388 | \$1,347      |
| Dec 2010             | 0.065                | \$19,903 | \$1,294      |
| Mar 2011             | 0.078                | \$19,567 | \$1,526      |
| Jun 2011             | 0.078                | \$19,238 | \$1,501      |
| Sep 2011             | 0.079                | \$19,538 | \$1,543      |
| Dec 2011             | 0.082                | \$20,063 | \$1,645      |
| Mar 2012             | 0.081                | \$20,050 | \$1,624      |
| Jun 2012             | 0.082                | \$19,950 | \$1,636      |

| # of Points | Annual Frequency Exponential Fit | Annual Severity Exponential Fit | Annual Pure Premium Exponential Fit |
|-------------|----------------------------------|---------------------------------|-------------------------------------|
| 12          | 15.9%                            | -1.7%                           | 13.9%                               |
| 8           | 16.0%                            | -1.7%                           | 14.0%                               |
| 6           | 4.7%                             | 2.9%                            | 7.7%                                |
| 4           | 4.1%                             | 2.5%                            | 6.7%                                |

Calculate the 2010 accident year trended ultimate loss & ALAE to be used in a rate change analysis. Justify any trend selections.

9. (2 points)

An actuary develops an overall indicated rate increase of 4.5% using the following assumptions:

- All expenses are variable.
- Total permissible loss ratio = 65%.
- Profit and contingency provision = 5%.

The actuary's manager asks that the expenses be split into fixed and variable components as follows:

- Fixed = 75% of total expenses.
- Variable = 25% of total expenses.

a. (1.25 points)

Calculate the revised overall rate indication with the new expense split suggested by the actuary's manager.

b. (0.25 point)

Briefly explain why splitting the expenses as described above results in a different indication.

c. (0.5 point)

Identify two reasons an actuary may want to split expenses into fixed and variable components.

10. (2.25 points)

Given the following information for a policy:

- Annual earned premium = \$1,000.
- New business expected loss ratio = 60%.
- Losses expected to decrease \$25 per year.
- New business expenses = \$420.
- Renewal business expenses = \$350.
- Probability of first renewal = 85%.
- Probability of second renewal = 90%.
- Probability of third renewal = 0%.
- Assume an annual discount rate of 3%.

a. (1.75 points)

Calculate the lifetime value of the expected total profit as a percentage of premium.

b. (0.5 point)

Identify two considerations used in the analysis in part a. above that differ from standard actuarial ratemaking techniques.

11. (3.5 points)

An insurance company is researching three new rating variables to include in its homeowners risk classification system. The insurer has determined the following information about the existing book of business:

| Credit    | Exposures | Pure Premium | Competitor's Rating Plan Factor | Base Class |
|-----------|-----------|--------------|---------------------------------|------------|
| Excellent | 1,500     | \$116.67     | 0.85                            | No         |
| Good      | 2,500     | \$128.00     | 1                               | Yes        |
| Fair      | 1,000     | \$155.00     | 1.3                             | No         |
| Total     | 5,000     | \$130.00     |                                 |            |

| Age of Homeowner | Exposures | Pure Premium | Competitor's Rating Plan Factor | Base Class |
|------------------|-----------|--------------|---------------------------------|------------|
| Under 30 years   | 800       | \$150.00     | 0.7                             | No         |
| 30 to 40 years   | 1,200     | \$116.67     | 1                               | Yes        |
| Over 40 years    | 3,000     | \$130.00     | 1.2                             | No         |
| Total            | 5,000     | \$130.00     |                                 |            |

| Loss Prevention   | Exposures | Pure Premium | Competitor's Rating Plan Factor | Base Class |
|-------------------|-----------|--------------|---------------------------------|------------|
| Fire extinguisher | 100       | \$100.00     | 0.9                             | No         |
| Smoke detector    | 4,700     | \$128.72     | 1                               | Yes        |
| None              | 200       | \$175.00     | 1.5                             | No         |
| Total             | 5,000     | \$130.00     |                                 |            |

- Credit is determined using the credit score for the primary homeowner.
- Age of homeowner is determined using the age of the primary homeowner.
- A homeowner with both a fire extinguisher and smoke detector would be classified with a smoke detector.
- Full credibility claim standard = 400.
- The square root rule is used to determine partial credibility.
- A competitor's rating relativities are used as the credibility complement.
- Frequency for every risk classification = 10%.
- Assume that the insurer can implement only one new rating variable at this time.
- Assume that each variable is independent.

a. (1.5 points)

For each potential rating variable, briefly describe two possible concerns of adding it to a risk classification system.

b. (0.75 point)

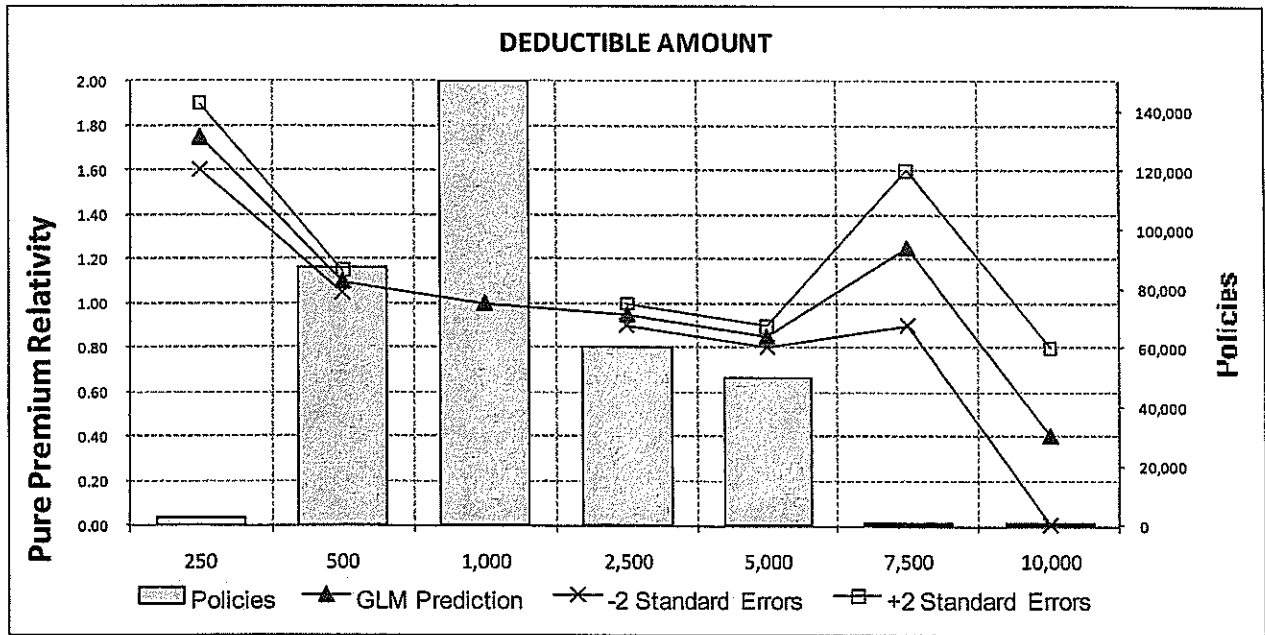
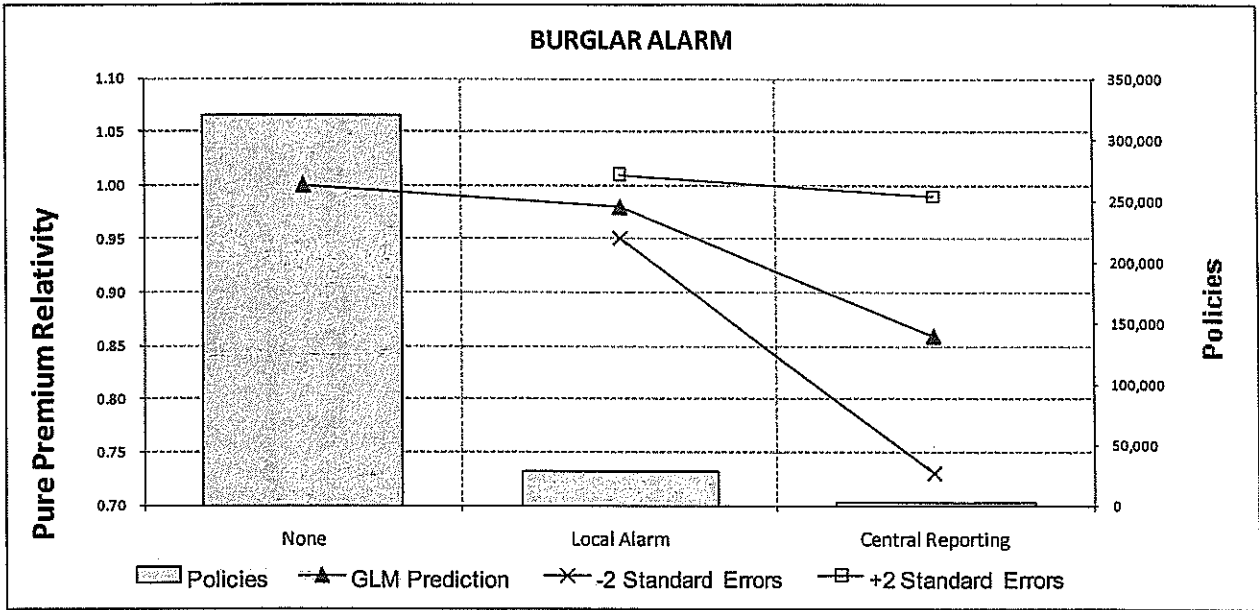
Without performing any calculations, recommend and justify which rating variable the insurer should implement within a risk classification system.

c. (1.25 points)

Develop the indicated credibility weighted rating factors for the variable recommended in part b. above.

12. (3 points)

An insurer is planning to revise burglar alarm and deductible rating plan factors for its Homeowners program. Given the following generalized linear model output:



<QUESTION 12 CONTINUED ON THE NEXT PAGE>

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12. (continued)

| Burglar Alarm     | GLM Prediction | -2 Standard Errors | +2 Standard Errors | Policies |
|-------------------|----------------|--------------------|--------------------|----------|
| None              | 1.00           |                    |                    | 320,000  |
| Local Alarm       | 0.98           | 0.950              | 1.010              | 27,500   |
| Central Reporting | 0.86           | 0.730              | 0.990              | 2,500    |

| Deductible | GLM Prediction | -2 Standard Errors | +2 Standard Errors | Policies |
|------------|----------------|--------------------|--------------------|----------|
| \$250      | 1.75           | 1.60               | 1.90               | 2,700    |
| \$500      | 1.10           | 1.05               | 1.15               | 87,000   |
| \$1,000    | 1.00           |                    |                    | 150,000  |
| \$2,500    | 0.95           | 0.90               | 1.00               | 60,000   |
| \$5,000    | 0.85           | 0.80               | 0.90               | 50,100   |
| \$7,500    | 1.25           | 0.90               | 1.60               | 150      |
| \$10,000   | 0.40           | 0.00               | 0.80               | 50       |

Propose revised burglar alarm and deductible rating plan factors. Document the relevant analysis and rationale to support the proposal.

13. (2 points)

Given the following for a large deductible commercial general liability policy:

|  |             |
|--|-------------|
| Per occurrence deductible  | \$250,000   |
| Loss elimination ratio for a \$250,000 deductible                | 80%         |
| ALAE/ground up loss ratio  | 10%         |
| Ground up loss estimate  | \$2,000,000 |
| Fixed expenses   | \$100,000   |
| Variable expenses as % of premium                                | 12%         |
| Underwriting profit as a % of premium                            | 3%          |
| Deductible processing cost as a % of losses below the deductible | 5%          |
| Credit risk as a % of losses below the deductible                | 2%          |
| Additional risk margin as a % of excess losses                   | 8%          |

- The insurer will handle all claims, including those that fall below the deductible.
- The insurer will make the payments on all claims and will seek reimbursement for amounts below the deductible from the insured.
- The deductible is for loss only.
- All ALAE is paid by the insurer.

Calculate the premium for the large deductible policy.



14. (1.25 points)

An insurer proposes to increase rates by 6.0% where many individual policy impacts will be above 10%. The insurer proposes a capping rule that will restrict premium changes at the policy level to plus or minus 10.0%.

a. (0.5 point)

Identify two problems that a capping rule may cause for an insurer.

b. (0.75 point)

Explain why an insurer would propose a capping rule in light of the problems identified in part a. above.

15. (2.5 points)

An employer negotiated a workers compensation retrospective policy with an insurer, effective from January 1, 2011 to December 31, 2011. The first adjustment of the retrospective premium occurs six months after the end of the policy period and annually thereafter until the tenth adjustment.

The reported losses during the policy period evaluated as of June 30, 2012 are as follows:

| <u>Claim</u> | <u>Reported Losses</u> |
|--------------|------------------------|
| #1           | \$300,000              |
| #2           | \$200,000              |
| #3           | \$100,000              |

The provisions for this retrospective rating plan are as follows:

|  |           |
|--|-----------|
| Minimum retrospective premium ratio        | 50%       |
| Maximum retrospective premium ratio        | 150%      |
| Loss Conversion Factor                     | 1.2       |
| Per Accident Loss Limitation               | \$150,000 |
| Expense Allowance Excluding Tax Multiplier | 25%       |
| Expected Loss Ratio                        | 60%       |
| Tax Multiplier                             | 1.05      |
| Net Insurance Charge                       | 44.6%     |
| Standard Premium                           | \$540,000 |

a. (2 points)

Calculate the retrospective premium as of June 30, 2012.

b. (0.5 point)

Discuss what could cause the retrospective premium in part a. above to change for the insured between June 30, 2012 and the tenth adjustment.

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16. (1.75 points)

Given the following information:

| <u>Accident</u><br><u>Half-Year</u> | <u>Cumulative Closed Claim Counts</u> |                  |                  |                  |                  |                  |
|-------------------------------------|---------------------------------------|------------------|------------------|------------------|------------------|------------------|
|                                     | <u>6 Months</u>                       | <u>12 Months</u> | <u>18 Months</u> | <u>24 Months</u> | <u>30 Months</u> | <u>36 Months</u> |
| 2010-1                              | 4,898                                 | 7,349            | 7,571            | 7,647            | 7,647            | 7,647            |
| 2010-2                              | 5,576                                 | 6,786            | 7,487            | 7,569            | 7,569            |                  |
| 2011-1                              | 6,580                                 | 10,215           | 10,618           | 10,724           |                  |                  |
| 2011-2                              | 7,514                                 | 9,564            | 10,953           |                  |                  |                  |
| 2012-1                              | 8,894                                 | 13,807           |                  |                  |                  |                  |
| 2012-2                              | 10,265                                |                  |                  |                  |                  |                  |

| <u>Accident</u><br><u>Half-Year</u> | <u>Age-to-Age factors</u> |              |              |              |              |
|-------------------------------------|---------------------------|--------------|--------------|--------------|--------------|
|                                     | <u>6-12</u>               | <u>12-18</u> | <u>18-24</u> | <u>24-30</u> | <u>30-36</u> |
| 2010-1                              | 1.500                     | 1.030        | 1.010        | 1.000        | 1.000        |
| 2010-2                              | 1.217                     | 1.103        | 1.011        | 1.000        |              |
| 2011-1                              | 1.552                     | 1.039        | 1.010        |              |              |
| 2011-2                              | 1.273                     | 1.145        |              |              |              |
| 2012-1                              | 1.552                     |              |              |              |              |

Assume no closed claim count development after 36 months.

a. (1.25 point)

Estimate the ultimate claim count for accident year 2012.

b. (0.5 point)

Briefly discuss two advantages for analyzing this data using accident half-years as opposed to full accident years.

17. (1.25 points)

The following information is available for a self-insured entity:

| Accident<br><u>Year</u> | Case<br><u>Outstanding</u> | Industry<br>Reported CDF<br><u>to Ultimate</u> | Industry<br>Paid CDF<br><u>to Ultimate</u> |
|-------------------------|----------------------------|--|--|
| 2010                    | \$30                       | 1.005  | 1.105                                      |
| 2011                    | \$60                       | 1.035  | 1.235                                      |
| 2012                    | \$110                      | 1.120  | 1.560                                      |

a. (0.5 point)

Using a case outstanding development technique, estimate the unpaid claims for accident year 2012 as of December 31, 2012.

b. (0.5 point)

Identify two limitations to the technique used in part a. above.

c. (0.25 point)

Briefly describe a situation when this technique is particularly useful.

18. (2 points)

a. (0.25 point)

Briefly explain the key assumption of the Bornhuetter-Ferguson method.

b. (0.5 point)

Briefly explain how the Bornhuetter-Ferguson method can be considered a credibility-weighted method and how the credibility is calculated.

c. (0.25 point)

Briefly describe one situation where the credibility-weighted assumption underlying the Bornhuetter-Ferguson method may not apply.

d. (0.5 point)

Explain whether the paid or reported Bornhuetter-Ferguson method is more responsive in a situation where claim ratios are increasing.

e. (0.5 point)

Compare and contrast the Cape Cod method and Bornhuetter-Ferguson method by providing one similarity and one difference.

19. (3.25 points)

Given the following information:

| Accident Year | Reported as of December 31, 2012 |            | Payroll (\$000) |
|---------------|----------------------------------|------------|-----------------|
|               | Claim Counts                     | Severities |                 |
| 2010          | 1,549                            | \$22,418   | \$63,438        |
| 2011          | 1,455                            | \$18,730   | \$62,893        |
| 2012          | 1,023                            | \$12,501   | \$67,005        |

| As of Month | Reporting Patterns (Reported %) |            |
|-------------|---------------------------------|------------|
|             | Claim Count                     | Severities |
| 12          | 85.0%                           | 43.0%      |
| 24          | 95.0%                           | 67.0%      |
| 36          | 98.0%                           | 83.0%      |

- The reported claim counts for accident year 2012 are unusually low due to a temporary slowdown of claims being opened.
- Annual frequency trend = -2%.
- Annual severity trend = +5%.
- Annual payroll trend = +4%.

Use an appropriate frequency-severity technique to estimate the IBNR for accident year 2012 at December 31, 2012 and justify all selections.

EXAM 5, SPRING 2013

20. (3 points)

Given the following information for a line of business:

- Assume no reported claims development past 36 months.
- Annual claim severity trend = +5%.
- Paid claim development method ultimate loss for accident year 2012 = \$10,275,000.
- Reported claim development method ultimate loss for accident year 2012 = \$9,650,000.

| Cumulative Paid Claims (\$000s) |           |           |           |
|---------------------------------|-----------|-----------|-----------|
| Accident Year                   | 12 Months | 24 Months | 36 Months |
| 2010                            | \$2,100   | \$6,410   | \$8,300   |
| 2011                            | \$2,210   | \$7,000   |           |
| 2012                            | \$2,550   |           |           |

| Cumulative Closed Claim Count |           |           |           |
|-------------------------------|-----------|-----------|-----------|
| Accident Year                 | 12 Months | 24 Months | 36 Months |
| 2010                          | 35        | 75        | 99        |
| 2011                          | 35        | 80        |           |
| 2012                          | 40        |           |           |

| Cumulative Reported Claims (\$000s) |           |           |           |
|-------------------------------------|-----------|-----------|-----------|
| Accident Year                       | 12 Months | 24 Months | 36 Months |
| 2010                                | \$5,300   | \$7,810   | \$8,500   |
| 2011                                | \$5,500   | \$8,130   |           |
| 2012                                | \$6,000   |           |           |

| Cumulative Reported Claim Count |           |           |           |
|---------------------------------|-----------|-----------|-----------|
| Accident Year                   | 12 Months | 24 Months | 36 Months |
| 2010                            | 80        | 98        | 100       |
| 2011                            | 79        | 97        |           |
| 2012                            | 82        |           |           |

| Outstanding Claims (\$000s) |           |           |           |
|-----------------------------|-----------|-----------|-----------|
| Accident Year               | 12 Months | 24 Months | 36 Months |
| 2010                        | \$3,200   | \$1,400   | \$200     |
| 2011                        | \$3,290   | \$1,130   |           |
| 2012                        | \$3,450   |           |           |

| Outstanding Claim Count |           |           |           |
|-------------------------|-----------|-----------|-----------|
| Accident Year           | 12 Months | 24 Months | 36 Months |
| 2010                    | 45        | 23        | 1         |
| 2011                    | 44        | 17        |           |
| 2012                    | 42        |           |           |

Fully discuss the considerations in deciding between using the paid or the reported claim development method to estimate ultimate claims for this line of business, and recommend an ultimate loss estimate for accident year 2012.

21. (2 points)

Given the following information as of the December 31, 2011 actuarial valuation:

| <u>Accident Year</u> | <u>Ultimate Claims</u> | <u>Reported Claims</u> | <u>Paid Claims</u> |
|----------------------|------------------------|------------------------|--------------------|
| 2010                 | \$1,200                | \$280                  | \$125              |
| 2011                 | \$1,300                | \$125                  | \$75               |
| <b>Total</b>         | <b>\$2,500</b>         | <b>\$405</b>           | <b>\$200</b>       |

| <u>Age in Months</u> | <u>Cumulative Percent Reported</u> | <u>Cumulative Percent Paid</u> |
|----------------------|------------------------------------|--------------------------------|
| 36                   | 40%                                | 12%                            |
| 24                   | 25%                                | 10%                            |
| 12                   | 10%                                | 5%                             |

Given the following information as of December 31, 2012:

| <u>Accident Year</u> | <u>Reported Claims</u> | <u>Paid Claims</u> |
|----------------------|------------------------|--------------------|
| 2010                 | \$470                  | \$200              |
| 2011                 | \$320                  | \$175              |
| <b>Total</b>         | <b>\$790</b>           | <b>\$375</b>       |

a. (0.5 point)

Based on the 2011 actuarial valuation, calculate expected paid claims for each accident year during calendar year 2012.

b. (0.5 point)

Based on the 2011 actuarial valuation, calculate expected reported claims for each accident year during calendar year 2012.

c. (0.5 point)

Discuss a scenario that explains any differences between actual and expected paid and reported claims as of December 31, 2012.

d. (0.5 point)

Using the scenario discussed in part c. above, justify the selection of a reserving technique for estimating ultimate claims as of December 31, 2012.



22. (3 points)

An actuary is assisting a manufacturing company in reserving its self-insured workers compensation program as of December 31, 2012. The program began on January 1, 1998 and has undergone the following changes in recent years:

- On January 1, 2007, the per-occurrence retention was increased from \$300,000 to \$750,000.
- On January 1, 2010, the company automated some of its production process. As a result, the company replaced a significant portion of its assembly-line staff with sales staff.

The actuary would like to use the following methods and data to estimate ultimate claims as of December 31, 2012:

- Development method using company-specific claim development triangles.
- Expected claims method using payroll as exposure base and the average of the reported and paid claim development projections as initial estimates of ultimate claims.
- Frequency-severity method using company-specific claim count development triangles.

a. (1 point)

Discuss necessary adjustments the actuary should make to the company-specific data to use the development method.

b. (1 point)

Briefly describe four adjustments the actuary should consider making to historical claims and exposures to put them on current levels in the expected claims method.

c. (1 point)

Describe two diagnostic tests the actuary should perform before using the frequency-severity method.

23. (2 points)

Given the following information:

Unadjusted Case Outstanding Claims (\$000s)

| Accident Year | <u>12 Months</u> | <u>24 Months</u> | <u>36 Months</u> |
|---------------|------------------|------------------|------------------|
| 2010          | \$10,300         | \$21,300         | \$37,500         |
| 2011          | \$11,400         | \$29,400         |                  |
| 2012          | \$15,600         |                  |                  |

Open Claim Counts

| Accident Year | <u>12 Months</u> | <u>24 Months</u> | <u>36 Months</u> |
|---------------|------------------|------------------|------------------|
| 2010          | 1,030            | 1,420            | 1,500            |
| 2011          | 1,140            | 1,470            |                  |
| 2012          | 1,200            |                  |                  |

Unadjusted Cumulative Paid Claims (\$000s)

| Accident Year | <u>12 Months</u> | <u>24 Months</u> | <u>36 Months</u> |
|---------------|------------------|------------------|------------------|
| 2010          | \$2,575          | \$15,975         | \$30,000         |
| 2011          | \$2,850          | \$18,200         |                  |
| 2012          | \$3,900          |                  |                  |

Selected annual severity trend = +5%

a. (1.5 points)

Calculate the adjusted cumulative reported claim triangle using the Berquist-Sherman case outstanding adjustment technique.

b. (0.5 point)

Discuss whether IBNR estimated using the Berquist-Sherman case outstanding adjustment technique should be higher or lower than IBNR estimated using an unadjusted reported claim development technique.

24. (2.5 points)

Given the following information:

| <u>Paid Claims Gross of Salvage &amp; Subrogation</u> |                  |                  |                  |                  |
|---|------------------|------------------|------------------|------------------|
| <u>Accident Year</u>                                  | <u>12 Months</u> | <u>24 Months</u> | <u>36 Months</u> | <u>48 Months</u> |
| 2009  | \$2,000          | \$2,400          | \$2,500          | \$2,500          |
| 2010  | \$2,100          | \$2,300          | \$2,400          |                  |
| 2011  | \$2,100          | \$2,400          |                  |                  |
| 2012  | \$2,500          |                  |                  |                  |

| <u>Paid Salvage &amp; Subrogation</u> |                  |                  |                  |                  |
|---------------------------------------|------------------|------------------|------------------|------------------|
| <u>Accident Year</u>                  | <u>12 Months</u> | <u>24 Months</u> | <u>36 Months</u> | <u>48 Months</u> |
| 2009                                  | \$98             | \$166            | \$250            | \$250            |
| 2010                                  | \$105            | \$163            | \$240            |                  |
| 2011                                  | \$107            | \$170            |                  |                  |
| 2012                                  | \$75             |                  |                  |                  |

- Assume no development after age 48.
- Ultimate claims for accident year 2012 = \$2,985.

a. (0.75 point)

Using a development approach, estimate the ultimate salvage and subrogation for accident year 2012.

b. (1.5 points)

Using a ratio approach, estimate the ultimate salvage and subrogation for accident year 2012.

c. (0.25 points)

Briefly discuss which approach, the development or ratio approach, to select in recommending an ultimate salvage and subrogation estimate for accident year 2012.

25. (2.25 points)

Given the following information for a portfolio written on claims-made policy form:

| Calendar Year | Paid ULAE | Paid Claims | Year-End Outstanding Case Reserve | Year-End Outstanding IBNR |
|---------------|-----------|-------------|-----------------------------------|---------------------------|
| 2009          | \$409     | \$3,625     | \$7,575                           | \$6,250                   |
| 2010          | \$476     | \$5,875     | \$10,450                          | \$7,500                   |
| 2011          | \$614     | \$7,950     | \$13,750                          | \$8,750                   |
| 2012          | \$761     | \$10,375    | \$16,500                          | \$10,625                  |

Claim amounts include ALAE.

a. (1.5 points)

Calculate a ULAE provision as of December 31, 2012 using the Kittel adjustment.

b. (0.5 point)

Explain the purpose of the Kittel adjustment.

c. (0.25 point)

Briefly explain a shortcoming of the classical method that is not addressed by the Kittel adjustment.

26. (2 points)

An actuary is conducting a reserve review for a line of business and calculates the following:

| Accident Year | Claims as of December 31, 2012 |          | Projected Ultimate Claims |           |           |           |                                    |                         |
|---------------|--------------------------------|----------|---------------------------|-----------|-----------|-----------|------------------------------------|-------------------------|
|               |                                |          | Development Method        |           | BF Method |           | Frequency-Severity                 |                         |
|               | Reported                       | Paid     | Reported                  | Paid      | Reported  | Paid      | Claim Count and Severity Technique | Disposal Rate Technique |
| 2009          | \$76,700                       | \$75,800 | \$77,501                  | \$77,483  | \$77,758  | \$78,022  | \$77,474                           | \$77,817                |
| 2010          | \$104,000                      | \$98,100 | \$113,782                 | \$113,828 | \$113,374 | \$113,165 | \$112,669                          | \$106,363               |
| 2011          | \$107,200                      | \$55,100 | \$130,379                 | \$94,770  | \$127,393 | \$102,646 | \$132,743                          | \$107,447               |
| 2012          | \$58,100                       | \$20,400 | \$120,014                 | \$89,600  | \$121,397 | \$115,159 | \$123,383                          | \$93,012                |

a. (1.5 points)

Suggest a reason for the disparity between the estimates of ultimate claims for accident year 2011 and propose diagnostic tests that would verify the assumption.

b. (0.5 point)

Determine what steps the actuary should take to determine the most appropriate methodology to project ultimate claims for accident year 2011.

## Exam 5

## Basic Techniques for Ratemaking and Estimating Claim Liabilities

| QUESTION | POINT VALUE OF QUESTIONS | (a)  | (b)  | (c)  | (d) | (e) | (f) | (g) |
|----------|--------------------------|------|------|------|-----|-----|-----|-----|
| 1        | 2                        | 0.5  | 0.5  | 0.5  | 0.5 |     |     |     |
| 2        | 2                        | 1    | 0.25 | 0.25 | 0.5 |     |     |     |
| 3        | 2.5                      |      |      |      |     |     |     |     |
| 4        | 3                        |      |      |      |     |     |     |     |
| 5        | 4                        |      |      |      |     |     |     |     |
| 6        | 2.5                      | 0.5  | 0.5  | 0.5  | 0.5 | 0.5 |     |     |
| 7        | 3                        |      |      |      |     |     |     |     |
| 8        | 3                        |      |      |      |     |     |     |     |
| 9        | 2                        | 1.25 | 0.25 | 0.5  |     |     |     |     |
| 10       | 2.25                     | 1.75 | 0.5  |      |     |     |     |     |
| 11       | 3.5                      | 1.5  | 0.75 | 1.25 |     |     |     |     |
| 12       | 3                        |      |      |      |     |     |     |     |
| 13       | 2                        |      |      |      |     |     |     |     |
| 14       | 1.25                     | 0.5  | 0.75 |      |     |     |     |     |
| 15       | 2.5                      | 2    | 0.5  |      |     |     |     |     |
| 16       | 1.75                     | 1.25 | 0.5  |      |     |     |     |     |
| 17       | 1.25                     | 0.5  | 0.5  | 0.25 |     |     |     |     |
| 18       | 2                        | 0.25 | 0.5  | 0.25 | 0.5 | 0.5 |     |     |
| 19       | 3.25                     |      |      |      |     |     |     |     |
| 20       | 3                        |      |      |      |     |     |     |     |
| 21       | 2                        | 0.5  | 0.5  | 0.5  | 0.5 |     |     |     |
| 22       | 3                        | 1    | 1    | 1    |     |     |     |     |
| 23       | 2                        | 1.5  | 0.5  |      |     |     |     |     |
| 24       | 2.5                      | 0.75 | 1.5  | 0.25 |     |     |     |     |
| 25       | 2.25                     | 1.5  | 0.5  | 0.25 |     |     |     |     |
| 26       | 2                        | 1.5  | 0.5  |      |     |     |     |     |
| TOTAL    | 63.5                     |      |      |      |     |     |     |     |

### Exam 5 Question #1

1. a. For CY2011, A Earned  $\frac{1}{2}$  exposures =  $50 \times 2 \times \frac{1}{2} = 50$   
B also earns  $\frac{1}{2}$  exposures =  $100 \times 2 \times \frac{1}{2} = 100$   
CY2011 Earned Exposures =  $50 + 100 = 150$
  
- b. Evaluated as of 12/31/2010  
A earned =  $50 \times 2 \times \frac{1}{2} = 50$   
B earned =  $100 \times 2 \times \frac{1}{4} = 50$   
Total earned exposures =  $50 + 50 = 100$   
  
Evaluated as of 12/31/2011  
A earned  $50 \times 2 = 100$   
B earned  $100 \times 2 \times \frac{3}{4} = 150$   
Total earned exposures =  $100 + 150 = 250$
  
- c. Evaluated as of 12/31/2010  
B written exposures =  $100 \times 2 = 200$   
  
Evaluated as of 12/31/2011  
B written exposures =  $100 \times 2 - 100 \times 2 \times \frac{3}{4} = 50$
  
- d. CY2010 B written exposures =  $100 \times 2 = 200$   
CY2011 B written exposures =  $-100 \times 2 \times \frac{1}{2} = -100$

**Exam 5 Question #2**

|                |         |     |                                |
|----------------|---------|-----|--------------------------------|
| a. Dec 31 2011 | 950 ↙   | -1% | select semiannual trend at -1% |
| June 30 2012   | 940.5 ↙ | -1% |                                |
| Dec 31 2012    | 931     |     |                                |

Trend period: 1/1/2012- 7/1/2014

Avg. written dates.  
2.5 yrs (5 half years)

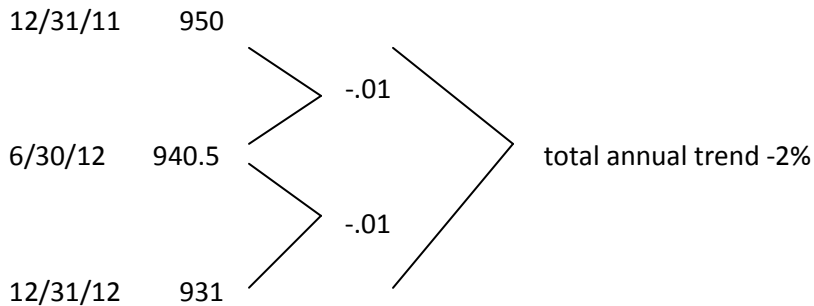
$$114,208,050 ([1 - .01])^5 = 108,610,779$$

OR

Trend period 1/1/12 to 7/1/14                      2.5 yrs

CY 2012 Earned from @CRL \* Trend<sup>2.5</sup> = Projected EP

AVG WNT @ CRL



$$\text{Projected 2012 EP @ CRL} = 114,208,050 * 0.98^{2.5} = 108,583,017.3$$

- b. It takes into account changes in exposure distributions, for what is expected to occur when rates are in effect.

OR

Premium trend accounts for the gradual shift in the book of business for things such as inflation or mix of business

- c. Using historical rates would cause a double-counting effect in the trend calculation

OR

Using written premium at historical rate leads to determine premium trend would include rate changes in the selected trend number, when we don't necessarily expect those rate changes to continue into the future.



- d. This change would cause premiums to go lower because fewer losses would be paid. The true projected premium is lower than that calculated above.

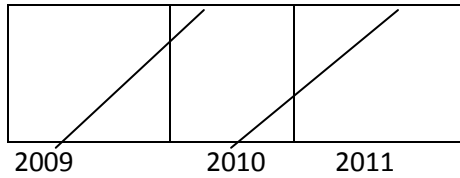
OR

The true projected earned premium will be longer because a higher deductible gives the insured a discount on premium.

### Exam 5 Question #3

1. Adjust the earned premium to current rate level. This will avoid an indication that ignores past rate changes and provides a better projection of future loss ratios.
2. Determine a loss trend and apply to the Loss + ALAE. This will create a better projection of future losses if there is an ongoing or past change in frequency or severity of losses
3. Develop losses to ultimate. The rate must account for all losses from the policies, not just the ones that have been reported thus far. Ignoring IBNR will create an inadequate rate.
4. Include a ULAE load. The rate must provide for all costs associated with the transfer of risk so it must include adjustment expenses that are not allocated to specific claims
5. Use a volume-weighted average of loss ratios. 2012 has significantly more premium than past years and will be more responsive to changes in the book so it should be given more weight.

**Exam 5 Question #4**



For 2009: On-level factor:  $\frac{1.03 \times 1.02}{9/32 \times 1.03 + 23/32 \times 1} = 1.0418$

For 2010: On-level factor:  $\frac{1.03 \times 1.02}{\frac{1}{32} \times 1 + \frac{1}{8} \times 1.03 \times 1.02 + \frac{27}{32} \times 1.03} = 1.0184$

For 2011: On-level factor  $\frac{1.03 \times 1.02}{\frac{1}{8} \times 1.03 + \frac{7}{8} \times 1.03 \times 1.02} = 1.00246$

Uses the average 2009-2011 ratio as the expected loss ratio

$$\frac{1}{3} \left( 66\% \times \frac{1.04^2}{1.0418} + 67\% \times \frac{1.04^2}{1.0184} + 70\% \times \frac{1.04}{1.00246} \right) = 71.68\%$$

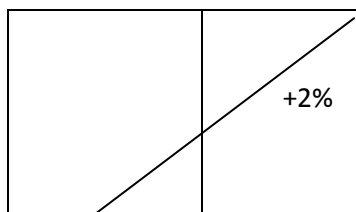
For 2012:  $50,000 \times 71.68\% \times (1 - 10\%) + 4200 = 36456$

OR

BF ULT. Losses = 4200 + [% unrept @ 12/31/12 x LR x EP]

2011 ULT loss ratio =  $\frac{2011 \text{ Loss} + LAE}{2011 EP}$

2010                      2011



On level factor for 2011 EP =  $\frac{1.02}{1 (1/8) + 1 (7/8)} = 1.002$

2011 LR adj for 2012 =  $.7 \frac{1.04}{1.002} = .727$

BF ULT Loss for 2012 = 4200 + .727(.9) 50,000

= 36,915

**Exam 5 Question #5**

(f = 6%, v = 30%, Q = 5%, V\* = 27%)

\*agency commission = variable expense -3%

Annual Policy

|   |       |          |          |          |     |
|---|-------|----------|----------|----------|-----|
|   | 12-24 | 24-36    | 36-48    | 48-60    | 60+ |
| Selected ATAF reported Losses: 1.200965 |       | 1.100036 | 1.050147 | 1.010157 | 1   |

$$\frac{1030 + 1004 + 1012}{928 + 921 + 920}$$

↓

Judgmentally Selected

|          | Reported Losses | CDF-ULT  | Loss Trend           | LAE loading | Projected ult claims |
|----------|-----------------|----------|----------------------|-------------|----------------------|
| 2011(24) | 966,000         | 1.166933 | 1.03 <sup>3.25</sup> | 1.025       | 1,271,943.715        |
| 2012(12) | 890,000         | 1.401446 | 1.03 <sup>2.25</sup> | 1.025       | 1,366,387,864        |

$$\sphericalangle = 1.200965 \times 1.100036 \times 1.050147 \times 1.010157$$

Trend Period [07/01/20xx-Avg DOL {(03/01/2013-12/31/2014 PY)}

10/01/2014

2011=3.25

2012=2.25

|      | EP      | On-level factor* | Premium Trend        | Projected Trended Premium |
|------|---------|------------------|----------------------|---------------------------|
| 2011 | 2163000 | 1.00             | 0.99 <sup>3.25</sup> | 2,093,490.054             |
| 2012 | 2120000 | 1.00             | 0.99 <sup>2.25</sup> | 2,072,597.876             |

\*Already on-level as no rate change in past 3 years

Trend period: Avg written date of CY 20XX EP - Avg written date of (07/01/2013-12/31/2014 PY)

01/01/20XX

04/01/2014

2011=3.25

2012=2.25

$$\text{Indicated Rate Change} = \frac{LR + F}{I - V - Q_r} - 1 = \frac{0.633288 + 0.06}{1 - 0.28 - 0.05} - 1 = +3.476\%$$

$$LR = \frac{1,271,943.715 + 1,366,387.864}{2,093,490.054 + 2,072,597.876} = \frac{0.63328}{\square}$$

1/3 period

2/3 period

↑

↑

$$V \text{ approx in forecast period} = \frac{07.01.2013 - 31.12.2013 \times 0.30 + 01.01.2014 - 31.12.2014 \times 0.27}{07.01.2013 - 31.12.2014}$$

$$= 1/3(0.3) + 2/3(0.27) = 0.28$$

OR

|        | 12-24 | 24-36    | 36-48  | 48-60 |
|--------|-------|----------|--------|-------|
| Rpt    |       | Loss Dev | Δ      |       |
| 08     | 1.19  | 1.11     | 1.05   | 1.01  |
| 09     | 1.20  | 1.09     | 1.049  |       |
| 10     | 1.21  | 1.1      |        |       |
| 11     | 1.2   |          |        |       |
| Sel    | 1.2   | 1.1      | 1.05   | 1.01  |
| To ULT | 1.400 | 1.167    | 1.0605 | 1.01  |

| CY   | Loss    | LDF   | Trend Fact           | LAE   | Trended Dev Losses' |
|------|---------|-------|----------------------|-------|---------------------|
| 2011 | 966,000 | 1.167 | 1.03 <sup>3.25</sup> | 1.025 | 1,272,017           |
| 2012 | 890,000 | 1.400 | 1.03 <sup>2.25</sup> | 1.025 | 1,364,978           |

Prem (1/1/12 - 4/1/14)

| CY   | EP        | Trend               | Trended Ep | LR    |
|------|-----------|---------------------|------------|-------|
| 2011 | 2,163,000 | .99 <sup>3.25</sup> | 2,093,490  | .6076 |
| 2012 | 2,120,000 | .99 <sup>2.25</sup> | 2,072,598  | .6586 |

Avg: .6331 ↓

Ind Change

$$\frac{.6331+.06}{0.67} = 1.0345$$

Ind Change

+ 3.45%

$$\text{PLR } 7/1/13 - 1/1/13 = 1 - .3 - .05 = .65$$

$$1/1/14 - 12/31/14 = 1 - .27 - .05 = .68$$

$$\text{WTD } 1/3 (.65) + 2/3 (.68) = .67$$

**Exam 5 Question #6**

- a. Occurrence Policy has both pure IBNR + IBUER, CM policy only has IBNER

OR

CM has no pure IBNR @ report year end because all claims in the report have been reported (by def.), development is limited to IBNER. Occurrence policies will see development due to both pure IBNR + IBNER, since policies can be reported long after they occur.

- b. Claims made policy has a much shorter period of time between the coverage trigger and the settlement date- not as much impacted by loss cost increase.

OR

Occurrence policies incur liability for claims that occur now but are reported much later so inflation/loss trend accumulates on these costs whereas CM policies incur liability for claims reported @ today's cost levels.

- c. With occurrence policy, claims are covered that are reported much further out into the future. These loss trends will therefore have a greater impact on the losses covered by an occurrence policy - more impact of inflation/loss trends

OR

Occurrence policy can have losses reported much later, trends have leverage on future costs than current costs →  $\Delta$  in trend affects occurrence more than CM.

- d. Retroactive date= losses only covered by CM policy if they occur after retro date

|             |    | Lag     |         |         |
|-------------|----|---------|---------|---------|
|             |    | 0       | 1       | 2       |
| Report Year | 10 | L(10,0) | L(10,1) | L(10,2) |
|             | 11 | L(11,0) | L(11,1) | L(11,2) |
|             | 12 | L(12,0) | L(12,1) | L(12,2) |

Occurrence policy in 10 would cover losses on shaded diagonal. CM policy in 11, without a retro date would cover entire row=overlap on L (11,1)

OR

Apply retroactive date to the new CM policy to limit coverage to losses that occur after such a date.

A=occ. Policy covg

B= CM covg w/o adj

|    |   | <u>LOG</u> |            |   |   |   |
|----|---|------------|------------|---|---|---|
|    |   | year       | 0          | 1 | 2 | 3 |
| 11 | A |            |            |   |   |   |
| 12 | B |            | A/B        | B | B |   |
| 13 |   |            | ↑          | A |   |   |
| "  |   |            | (Over Lap) |   | A |   |

(previous years as well if avg covg provided before 2011)

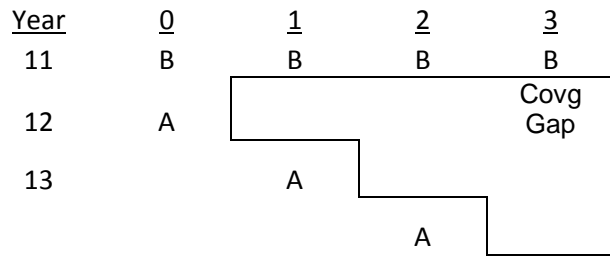
- e. Use Extended reported period Endorsement = provides coverage for losses that occurred when CM coverage effective, but reported after expiration of last CM policy.

CM policy in 10 covers entire row. Occurrence policy in 11 covers diagonal = L(11,0) and L (12,1). No coverage for L(11,1) or L(11,2) or L(12,2).

|             |    | Lag     |         |         |
|-------------|----|---------|---------|---------|
|             |    | 0       | 1       | 2       |
| Report Year | 10 | L(10,0) | L(10,1) | L(10,2) |
|             | 11 | L(11,0) | L(11,1) | L(11,2) |
|             | 12 | L(12,0) | L(12,1) | L(12,2) |

OR





Purchase tail coverage to cover during gap

### Exam 5 Question #7

Proposed effective date 7/1/2013 for annual pols in effect 1 year to avg loss date of 7/1/2014

| AY   | Loss (000) | Trend      | Benefit Changes*       | ULT Losses (0001) |
|------|------------|------------|------------------------|-------------------|
| 2010 | 1,875      | $(1.02)^4$ | $(1.05)(1.02) = 1.071$ | 2,173.7           |
| 2011 | 1,875      | $(1.02)^3$ | $(1.05)(1.02)$         | 2,131.0           |
| 2012 | 2,000      | $(1.02)^2$ | $(1.05)(1.02)$         | 2,228.5           |

\*since all losses are reported at pre July 2011 benefit levels all years need both the 2% and 5% adjustment

### Exam 5 Question #8

Use 2-part trend since historical trend is different due to changing book of business. Assume 6-month reporting periods for trend period selection.

$$\text{Historical trend period} = 7/1/2010 - 4/1/2012 = 1.75$$

$$\text{Projected trend period} = 4/1/2012 - 7/1/2013 = 1.25$$

$$\text{Historical trend selection: freq} = 16\% \text{ sev} = -1.7\%$$

Use 8 point trends for both frequency and severity, this will account for the change in the book of business

$$\text{Future trend selection: freq} = 4.1\% \text{ sev} = 2.5\%$$

Used 4 point trends for frequency and severity since this includes the period after the mix of business changed and should be indicative of future patterns.

$$2010 \text{ AY trended Ult Loss} + \text{ALAE} = 10,000,000 \times 1.12 \times (1.16 \times .983)^{1.75} \times (1.041 \times 1.025)^{1.25}$$

Used 30 month CDF-ULT factor 1.12

$$= \$15,282,922$$

**Exam 5 Question #9**

a.  $PLR = .65 = 1 - V - Q$                        $V = .3 \rightarrow$  *current total expense*

Fixed % =  $.75(.3) = .225$

Variable % =  $.25(.3) = .075$

$1.045 = \frac{\text{Loss Ratio}}{.65}$

Loss ratio =  $.67925$

Revised Indication =  $\frac{.67925 + .225}{1 - .075 - .05} = 1.0034$

3.34% Increase

- b. Splitting expenses into fixed + variable accounts for the fact that certain expenses are a set amount for each risk, regardless of premium size. Depending on ratio of fixed vs variable, indication will differ due to fixed included on top off equation added to loss ratio.

OR

Allows fixed expenses to be added in with the loss of ratio and the revised permissible loss ratio to be higher which lowers indication.

OR

Because fixed expenses are not changing with premium they are a set in stone percentage. That's why we add them to the LR rather than include it in the permissible ratio.

- c. 1) Assuming all variable expenses when some are truly fixed will over charge high premium risks and under charge low premium risks.

2) Fixed expenses may be affected by trend, so separating allows us to apply trend factors to get more accurate expense load.

OR

1) including fixed and variable expenses together could distort your indication

2) Including them together could cause you to undercharge small premium policies and overcharge large premium policies.

OR

1) because some expenses do not vary with premium and in order to correctly account for it, it should be fixed.

2) Also it helps better track expenses and understand expenses

### Exam 5 Question #10

a.

| Duration | (1)<br>Premium | (2)<br>Loss | (3)<br>Expense | (4)<br>Persistency | (5)<br>Cumulative<br>Persistency | (6)<br>Discount<br>Factor | (7)=[ (1) - (2) - (3) ]<br>x (5) / (6)<br>PV of Profit | PV of<br>Premium |
|----------|----------------|-------------|----------------|--------------------|----------------------------------|---------------------------|--|------------------|
| 1        | \$1,000        | \$600       | 420            | 100%               | 100%                             | 1.000                     | -20  | 1,000            |
| 2        | 1,000          | 575         | 350            | 85%                | 85%                              | 1.030                     | 61.89  | 825.24           |
| 3        | 1,000          | 550         | 350            | 90%                | 76.5%                            | 1.0609                    | 72.11  | 721.09           |

Profit/premium =  $\$114 / \$2,546.33 = 4.477\%$

b. i) standard actuarial ratemaking techniques typically do not consider persistency, the likelihood of and insured renewing his policy.

ii) Standard actuarial ratemaking techniques only consider premium and losses for the period in which rates will be in effect, not over the lifetime of the insured with the insurer.

**Exam 5 Question #11**

Credit: -Lacks causality as is correlated with loss exposure; however, difficult to show causality  
 -Invades privacy of insureds

Age: -Lacks controllability since insured cant control their age  
 -The indicated relativities from the insurer’s data differ significantly from competitor relativities. (e.g. Ind Under 30 Rel > 1.00)

Loss Prevention:

-Difficult and expensive to verify as it is subject to manipulation from the insureds  
 -Non sensical deifinition. Why would someone with both a fire extinguisher and a smoke detector be rated higher than someone with just a fire extinguisher

- a. I would recommend credit score as score as a variable.  
 -significant loss cost differentiation  
 -objective definition  
 -Easy and inexpensive to verify and administer  
 -Social concerns are not sufficient to prevent using this variable (assuming it is legal to do so)

| Credit    | PP     | Ind Rel | Comp Rel | Z      |
|-----------|--------|---------|----------|--------|
| Excellent | 116.67 | 0.8975  | 0.8374   | 61.24% |
| Good      | 128.00 | 0.9846  | 0.9852   | 79.06% |
| Fair      | 155.00 | 1.1923  | 1.2808   | 50.00% |
|           | 130.00 | 1.000   | 1.000    |        |

Ex:  $\frac{116.67}{130} = 0.8975$

Ex:  $\frac{0.85}{1.015} = 0.8374$

EX: 61.24% =  $\sqrt{\frac{1500 \times 0.1}{400}}$   
 $(\sqrt{\frac{reg \times exp}{400}})$

|               |
|---------------|
| @Base         |
| Cred Wgtd Rel |
| 0.888         |
| 1.000         |
| 1.256         |

$$\frac{(2) \times (4) + (3) \times [1 - (4)]}{(2) \times (4) + 3 \times [1 - (4)]}$$

EX: *For good*



## Exam 5 Question #12

Burglar Alarm- Relatively low volume and wide confidence interval for both Local Alarm and Central Reporting groups. The Local Alarm std errors suggest its not significantly different than the None category (the confidence interval encompass the relativity for none). Central reporting has very few exposures and large standard errors. I would recommend this variable not be used (1.00 factor for all groups).

Deductible :

|      |       |      |      |      |       |
|------|-------|------|------|------|-------|
| 250  | 500   | 2500 | 5000 | 7500 | 10000 |
| 1.50 | 1.000 | 0.95 | 0.85 | 0.75 | 0.65  |

1. 250 not enough data

2. 500, 1000, 2500, and 2000: fit very well and sufficient data factor directionally also make sense. Use indicated factors.

3. 7500: reversal should be lower than 5,000

10,000: indicated factors are too small, may be due to sparse data judgmentally select 0.65.

7500: Select the average factors of 5,000 and 10,000

**Exam 5 Question #13**

$$\text{LER} = .0$$

$$\text{ALAE} = .1$$

$$L = 2M$$

$$\text{ALAE}\$ = .1 \times (2,000,000) = 200,000$$

$$\text{Loss} = (1 - .8) \times (2,000,000) = 400,000$$

$$\text{Fee for handle ded: } .8 \times (2,000,000) \times .05 = 80,000$$

$$\text{Credit Risk} = .8 \times (2,000,000) \times .02 = 32,000$$

$$\text{Risk Margin} = (1 - .8)(2,000,000)(.08) = 32,000$$

$$\frac{L + E_L + \text{Ded Fee} + \text{Credit Risk} + \text{Risk Margin} + F}{1 - V - Q} = 992,941.176\$$$
$$\frac{400,000 + 200,000 + 80,000 + 32,000 + 100,000}{1 - .12 - .03} = 992,941.176\$$$

Exam 5 Question #14

- a.
1. Insurer will not be charging what they should be to keep the fundamental insurance equation in balance and earn their target underwriting profit.
  2. Systems limitations-need to program this rule into computer systems. Can get complicated as to what gets capped and what doesn't and how this changes the rating algorithm

OR

1. May cause need for premium transition
2. Insurer may not get all the rate needed

OR

1. Can cause rates to be inadequate
2. Can be subject to adverse selection

- b.
- May have a concern that they will not retain policyholders if they raise rates substantially at renewal-may cause insureds to shop- Also might be regulation reasons-restrictions on the amount of rate increase a policyholders can see at each renewal

OR

Keep customers from getting shocked at renewal and shopping.

OR

An insurer would propose a capping rule in light of the problems in (a) to maximize the retention. An insurer might be able to get an increase in rate in the future which will make rates adequate again. The more profitable business they retain the more profits they will enjoy in the long run.

**Exam 5 Question #15**

a) Basic Premium =  $(0.25 - (1.2 - 1)(0.60) + 0.446) 540,000 = 311,040$

Retro Premium =  $(400,000(1.2) + 311,040)1.05 = 830,592$

Before min/max

Max Retro Premium is  $1.5(590,000) = 810,000$

So the final retrospective premium is 810,000

- b) The retro premium could decrease from the max cap if reports losses develop downward or if claims are closed with no payment.

**Exam 5 Question #16**

- a. There appears to be a seasonal pattern in the age-to-age factors that causes differences between XXX-1 and XXX-2 half years.

I would select a separate pattern for each half year (-1 and -2) using simple all year averages.

|          | 6-12  | 12-18 | 18-24 | 24-30 | 30-36 | 36-vlt |
|----------|-------|-------|-------|-------|-------|--------|
| Sel (-1) | 1.535 | 1.035 | 1.010 | 1.000 | 1.000 | 1.000  |
| Sel (-2) | 1.245 | 1.124 | 1.011 | 1.000 | 1.000 | 1.000  |

$$\text{ULT count AY 2012} = 13,807(1.035)(1.01) + 10,265(1.245)(1.124)(1.011) = 28,956$$

- b. Allows for recognition of seasonal patterns in claims development

Allow for better recognition of growing portfolio as average accident date shifts.

OR

ADV 1: Since there is a pretty clear seasonality effect based on the ATA values that vary significantly by period, using this type of analysis captures these differences to produce a more accurate development projection.

ADV 2: Using shorter time frames such as half year can also help the accuracy of projection during times of greatly increasing exposure (due to higher granularity). This could be useful here, since the claims closed down the 6 and 12 month columns are increasing noticeably, which may be due in part to an exposure increase.

OR

1. Because of the developmental seasonality it helps to pick different patterns for the different half years'
2. The counts appear to be increasing at a decent rate. When counts are increasing like this it could mean an increase in exposures. Splitting the years into half-years better deals with the changing average date of loss that accompanies rapidly increasing exposures.

**Exam 5 Question #17**

a. Case O/S development factors 2012 =  $\frac{(1.12 - 1) \times 1.56}{1.56 - 1.12} + 1 = 1.425$

Unpaid claim =  $110 \times 1.425 = 156.75$

- b. 1) Industry benchmark CDF often prove to be inaccurate for a particular insurer  
2) Analysis can be distorted by large losses in case outstanding

OR

Industry benchmarks aren't accurate or don't apply to this self insured entity  
- Paid CDFs might be highly leveraged → subject to inaccurate estimates

- c. This technique is useful when no other technique is available because the only information the self-insured has is case O/S.

Exam 5 Question # 18

- a. Key assumption: Losses reported (paid) to date do not tell you anything about the losses that are yet to be reported (paid)  
(Unpaid) Unreported losses are better estimated based on an a priori initial expected ultimate.

OR

Assumes the actuary's a priori estimate is a better indicator of unpaid/unreported claims than experience to date

- b. The method is considered a cred weighted method of the Development Method and Initial Expected.

$Z$  (Dev Method) + (1- $Z$ ) Initial Expected Ultimate

$Z$

$$= \text{The percent reported to date} = \frac{1}{\text{cumulative dev. factor}} = \frac{1}{\text{CDF}}$$

*From development method*

OR

Cred weighting of Development and Expected Claim techniques, The weight is based on % paid (or % rptd.)

I.E:  $B-F \text{ Ult} = \% \text{ paid} * \text{Dev Ult} + (1 - \% \text{ paid}) * \text{Exp Cl. Ult}$

- c. On a pattern that goes above 100% reported or paid You'll see this on lines with salvage + subrogation or short tailed lines with strong case reserves. The % reported amount (2) cannot go above 1 in credibility theory. Therefore, in this situation, in theory, the method shouldn't be used.

OR

Would not apply if % paid is greater than 100% (Violates credibility definition)

- d. The reported method would be more responsive because the development method is responsive to increasing claim ratios, and the reported BF method will give more weight to the development method early on since % Rpt is often greater than % paid.

OR

Rptd is more responsive, since % rptd is usually greater than % paid, thereby putting more weight on the developed emerging exp. And less on the a priori estimate

- e. Similarity- CC (Cape Cod) and BF methods both assume the unreported amount should be based off of another estimate and not developed as in the development technique. In other words, they both assume that experience to date in an AY doesn't tell you everything about future development.

Difference: The two methods calculated the "initial expected" ultimate differently. The BF method relies on an a priori selected loss ratio and the CC method calculates the LR (or PP) using the losses to date divided by the "used up" premium. Therefore the CC method is more responsive.

OR

Both methods are cred weighting of Dev & Exp Claims but B-F initial exp loss ratio is an a priori estimate, while Cape Cod determines IELR using reported losses & used-up premium



**Exam 5 Question #19**

Because 2012 frequency is off, severity is probably also impacted (smaller claims open faster), so 2012 will not be used in the calculation.

|      | Counts | CDF   | Trend            | Trend +Dev counts (a) |
|------|--------|-------|------------------|-----------------------|
| 2010 | 1549   | 1/.98 | .98 <sup>2</sup> | 1518.02               |
| 2011 | 1455   | 1/.95 | .98              | 1500.95               |

|      | Sev   | CDF   | Trend               | Trend+ Dev sev (b) |
|------|-------|-------|---------------------|--------------------|
| 2010 | 22418 | 1/.83 | (1.05) <sup>2</sup> | 29778.13           |
| 2011 | 18730 | 1/.67 | 1.05                | 29352.99           |

| Exposure | Trend               |   | Trended Exp (c) |
|----------|---------------------|---|-----------------|
| 63438    | (1.04) <sup>2</sup> | = | 68614.54        |
| 62893    | (1.04)              | = | 65408.72        |

$$\text{Trended PP} = \frac{(a) - (b)}{(c)}$$

2010 658.81

2011 673.57

Sel avg 666.19

ULT 2012

$$= \text{Sel PP} \times \text{payroll}(\$100)$$

$$666.19 \times 67005 = 44,638,060.95$$

$$\text{IBNR} = 44,638,060.95 - (1023) \times 12501$$

$$= \$31,849,537.95$$

OR

| ULT claims | Trended                   |        | Trended Payroll   |
|------------|---------------------------|--------|---|
| 1549/0.98  | <b>1.0192<sup>2</sup></b> | = 1642 | 63,438 x <b>1.04<sup>2</sup></b> = <b>68,615</b>        |
| 1455/0.95  | <b>1.0192<sup>1</sup></b> | =1561  | <b>62,893</b> x <b>1.04<sup>1</sup></b> = <b>65,409</b> |
| 1023/0.85  | <b>1.0192<sup>0</sup></b> | =1204  | <b>67,005</b> x <b>1.04<sup>0</sup></b> = <b>67,005</b> |

Freq trend= Claim Trend / Payroll Trend = 0.98 = 1.0192 / 1.04

2010 Freq = 1642/68,615= 0.0239

2011 Freq= 1561/65,409= 0.0239

= Sel 0.0239

ULT trended Severity

22,418/ 0.83 x **1.05<sup>2</sup>** = **29,778** →All Average Sel= 29,401

18,730/0.67x **1.05** = **29,353**

12,501/0.43x **1.00** = **29,072**

**0.0239 x 67,005 x 29,401 = 47,083,335 Ult**

**47,803,335 - 1023 x 12501 = 34,294,812 IBNR**

Selected Frequency based on 2010 + 2011 because 2012 had a slowdown in claim counts, making it project an inaccurately low ULT claim count.

Severity is still reliable because it is an average number i.e. volume is controlled for Used an all years average for stability.

OR

|      | Ultimate Claims   | Trended Exposure           | Frequency |
|------|-------------------|----------------------------|-----------|
| 2010 | 1549 / .98 = 1580 | 63,438 x 1.04 <sup>2</sup> | 2.30%     |
| 2011 | 1455 / .95 = 1532 | 62,893 x 1.04              | 2.34%     |

Trended Frequencies

2010  $.023 (.98)^2 = .0221$

2011  $.0234(.98) = .0229$

Simple Average = .0225 = Selected Freq

|      | Ultimate Severity            | Trended Ut sev         |
|------|------------------------------|------------------------|
| 2010 | $\frac{22418}{.83} = 27010$  | 29,779                 |
| 2011 | $\frac{18730}{.47} = 27955$  | 29,353                 |
| 2012 | $\frac{12501}{.43} = 29,072$ | 29,072                 |
|      |                              | Simple average= 29,401 |

Ultimate Claims= 29,401 x .0225 x 67,005

= 44,325,315

IBNR= 44,325,315 - 1,023 · 12,501= 31, 536,792

Since AY 2012 claim counts were subject to an temporary slowdown they were removed from the calculation of the ultimate frequency because using the current report patterns would severely underestimate ultimate freq. for that year. Severity was assumed to be unaffected since there was no mention of a change in claim department methodology, just a slowdown in opening all claims.



**Exam 5 Question #20**

Check avg. paid severities:

|    |      |         |       |         |  |       |
|----|------|---------|-------|---------|--|-------|
| AY |      | 12      |       | 24      |  | 36    |
| 10 | 1.05 | { 60    | 1.024 | { 85.47 |  | 83.84 |
| 11 | 1.01 | { 63.14 |       | { 87.5  |  |       |
| 12 |      | { 63.75 |       |         |  |       |

$\sphericalangle = 7000/80$

Avg pd appears to be trending at rate less than 5% For most recent

Could indicated change in settlement practice could be closing more small claims.

Check Avg

Case Outstanding:

$$\text{Avg Case out} = \frac{\text{Out CLM}}{\text{Out CLM Ct}}$$

|    |      |         |      |         |  |     |
|----|------|---------|------|---------|--|-----|
| AY |      | 12      |      | 24      |  | 36  |
| 10 | 1.05 | { 71.11 | 1.09 | { 60.87 |  | 200 |
| 11 | 1.02 | { 74.77 |      | { 66.47 |  |     |
| 12 |      | { 76.19 |      |         |  |     |

Avg. case outstanding increased by less than 5% per year at 12 months and greater than 5% per year at 24 months. Could indicate a change in type of claim being closed at the pd.

Look at closed to reported of ratio: Closed Ct/Rep Ct

|    |       |       |                       |
|----|-------|-------|-----------------------|
| AY | 12    | 24    | 36                    |
| 10 | .4375 | .7653 | .99 $\sphericalangle$ |
| 11 | .4430 | .8247 | =99/100               |
| 12 | .4878 |       |                       |

Closed to report count ratio appears to be increasingly, indicating a speed up in claim settlement. Since there is a speed up in settlement and avg. pd severity is trending at rate lower than 5%, it appears the insurer is closing more small claims quickly.

Avg rep clm

|    |      |         |      |         |  |    |
|----|------|---------|------|---------|--|----|
| Ay |      | 12      |      | 24      |  | 36 |
| 10 | 1.05 | { 66.25 | 1.05 | { 79.69 |  | 85 |
| 11 | 1.05 | { 69.62 |      | 83.81   |  |    |
| 12 |      | 73.17   |      |         |  |    |

Avg. Rep. CLM increasing at steady rate of 5%.

Due to the diagnostics and explanations above, I would select the reported dev method ultimate of \$9.65 mil.

**Exam 5 Question #21**

|      |               |          |  |
|------|---------------|----------|--|
| a.   | Ultimate-Paid | % unpaid | developed in CY 2012                               |
| 2010 | 1075          | 90%      | $(1075 / (.9)) (12\% - 10\%) = 23.89$              |
| 2011 | 1225          | 95%      | $\left(\frac{1225}{.95}\right) (.1 - .05) = 64.47$ |

OR

| Yr   | Ult Paid | % pd | %pd age+12 | % pd in age | EXP paid in 2012 |
|------|----------|------|------------|-------------|------------------|
| 2010 | 1200     | .1   | .12        | .02         | 24               |
| 2011 | 1300     | .05  | .1         | .05         | 65               |
|      | (1)      | (~)  | (3)        | (3)-(2)     | 89               |

OR

Expected paid claims in CR 2012

- AY 2010 =  $125 \left( \frac{1}{.10} \div \frac{1}{.12} - 1 \right) = 25$
- AY 2011 =  $75 \left( \frac{1}{.05} \div \frac{1}{.1} - 1 \right) = 75$

b.

|      |                   |              |  |
|------|-------------------|--------------|--|
|      | Ultimate-Reported | % unreported |  |
| 2010 | 920               | .75          | $\left(\frac{920}{.75}\right) (4 - .25) = 184$ |





OR

I would use a reported dev. technique as it is not affected by decrease in settlement lag.

OR

I would suggest using the expected claims technique because you can judgmentally adjust the expected claims ration up due to the shift.

### Exam 5 Question 22

- a. If possible, the actuary should restate the historical triangles to a \$300k retention (one triangle) and to a \$750K retention (a separate triangle) in order to remove the distortion that the change in retention would otherwise create. The actuary should then review these triangles separately and select LDFs to be applied to the appropriate retention by year.

Or

The actuary should adjust the claims data to be used in development method since the retention was increased from \$300,000 to \$750,000. The increase in retention will increase the claims reported and paid. Therefore, claims data before 2007 should be adjusted to current level before applying the development method. In addition, the change from assembly-line to sales will have an impact to the claims. Less injury will be expected when the company automated some of its production process. Hence, claims data before 2010 should be adjusted.

- b. -Adjust the losses so they are on the 750,000 retention level by using ILFS.  
-Adjust losses to account for the change in workers. Sales staff will have fewer losses (injuries) than assembly staff  
-Adjust the exposures to account for inflation.  
-Adjust the losses to account for benefit changes related to inflation. As the workers get raises, the losses will increase.

OR

1. Cap the historical claims, select large loss load
2. Apply loss trend
3. Apply benefit level change adjustment
4. Apply exposure trend

- c. Look at the avg severity amount → claims/closed counts. The change in per occurrence retention could have an effect on severity.  
  
-Look at frequent triangle → claims/exposures. Change in production could have significant increases on frequency.

OR

1. Paid to reported claim counts to determine if there were any changes in claim settlement rate.
2. Average case outstanding per open claim to see if there were any changes in case outstanding adequacy.

**Exam 5 Question #23**

a. Avg case = Case/Open 13/1.05=12.38

Adj Avg Case (\$000)

|      | <u>12</u> | <u>24</u> | <u>36</u> |
|------|-----------|-----------|-----------|
| 2010 | 11.791    | 19.048    | 25        |
| 2011 | 12.381    | 20        |           |
| 2012 | 12        |           |           |

(\$000) *Adj Rept = (Adj Avg Case x Open) + Paid*

|      | <u>12</u> | <u>24</u> | <u>36</u> |
|------|-----------|-----------|-----------|
| 2010 | 14,720.12 | 43,022.62 | 67,500    |
| 2011 | 16,964.29 | 47,600    |           |
| 2012 | 19,500    |           |           |

b. Original Avg Case

|    | <u>12</u> | <u>24</u> | <u>36</u> |
|----|-----------|-----------|-----------|
| 10 | 15        | 25        |           |
| 10 | 20        |           |           |
| 13 |           |           |           |

Adj Avg Case amounts are higher than original avg case amounts so adjusted case will ↑ resulting in ↑ reported amounts in earlier years, and lower LDFS, thus less IBNR. Unadjusted would overstate so adjusted will be lower than unadj.

OR

Whether the B/S case OS method produces higher or lower IBNR depends on how the trend in case reserves relates to the selected severity trends. If the case trend is higher, the adjusted amount will be higher in the B/S than development method. This will lead to lower CDFs, and lower IBNR amounts. Vice Versa if the trend in case OS is lower than the select severity trend.

**Exam 5 Question #24**

a) Paid S&S ATA

Select all year weighted avg.

|              |              |              |               |
|--------------|--------------|--------------|---------------|
| <u>12-24</u> | <u>24-36</u> | <u>36-48</u> | <u>48-ULT</u> |
| 1.6097       | 1.4894       | 1.000        | 1.000         |

e.g.  $1.6097 = (166 + 163 + 170) / (98 + 105 + 107)$

2012 ult S&S =  $(75) (1.6097) (1.4894) = 179.81$

b) Ratio SS/Paid

|    | <u>12</u> | <u>24</u> | <u>36</u> | <u>48</u> | <u>ULT ratio</u>             |
|----|-----------|-----------|-----------|-----------|------------------------------|
| 09 | 0.049     | 0.069     | 0.1       | 0.1       | 0.1                          |
| 10 | 0.05      | 0.071     | 0.1       |           | 0.1                          |
| 11 | 0.051     | 0.071     |           |           | $0.071(1.429) = 0.10$        |
| 12 | 0.03      |           |           |           | $0.03(1.4701)(1.429) = 0.06$ |

→ select 0.1

Select all yr weighted avg of ratios:

|              |              |              |
|--------------|--------------|--------------|
| <u>12-24</u> | <u>24-36</u> | <u>36-48</u> |
| 1.407        | 1.429        | 1            |

AY2012 S&S ult=  $(2985)(0.1)=298.5$

c. Ratio approach provides more stability, less subject to leveraging at early maturities

**Exam 5 Question #25**

a.

| <u>CY</u> | <u>PD ULAE</u> | <u>Pd claims</u> | <u>Reported claims</u> | <u>Ratio</u> |
|-----------|----------------|------------------|------------------------|--------------|
| 09        | 409            | 3625             | 17450                  | .0388        |
| 10        | 476            | 5875             | 23825                  | .0320        |
| 11        | 614            | 7950             | 30450                  | .0320        |
| 12        | <u>761</u>     | <u>10,375</u>    | <u>37,500</u>          | <u>.0318</u> |
|           | 2260           | 27,825           | 109,225                | .0330        |

Selected CY 09-12 Avg

Unpaid ULAE= .0330 (50% (16500 +10625))= 447.6

- 1) Pd ULAE/Avg (Pd claims and reported claims)
- 2) Pd claims + case ols +IBNER  
 $\simeq$  (assuming "year-end O/S IBNR" = IBNER)

OR

|    | Pd ULAE | Pd    | Reported = Paid + $\Delta$ case + IBNR |
|----|---------|-------|--|
| 09 |         |       | 5875+(10450-7575)+(7500-6250)=         |
| 10 | 476     | 5875  | 10000                                  |
| 11 | 614     | 7950  | 12500                                  |
| 12 | 761     | 10375 | 15000                                  |

ULAE / Avg(paid, reported)

|    |                      |         |
|----|----------------------|---------|
| 10 | 476/((5875+10000)/2) | =.05997 |
| 11 |                      | =.06000 |
| 12 |                      | =.06000 |

.0600 avg select

$$.06 \times .5 \times 16500 + .06 \times 10625 = 1132.5$$

IBNR

- b. It accounts for ULAE on reported but not yet paid claims. It is an adjustment to the classical technique. It is useful for cases like this where there is growing business + it is not steady state.
- c. A short coming of the classical method is the assumption that 50% of the ULAE is incurred when claims are opened and 50% of the ULAE is closed. This is not addressed by the kittel method. The problem is that the 50%-50% assumption is inflexible and doesn't distinguish between the cost of closing a claim and maintaining a claim.

OR

When inflation affects paid ULAE and claims differently

OR

Both assume 50% of ULAE is paid on opening and 50% on closing. This assuming is not always true.

### Exam 5 Question #26

- a. Perhaps case outstanding adequacy was strengthened for AY 2011, with no change in payment pattern. Thus the DFM (reported) is applying too-high DFs to reported losses and coming up with too high estimate of ultimate. If severity in the F-S technique includes reported losses' severity, then this will similarly produce a high result.

To verify produce triangles of average paid and average case OS. Look for a jump between 2010 and 2011 @24 months that is larger than the average increase in pd avg down the columns.

OR

A slowdown in the settlement pattern could have caused the differences as it would have applied the historic CDF's to a lower paid amount at early maturities.

-This could be tested by looking at the paid-to-reported claims ratios and the closed count-to-reported count if these ratios decrease for a given maturity for new accident years, this would support the reason.

- b. Discuss these questions with claims dept manager, and examine payment patterns to make sure they are consistent. If so, use a paid DFM or BF.

OR

The actuary should confirm there was a change to the settlement pattern and check if there were changes to the case strength. If there were changes the data could be adjusted using the Berquist Sherman technique the actuary should talk to the claims department to get insight into the process.

**Exam 5 Examiner's Report  
Spring 2013**

1.

- a. Most candidates answered this question correctly. A small number of candidates misread the problem and assumed that the provided vehicle counts were actually the exposures over the two year period, which caused the answer to be halved.
- b. Most candidates answered this question correctly. A small number of candidates misread the problem and assumed that the provided vehicle counts were actually the exposures over the two year period, which caused the answer to be halved. A few others calculated only the earned car-years for one of the evaluation dates requested.
- c. Candidates generally answered this answer correctly. A small number of candidates misread the problem and assumed that the provided vehicle counts were actually the exposures over the two year period, which caused the answer to be halved. Some candidates also provided the combined values for both Policy A & B instead of just policy B. Full credit was given to candidates that clearly identified the portion attributable to Policy B. A few others calculated only the written car-years for one of the evaluation dates requested.
- d. Candidates generally answered this answer correctly. A small number of candidates misread the problem and assumed that the provided vehicle counts were actually the exposures over the two year period, which caused the answer to be halved. Some candidates also provided the combined values for both Policy A & B instead of just policy B. Full credit was given to candidates that clearly identified the portion attributable to Policy B. A few others calculated only the written car-years for one of the calendar years requested.

There were also some candidates who weren't familiar with the concept of having negative calendar year counts in cases where a multiple-year policy was cancelled in a subsequent year. These candidates often got the 2010 value correct, but would either answer the 2011 value as 0 or 100.

2.

- a. In general candidates scored well. Some of the common errors were:
  - -1% trend (not annual)
  - Wrong trend period
  - 8.5% or 8.9% trend (using total WP or WP over EP)
  - Apply trend to WP
  - Calculating EP from WP instead of projecting the given EP



- b. A common error was to say the premium trend is used to bring historical premium to expected future cost level which is stating what the premium trend does but not why you'd do it. The other common mistake was to mention rate changes as part of the premium trend.
  - c. Candidates often compared average premium to total premium instead of historical premium to current level premium. The other common mistake was to compare written premium to earned premium instead of historical premium to current level premium.
  - d. Candidates scored very well on this part. When candidates missed points it was due to not responding to the actual question asked but instead describing how the issue could be addressed.
3. The question presented an analysis for a rate indication. The candidate was requested to provide 5 improvements for the analysis and briefly explain the purpose of each. Suggesting improvements to the company's operation did not address the question asked and did not receive credit.

The majority of candidates recommended and received full credit for at least four enhancements to the analysis. Many recommended and received full credit for five. Those that did not receive credit for all 5 recommendations didn't attempt an answer or suggested enhancements that did not improve the analysis. Additionally, some candidates confused various concepts (for example, "trend losses to ultimate"), provided a response that summarized prior enhancements, were too general in their recommended improvement, or simply identified a shortcoming in the analysis without offering an enhancement, and did not receive credit.

Candidates generally struggled to receive credit for briefly explaining the purpose of each recommendation; most candidates received less than full credit on four of the five explanations requested. Most candidates did not provide an explanation or attempted to give further explanation of the enhancement without explaining its purpose -- these did not receive credit. Many candidates restated a version of the original recommended improvement to the analysis in their explanation of the purpose (i.e. "Earned premium can be adjusted to the current rate level. This makes sure that all premiums are on-level."), which did not get credit for explaining the purpose of the bringing the premium to current rate levels.

4. Many candidates did not identify the need to adjust historical loss ratios for the future 2012 level. Some did not develop on-level-factors or apply them appropriately to the historical loss ratios, while others did not apply loss trend to the historical loss ratios. Some thought that the 2012 on-level earned premium was the only on-level adjustment needed, but this number was provided and the historical loss ratios still need adjustment for future levels. We also frequently saw misidentified loss trend periods (2 years instead of 3, 1.5 years instead of 1, etc.).
5. In general, this question was completed well although there were a couple common errors on this question.

1. Most candidates recognized an adjustment needed to be made for the commission change, but the adjustment wasn't consistently done correctly.

2. The trend period for losses and premium was often determined incorrectly. Although rates were in effect for 18 months, candidates are expected to know to properly determine trend period.

6.

- a. More than half of the candidates provided enough components of IBNR for both claims-made and occurrence to get full credit. Many candidates named only the pure IBNR component but did not state that it was the only difference between the policies. No credit was granted for candidates stating that Occurrence has IBNR and Claims-Made does not, because Claims-Made has IBNER, a component of IBNR.

Other candidates named additional components of IBNR, such as claims in transit or reopened claims. No credit was granted or deducted for these additional components, unless they were assigned incorrectly.

In general the majority of candidates seemed to understand the question and what was being asked. The most common mistakes were not including both Pure IBNR and IBNER in their contrast or simply stating that Claims-made has no IBNR.

- b. About half of the candidates received full credit for either some reference to Occurrence policies having claims reported further in the future at a higher cost level, or additional pricing risk associated with having to make a longer projection for Occurrence policies.

Several candidates received partial credit for showing a specific numeric example of lower costs, but without a full explanation of the cause.

Some candidates received no credit for simply stating that Claims-Made lack pure IBNR, or have no claims reported after the policy expiration, so the overall cost is less. However, these claims are balanced by claims reported from earlier accident years, such that it is the higher future cost levels (& additional pricing risk), not additional claims, that result in Claims-Made policies costing less than Occurrence policies.

Many candidates stated that Claims-Made policies have only one year of trend, or are fully settled &/or paid at the end of the year, while Occurrence policies have many years of trend. These responses received no credit, as it is the report lag that is shorter for the Claims-Made policies, not the settlement lag. Just like for Occurrence policies, inflation will act on Claims-Made policies for as long as the settlement lag lasts, which will likely be several years for a long-tailed line.

In general, a large number of candidates spent far too much time on this part. A simple statement with one or two sentences would have garnered full credit, but candidates seemed to misunderstand the intent and provided much lengthier responses – which cost them time and also increased the risk that they would misstate something resulting in only partial credit.

- c. About half of the candidates received full credit for some reference to Occurrence policies having claims reported further in the future.

Several candidates received partial credit for showing a specific numeric example of the higher impact, but without a full explanation of the cause.

Many candidates stated that Claims-Made policies have only one year of trend, or are fully settled &/or paid at the end of the year, while Occurrence policies have many years of trend. These responses received no credit, as it is the report lag that is shorter for the Claims-Made policies, not the settlement lag. Just like for Occurrence policies, inflation will act on Claims-Made policies for as long as the settlement lag lasts, which will likely be several years for a long-tailed line.

Similar to part B, we found that candidate provided much lengthier responses than was necessary for full credit.

- d. More than half the candidates received credit for stating any of the following for the provision: retroactive date, first-year claims-made policy (or second-year, etc.), or for describing the provision as a date restricting the mature claims-made policy to cover only claims occurring on or after that date.

Several candidates did not get credit for the provision because they incorrectly described it as the date on or after which claims must be reported for the claims-made policy, which is simply the effective date of the claims-made policy.

About half of the candidates received partial credit for the overlap description using either a written description or a diagram showing at least one occurrence & claims-made policies, and where the policies intersected as the overlap.

Several candidates did not get credit for the written overlap description because they did not mention both the reporting & occurring situation for the overlap to happen, or they did not assign them correctly.

Several candidates did not get credit for the diagram overlap description because they labeled one axis as AY with the Occurrence policy on the diagonal, which is incorrect. Other candidates did not get credit for the diagram because they did not identify the following: the axis labels, the occurrence and claims-made policies & the overlap.

In both the written response and diagram, several candidates received no credit for describing the overlap as happening when both the claims-made and occurrence policies were effective at the same time (rather than in a subsequent year), which would cause an overlap regardless of the type of policy.

Based on the responses of the candidates, it does seem that they understood the question part and formulated appropriate responses. Some candidates did spend more effort than necessary elaborating on the provision and overlap rather than 'briefly describing' them as requested.

- e. Most candidates received at least partial credit for stating either of the following for the provision: tail policy or extended reporting endorsement. Similar responses were also accepted, as long as either the tail or extended reporting period for the claims-made policy was included in the response.

About half of the candidates received credit for the gap description using either a written description or a diagram showing at least one occurrence & claims-made policies, and the area between the policies where the gap would be.

Several candidates did not get credit for the written gap description because they did not mention both the reporting & occurring situation for the gap to happen, or they did not assign them correctly.

Several candidates did not get credit for the diagram gap description because they labeled one axis as AY with the Occurrence policy on the diagonal, which is incorrect. Other candidates did not get credit for the diagram because they did not identify the following: the axis labels, the occurrence and claims-made policies & the gap (or alternatively, the area where the tail coverage would fill in).

In both the written response and diagram, several candidates received no credit for describing the gap as happening when both the claims-made and occurrence policies were effective at the same time, rather than in a subsequent year.

As with part D, candidates did demonstrate a strong understanding of what was being asked, but some provided responses that were more involved than needed.

7. This question was a straightforward calculation. The most challenging part for candidates was the part of the question where it stated that losses given were prior to the 7/1/11 benefit change, and that all accident years needed to be adjusted by the both benefit changes (the full amounts) for full credit.

The majority of candidates missed this subtlety and approached the question by adjusting each accident year by a different amount. A common mistake among these candidates was to treat the 7/1/11 benefit change as applying to policies written on or after 7/1/11 (question stated that it applied to losses on or after) and/or treat the 10/1/12 benefit change as applying to losses on or after 10/1/12 (question stated that it was applied to policies written on or after).

Several candidates correctly calculated the average benefit level for losses in each of the given accident years, but then multiplied the given losses by the average benefit level (rather than using the average benefit level to calculate a benefit level adjustment factor before applying).

8. Only a very small number of candidates received the full credit. One of the most popular mistakes is the incorrect trending periods. Very few candidates got it right. A significant portion of candidates missed the assumption that "All policies are annual and written on January 1" and therefore calculated the total trending period as incorrect 3.5 years. Another common mistake is the application of one step trending without any adjustment. Most candidates did not use two step trending or one step trending plus onetime adjustment to account for the underwriting guidelines change. Regarding the loss development part, most candidates got it correct. A small percentage of candidates misread the ultimate LDFs provided in the question as age-to-age factors. Almost all candidates understood the correct trend factor calculation  $(\text{freq} * \text{sev})^{\wedge} \text{trend period}$ . They also understood the projected ultimate loss is calculated by multiply the incurred loss by the loss development factor to ultimate and trend factor. About 10% of all candidates did not attempt the question (having a blank or almost blank answer sheet).
9.
  - a. Many candidates received full credit for this question. When there was an error committed, candidates either used the permissible loss ratio as the experience loss ratio or flipped the variable and fixed expense percentages.
  - b. Many candidates had trouble with this question. The answer was a verbalization of part a of this question. Many didn't realize this and tried to define fixed and expense rather than stating how reflecting fixed impacted indication.

- c. The most common mistakes on this part was providing the similar responses twice, only defining fixed and variable expenses.
10. Generally speaking, the candidate pool did very well on both parts of this question.
- a. When candidates did make mistakes, the most common ones were:
    - 1. Only calculated the lifetime value of the expected total profit but did not calculate the expected premium (the denominator for the final ratio)
    - 2. Didn't apply cumulative persistency to the expected premium
    - 3. Incorrect discounting (for example, multiplying by 0.97 in year 2 instead of dividing by 1.03)
    - 4. Mathematical error (with credit given for the remainder of Part A in situations where the correct answer would have been calculated without the math error)
  - b. Candidates scored well on this part too, with credit was typically given for the following themes:
    - 1. The use of multiple policy years (i.e. "lifetime" of the policy)
    - 2. The use of persistency (i.e. "retention")
    - 3. Reflection of discounting
    - 4. Differences in expenses/losses for new business versus renewal business
- 11.
- a. Candidates needed to provide a brief description along with the characteristic they listed. Most candidates lost points for either no, or an insufficient, description of the characteristic listed. For example, a common insufficient answer is that "credit is discriminatory". Such an answer is not quite accurate, since all classification plan factors discriminate among insureds. Thus, a clarification of the nature of discrimination that causes concern is warranted. Some candidates mentioned concern that the age of homeowners relativities curve does not trend monotonically. Candidates who received credit typically mentioned lack of credibility in the youngest age group or the dissimilar direction compared to competitor relativities. However, the lack of monotonic relationship in and of itself was not accepted as a valid concern.
  - b. Many candidates did not provide a description commensurate with the point value assigned. In order to receive full credit, candidates needed to briefly describe at least three reasons to support their choice. Some candidates provided reasons for choosing a variable that contradicted the concerns listed in Part A, which lost them points. Often, candidates described reasons why they wouldn't choose other variables. Points were awarded when the reason a variable wasn't selected for one variable was a valid reason to select the chosen variable. For example, if the candidate didn't select loss prevention because it is difficult to verify and they were choosing credit score (which is not difficult to verify), points were awarded. However, if a candidate said they didn't select age of homeowner because of lack of credibility and they chose loss prevention (which has an issue with credibility),

points were not awarded. Many candidates who chose credit score lost points for saying the levels were “fully credible”, as opposed to “good credibility” which leads to a different discussion and also lead to candidates losing points in Part C.

- c. To receive full credit, candidates needed to correctly calculate the full credibility standard, calculate the credibility using the square root rule, calculate the company indicated relativities, credibility weight the company relativities with the competitor relativities, and finally re-base the credibility weighted relativities. The most common mistake here was claiming full credibility, not recognizing that the 400 full credibility standard refers to claim count and not exposure. For candidates who calculated the indicated company relativities relative to the total pure premium, a common mistake was not calculating the revenue neutral competitor relativities as well. Additionally, some candidates missed the instruction to use the competitor’s relativities as the complement of credibility.
12. In general, the response to this question was poor. Many candidates recognized the small data volume but incorrectly went about combining alarm types or deductibles into one category. This was often accompanied by a calculation of a proposed factor by weighted the GLM output. Time was unnecessarily lost by this calculation. Another common error was candidate’s often recognized unintuitive output that seemed to be the result of sparse data but yet still proposed to select the predicted factor.
  13. Many candidates received full credit on this question. Some common mistakes that were made on this problem:
    - Forgetting fixed expense is in the numerator.
    - Treating the loss elimination ratio as the excess loss ratio. If the candidate used the incorrect LER “correctly” (applied the deductible processing and credit risk loads to the losses under the deductible, the excess risk margin to the losses above the deductible, and used the losses above the deductible in the numerator) candidates still received some partial credit.
    - Applying the ALAE % to excess losses.
  14.
    - a. Candidates not receiving partial credit on often restated the same item twice or two sides of the same item. To receive full credit, 2 separate ideas were necessary.
    - b. On part b, very few candidates only received partial credit. Examples of full credit statements include:
      - “An insurer’s retention may decline if a rate cap is not adopted.”
      - “State laws may require a maximum rate change be followed for all policies.”
  15. This question was answered poorly with few candidates receiving full credit.

- a. In order to get full credit, candidates would need to calculate the basic premium and retrospective premium correctly, and calculate and apply the maximum/ minimum premium.

The common errors included:

- incorrectly calculating the capped losses
  - when calculating the basic premium, applying factors to adjust the net insurance charge that was provided in the question
  - incorrect basic premium formula
  - not applying the max/ min premium
- b. Candidates did better on this part. The most common error was to provide reasons that the premium could increase, as it was already at the maximum level. However, if candidates incorrectly calculated the retrospective premium in part a, and produced a number that was in between the min and max, we did award them full credit in part b if they stated that premium could rise or fall.

16.

- a. Most candidates were able to properly apply development factors, while not everyone reflected the seasonality in the data. Some of the common mistakes were as follows:
  - Developing the 6 month closed claims for the first half of the year instead of the 12 month closed claims.
  - Failing to reflect seasonality.
  - Applying 1<sup>st</sup> half factors to the 2<sup>nd</sup> half closed claims and vice-versa
  - Only calculating the ultimate claims for one half of the year
- b. Most candidates were able to recognize the seasonality. A significant number also recognized the exposure growth and shifting of average accident date. A common mistake was to misinterpret the question as referring to development age (6, 12, 18, etc vs 12, 24, 36, etc). This resulted in many responses along the lines of making the LDFs less leveraged.

17.

- a. About ½ the candidates received full credit on this question. The most common error was providing IBNR instead of total unpaid claims.
- b. Many candidates got partial credit on this question for only listing the “industry development/mix might not be like carrier development/mix” limitation. The other two limitations (large loss and leveraged) were not very common. There were several common limitations that did not receive credit, such as “this method only produces unpaid claims” or answers that made reference to the other case outstanding method (references to claims made policies).
- c. Many candidates got this question completely correct. A wide variety of answers were accepted, but did not give credit for candidates who said that the insurer had “limited” or



“thin” data. Credit was not given for candidates that referenced the other case outstanding method (references to claims made policies).

18.

- a. The majority of candidates received full credit. Those that didn't receive full credit typically lost points because they didn't differentiate between total claim versus unreported/unpaid claim.
- b. The majority of candidates received full credit. Those that didn't receive full credit were often mentioning the credibility calculation but were not mentioning to which method this factor would apply. Another common mistake was to weight Z with [Actual loss / reported / paid] instead of [Development Method Ultimate Loss/ reported / paid]
- c. The majority of candidates did not receive full credit. A common mistake for candidates was that they were mentioning situation where BF method was not appropriate instead of referring to a situation where credibility weighting assumption itself of BF method was not appropriate.
- d. The majority of candidates did not receive full credit. Most of the candidate identified the right method, but only a few had a clear explanation on why the reported method was more appropriate.
- e. Most candidates received full credit on this part.

19. Candidates generally performed well on the calculation portion of this question.

Some candidates did not calculate frequency (claim counts / payroll) and simply multiplied the average of 2010 and 2011 claim counts by a severity selection to determine 2012 ultimate claims. This does not account for the 2012 exposure levels and was not awarded full credit.

Some candidates calculated the ultimate loss indication correctly and subsequently lost points by failing to calculate the indicated IBNR associated with the ultimate loss. A small portion of candidates calculated the IBNR for all 3 accident years rather than just 2012.

Some candidates did not justify their selections, as specified in the question. Additionally, a portion of candidates simply wrote out their selection in words; for example, writing "select average of 2010 and 2011" does not constitute a justification and did not receive credit.

There were some candidates that spent time converting the percentage reported factors to loss development factors and subsequently multiplying by the claim counts and severities. The mathematical equivalent of dividing by the percentage reported could have saved the candidates time. A smaller portion of candidates used the percentage reported figures to create triangles of counts and severities that were unnecessary and subsequently not used in their solution.

Common mistakes included:

- Not using trend factors
- Not using loss development factors
- Applying loss development factors or trend factors to the incorrect year (for example, applying the 36-month factor to 2012 rather than 2010)
- Assuming that the inverse of the given percentage reported factors were age-to-age factors rather than age-to-ultimate factors

20. Candidates were supposed to evaluate Average Paid (and/or Outstanding) and Average Reported trends and compare them to the known severity of 5%. They should have noticed the increase in paid settlement and that reported trends matched the 5% severity. From there they were to conclude to use the reported method and not the paid. This conclusion should have been reached by evaluating changes (or lack of change) in both case adequacy and settlement rates.

Many candidates calculated Average Paid and Average Case severities, but did not calculate the Average Reported severities. Most candidates did calculate trend from year to year. Many of those lost credit by not making any statement on the stability or instability of the resulting trends. Also, comparisons of the observed paid severity to the outstanding severity, or the observed severities along the diagonal rather than down the columns of the triangle did not receive full credit.

Many candidates that only looked at average paid and case decided the change in trend of the case outstanding disproved using the reported method. But case alone is inconclusive in determining reported stability. Many of those candidates did not test for settlement rate changes, likely with the thought that they had identified the relevant piece of information to make their choice. Some candidates further went on to test the settlement rate but did not see how an apparent case adequacy change is influenced by a real settlement rate change.

Those that did calculate Average Reported often noticed that the year to year trend was stable and some of those mentioned that the trend was consistent with the 5% severity.

A large number of candidates went off onto a Berquist-Sherman technique or an "adjusted" reported methodology which was incorrect as the reported method without adjustment is the preferred method.

Full credit for the selection of the reported method was given if the correct choice was made or even if the words "select the reported method" and no numerical choice was made. If the candidate mistook the reported ultimate for incurred and then applied an LDF, or created their own LDF instead of using the ultimate given, full credit was still awarded. If they adjusted the reported triangle using a BS or other methodology and then developed to ultimate, no credit was given for selecting the reported method.

The question asked the candidates to choose between the paid and reported methods. Some candidates choose an average of them and got a number "Between." Since the reported was accurate and the paid was not candidates did not receive full credit.

- 21.

- a. Most candidates performed well , either applying the formula from the Friedland text or another reasonable estimation technique of expected loss emergence.
- b. Most candidates performed well , either applying the formula from the Friedland text or another reasonable estimation technique of expected loss emergence.
- c. Many candidates skipped this part. Some candidates focused on explaining the relatively minor difference in emerging reported losses while overlooking the more drastic difference in paid loss emergence. Other candidates described a scenario that would only partially explain the results derived in part a. and part b. Other candidates described scenarios that would result in the *opposite* results from those seen in part a. and part b., reversing the actual and expected losses. These responses generally received partial credit.
- d. Many candidates skipped part d. No credit was given for simply stating a reserve technique, as the question required the candidate to justify the technique. Some responses failed to link the response back to the scenario described in part c. as the question required.

22.

- a. Many candidates did not include a detailed discussion of how the changes in retention and / or risk profile would affect the data. Some candidates did not recognize that the actuary was working for a self insured client and not an insurance company; in these cases, some candidates said premium should be adjusted to current rate level, but the actuary would not have premium to use as an exposure base for the self-insured layer.
- b. Again, some candidates said premium should be adjusted to current rate level; however the actuary in the question would not have access to premium information for the self-insured layer.
- c. Some candidates discussed the need to review the data for changes in frequency and severity, but failed to identify diagnostics that could be used to test for changes.

23.

- a. A majority of the candidates received full credit on this part. When there were errors, the most common was calculation errors in the Acc Year 2010 at 24 months despite correct answers elsewhere in the final triangle.
- b. Many candidate provided answers that were factually correct but did not fully explain the issue at hand and/or the mechanics of the adjustment.

24.

- a. Most candidates received full credit. In limited cases, there were mathematical errors or no final calculation of the ultimate paid S&S.

- b. Most candidates received high partial credit. Very few candidates selected an ultimate ratio for accident year 2012 that considered ultimate ratios from prior years.
- c. Many candidates received full credit. Some of the common mistakes were not selecting a method by saying it does not matter and therefore not having a reason, or not giving a valid reason.

25.

- a. Candidates generally did not score well on this part.

Many candidates received partial credit for:

- using the average of paid and incurred losses in the denominator of the ULAE ratio
- selecting a ULAE ratio that was appropriate given the ratios calculated by year
- calculating the ULAE provision

Most candidates failed to properly calculate incurred losses as the sum of paid losses, the change in case reserves, and the change in IBNR. Errors made in the incurred loss calculation included simply adding paid losses to the year-end reserve values or not including IBNR. Some candidates did not properly use the average of paid and incurred losses in the denominator of the ratio. Additionally, many candidates calculated a ULAE ratio based on the sum of all years (a weighted average) instead of calculating the ratio by year to identify potential trends. Some candidates determined a ULAE ratio but did not calculate the ULAE provision. Finally, of candidates that did calculate the ULAE provision, almost all candidates failed to properly calculate the ULAE provision. The most common errors in this final step of the calculation included applying the ratio to the sum of year-end case reserves and IBNR for all years, or applying the ratio to 50% of case reserves and 100% of IBNR, despite the question clearly identifying the policy as being claims-made.

- b. Most candidates received either no credit or partial credit on this part. Many candidates failed to describe the purpose of the Kittel adjustment, and simply mentioned that the adjustment used the average of paid and reported losses in the denominator of the ratio. Candidates receiving partial credit failed to mention that the adjustment is intended to improve upon the classical method in the case of growing lines of business.
- c. The majority of candidates who attempted this part provided an acceptable response.

26.

- a. There were many potential causes to the discrepancy in the data – the most common responses were case reserve strengthening, claim payment slowdown, and the presence of an unpaid large loss. Credit was given to any explanation that made sense given the data.

In addition to stating a reason for the discrepancy between paid and reported methods, candidates received credit for explaining how the ultimates for some of the methods were

impacted instead of merely stating the result of reported method is overstated or paid method is understated.

A more complete answer would be giving case reserve strengthening as a reason and explaining how the same historical cdfs are applied to higher reported losses resulting in a possible overestimate

The question asked the candidate to propose “diagnostic tests” to verify the assumption. In order to receive full credit, candidates had to provide more than one test (some candidates only provided one test). In addition, some indication of how the diagnostic tests would be used to verify the assumption was required for full credit. Candidates did not receive full credit for simply listing tests without further explanation.

Other errors:

- Candidates assume a speed up in claim settlement when it should be a slowdown (candidates were able to receive points on the rest of the question with this answer).
  - Merely stating there was a change in claim settlement
- b. Some candidates listed diagnostic tests in part b but not in part a. For these candidates, credit was given in part a. for diagnostic tests listed in part b.

Many of the students gave only half the answer. They either explained what they would do to confirm their reason for the discrepancy without following-up with a solution or they would only give a solution. Full credit was awarded if the candidate indicated how their findings or confirmation steps will lead to a solution.