Group & Health Specialty Model Solutions
Fall 2015

1.

Learning Objectives:
The candidate will understand pricing, risk management, and reserving for individual long duration health contracts such as Disability Income, Long Term Care, Critical Illness, and Medicare Supplement.

Learning Outcomes:
The candidate will be able to identify differences between short-duration contracts and long-duration contracts, from the standpoints of pricing and reserving

Sources:
Individual Insurance, Bluhm

Ch. 4 Managing Antiselection (pages 103 – 107 for a, pages 99 – 100 for b & c)

Commentary on Question:
Most individuals received credit for the first half of the considerations for part A. Surprisingly, few individuals made a clear recommendation for a methodology and those that did typically did not indicate an internal anti-selection model.

Generally candidates that did well on the question were able to get full credit for part B.

Many individuals were able to explain the concept of Buydown Effect and Premium Leakage. Many had issues with the formula such as they reversed the signs. About half of candidates worked through the math to identify the claims necessary to calculate premium leakage. Very few, however, we able to use the values to calculate premium leakage correctly.

Solution:
(a)   Discuss the key considerations in modeling anti-selection and recommend a methodology for this situation.

Modeling considerations include:
1. Partitioning of the population: divide the insured population into healthy and unhealthy subsets based on expected claims.
2. Methodologies used to determine the cut-off line include:
   a. Choosing a CAST (durational) model,
   b. Choosing an external model
   c. Choosing an internal models

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1. Continued

> 3. Deterministic vs. Stochastic Models
>   a. Mean expected values are selected based on past experience in deterministic models, thus the results may not be reliable when significant changes occur or where there are big statistical fluctuations.
>   b. Stochastic models are more responsive to changing conditions but require more intense computation.
> 4. Markov Processes
>   Markov chain is created to project multiple subsets when further partitions are desired.
>
> Recommendation: Based on the assumptions provided, an internal antiselection models should be used in this case since we have an existing block of individual medical business where a decision is being made to change coverage as opposed to lapse coverage. Thus, a general CAST model is not appropriate; however a recommendation of a *modified* CAST model was accepted.

(b) Calculate the average expected premium for each plan in 2015, assuming 80% of the healthy insureds and 10% of the unhealthy ones in plan A will move to Plan B. Show your work.

Plan A Premium = **$8,280** = Old Premium * 15% Increase = $7200 * 1.15
Plan B Premium = **$7,286.40** = Plan A Premium * (1 - Buydown Impact) = $8,280 * (1 - .12) = $8,280 * .88

Plan B Preferred Members = 80% Move to Plan B = 80% * 400 = 320
Plan B Standard Members = 10% Move to Plan B = 10% * 600 = 60
Plan B Total Members = 320 + 60 = 380
Plan A Preferred Members = 400 – 320 (Moved) = 80
Plan A Standard Members = 600 – 60 (Moved) = 540
Plan A Total Members = 80 + 540 = 620

Average Premium = **$7,902.43** = (620 Plan A Members * $8280 Plan A Premium + 380 Plan B Members * $7286.40 Plan B Premium) / 1000 Total Members.

(c) Calculate the buy-down effect and the premium leakage that occurs in 2015. Show your work.

Plan A and Plan B Members before buy-down (2014) = 400 (Plan A) and 600 (Plan B)
2014 Average Incurred Claims = **$6,840.00** = Premium * Loss Ratio = $7,200 * .95
2014 Avg Std Incurred Claims = **$7,125.00** = 2014 Avg Inc Clms * (Total Members) /
(90% * Plan A Members + Plan B Members)

1. **Continued**

= $6,840 * (1000) / (90%(400) + 600) = $6,840 * 1000 / (960).

2014 Avg Prfd Incurred Claims = **$6,412.50** = 90% (Avg Std Claims) = 90% * ($7,125)
2015 Avg Plan A Std Claims = **$7,125** = 2014 Avg Std Clms * (1 + Trend) = $7,125 * (1 + 0%)
2015 Avg Plan A Prfd Claims = **$6,412.50** =2014 Avg Prfd Clms*(1+Trend)=$6,412.50*(1+ 0%)
2015 Avg Plan B Prfd Claims = **$6,091.88** = 2015 Avg Plan A Prfd Clms * (1 - Actual Prfd Buy Down Impact) = $6,412.50 * (1 - .05) = .95 * ($6,412.50)
2015 Avg Plan B Std Claims = **$5,700.00** = 2015 Avg Plan A Std Clms * (1 - Actual Std Buy Down Impact) = $7,125 * (1 - .20) = .80 * ($7,125.00)
Weighted Average of 2015 Claims = **$6,651.90** = (80 * $6,412.50 + 540 * $7,125 + 320 * $6,091.88 + 60 * $5,700) / 1000

Buydown Effect = Total Lost Member Premium Dollars Due to benefit buydowns.
= Premium collected if no new Plan Options - Premium collected with new Plan Options and assumed distribution.
= Members * (Avg. Prem for Plan A in 2015 assuming all select this Plan - Avg. Prem with assumed distribution)
= 1000 members * ($8,280.00 - $7,902.43) = **$377,568.00**
Necessary Premium in 2015
= Premium in 2015 using assumed distribution * Rate Increase Needed for Target Loss Ratio.

Target Loss Ratio = 2014 Clms Trended / New Plan A Premium = $6840 * (1 + 0) / 8280 = 82.61%.

Needed Premium = New Average Claims / Target Loss Ratio = $6,651.90 / .8261 = $8,052.30 PM.

Premium Leakage:
Higher risk members are less likely to opt for lower benefit plans than lower risk members.
Therefore impact is due to buydowns having lower overall effect due to antiselection in buydown behavior.

= Necessary Premium in 2015 - Actual Premium Collected in 2015
= 1000 * ($8,052.30 - $7,902.43) = $149,868.
$149,868 / $8,052,300 = 1.86%.

2. **Learning Objectives:**
Evaluate the risk associated with health insurance and plan sponsorship and recommend strategies for mitigating the risk.

Learning Outcomes:
The candidate will be able to complete a capital needs assessment:
- Understand capital needs for a given insurer
- Determine actions needed to address issues identified by assessment
- Describe components of an Economic Capital model

Sources:
Financial Enterprise Risk Management, Sweeting
Chapter 18

Commentary on Question:
Commentary listed underneath question component.

Solution:
(a)   Describe the key components of a definition of economic capital.

   Commentary on Question:
   Students generally did well on this part.

   Economic capital is additional funds needed to cover adverse situations at a given risk tolerance for a specific time horizon.

(b)   Compare the advantages of an internal capital model and a generic capital model.

   Commentary on Question:
   There were quite a few items that you could list, you didn't need to list all of the items to get all of the points.

   Internal Capital model:
   1. specific to the company's unique goals
   2. can use more robust methods of forecasting
   3. can use sensitivity testing of assumptions and scenarios
   4. practical considerations can be costly

   Generic Model:
   1. Usually factor based and formulaic
   2. can easily compare different companies
   3. regulators and rating agencies are familiar with it
   4. easier and cheaper to calculate

2. Continued

(c) Describe the differences between the Factor Table and Stress Test approaches when testing economic capital models.

Commentary on Question:
This was a little more nuanced.

The stress test allows varying assumptions and ranges of outcomes. This can reveal whether more or less capital should be held. Stress test can be deterministic or stochastic. The factor table applies a factor to each risk and may be good for comparing between firms.

(d) Determine which of these projects generates

(i) the greatest Shareholder Value and

(ii) the greatest Shareholder Value Added.

Show your work.

Commentary on Question:
Most people did well, getting all of the calculations correct and listing formulas. The hurdle rate and the growth rates were mixed up, giving negative values for the solutions. Graders gave full points for the correct application of the formulas.

1. Shareholder Value as SV = (rA – rG)/(rH – rG) x EC
2. SVA = SV– EC.
3. Shareholder Value for Project A = -35M, SV for Project B = -60M
4. Shareholder Value Added for Project A = -35M - 70M = -105M, and similarly -100M for Project B.
5. Project A has the greater SV, while Project B has the greater SVA

(e) Using the Euler capital allocation principle, determine if the current distribution of economic capital allocated to each of the projects is reasonably optimized, or suggest a better allocation of capital. Show your work.

Commentary on Question:
Most candidates missed the formula and calculation portion of this question. Partial credit was given for understanding the general idea.

Euler capital allocation principle is an approach to allocating the diversification benefit of adding a new block of business. It is the most complex yet fairest approach.

2.   Continued

F(L) = sum(k dF(k,L)/dk, and if the std dev of losses is the risk metric, this leads to
dF(L)/dk = (see study note for formula)
1.4/1.25 = 1.12 for A, .9/1.25 = .72 for B.
A economic capital/B economic Capital = 70/40 = 1.75, but Euler metrics are
1.12/.72 = 1.56, therefore allocate less to A .

3. **Learning Objectives:**
The candidate will understand an actuarial appraisal.

Learning Outcomes:
The candidate will be able to:
- Differentiate the components of an actuarial appraisal versus an embedded value.
- Describe an approach for preparing and actuarial appraisal.
- Describe risks associated with interpreting an actuarial appraisal and an embedded value.

Sources:
GHS-109-14, page 4
GHS-109-14, pages 5 – 12
GHS-109-14, pages 9-10
GHS-110-14, page 122

Commentary on Question:
Commentary listed underneath question component.

Solution:
(a) Describe the criteria that you as the actuary must meet to ensure that potential conflicts of interest are appropriately addressed before work on this project begins.

Commentary on Question:
Most students were well prepared for this section of the question, the majority were clearly able to identify the criteria an actuary must meet in order to perform the requested work.

- The actuary's ability to act fairly is unimpaired.
- There has been disclosure of the conflict to all present and known prospective Principals whose interests would be affected by the conflict.
- All such Principals have expressly agreed to the performance of the actuarial services by the Actuary.

(b) Identify and describe the components of your actuarial appraisal.

Commentary on Question:
Most students were able to answer this question in detail; however some students had difficulty identifying what was being asked. There were some students that listed the components of the actual report, rather than the components of the appraisal.

3. **Continued**

The components of the Actuarial Appraisal are the following:

<u>Adjusted net worth of the business as of the valuation date</u>, which includes
- Statutory Capital and Surplus
- Statutory Liabilities
- Non-admitted assets
- MV vs. Stat Value

<u>Value of the business in force</u>, which includes
- PV of Future Earnings at valuation date
- Model - using assumptions, validate starting inforce values

<u>Value of future business capacity</u>, which includes
- Calculated by PV of future after tax earnings on new business issued after valuation date

<u>Adjustment for the future cost of capital retained to support the business</u>
- Business being sold will need to be supported by capital and surplus as required by the NAIC RBC calculations (150% to 250%)

(c) Identify and describe the key assumptions that should be included and disclosed within the actuarial appraisal report.

Commentary on Question:
The majority of students answered this question with limited detail. Given the question was valued at 2 exam points, the graders were looking for a more thorough list and description of assumptions included in the actuarial appraisal. Students should have spent more time identifying and describing the assumptions.

The key assumptions that should be included, but not limited to, and disclosed in the actuarial appraisal report are as follows:
- <u>Policy Decrements</u> – Which includes lapse rates and persistency
- <u>Premium</u> - rate structure (age band vs. age step), modal distribution, family composition
- <u>Rate Increases</u> - amount, timing, applicability, downgrades
- <u>Claim Costs</u> - age curve, UW wear-off, trend, antiselection
- <u>Claims Reserves and Liabilities</u>
- <u>Unearned Premium Reserves</u>
- <u>Active Life Reserves</u>
- <u>Commissions</u> – Whether they are a % of premium or PMPM
- <u>Admin / Operational Expenses</u> - % of premium or PMPM
- <u>Federal Income Taxes</u> – how they impact the profit margin
- <u>Investment Income</u>

3.   **Continued**

- Reinsurance
- Appraisal Discount Rates

(d)   After performing your actuarial appraisal, you determine that the effective rate of return that could be achieved on this block is 7.0% per year.

    (i)   Describe in detail any formulas necessary for this calculation.

    (ii)   Determine whether this rate of return would be acceptable.

Justify your answer and show your work.

Commentary on Question:
Most students were able to accurately determine the required rate of return for LW. The question asked students to describe in detail the formulas used and some students lost grading points because they only calculated the formula, rather than describe why the formula was being used the description of the components of the formula.

Assuming Livewell's (LW) debt is 0%, using the Capital Asset Pricing Model (CAPM), we can determine the required rate of return, r_e, given the assumptions provided in the question.

$$r_e = r_f + \beta (r_m - r_f)$$

Where,
r_f is the risk free rate of return
r_m is the rate of return for the market
β is the risk factor relative to the market

Using this formula, $r_e = 2\% + 2.5 (6\% - 2\%) = 12\%$

Given the required rate of return for LW is 12% using CAPM, the acquisition would not be acceptable as the effective rate of return is 7%.

4. **Learning Objectives:**
The candidate will understand and apply risk adjustment in the context of predictive modeling.

Learning Outcomes:
The candidate will be able to develop and evaluate risk adjustments based on commonly used clinical data and grouping methods

Sources:
Health Risk Adjustment and Predictive Modeling, Duncan
Chapter 4

Commentary on Question:
This question tests the candidate's knowledge of building a risk-adjustment model. Candidates receiving maximum credit provided a clear and concise justification for their responses/decisions.

Solution:
(a)   Identify the most common types of data that are available in building a risk-adjustment model.

     Commentary on Question:
     Candidates were given full credit for answers which simply listed the most common types of data that are available.

- Actual diagnosis/chart data.
- Medical claims data
- Self-Reported data
- Rx claims data
- Lab data when available

(b)   Describe the challenges in constructing a condition-based model.

     Commentary on Question:
     Candidates were given full credit for answers which listed and described the challenges.

- The large number of different types of codes and large number of procedure and drug codes.
  - With so many codes it's hard to keep the model updated with changes in medical practice. The change to ICD10 will introduce further challenges including matching data pre and post transition.

4. Continued

- The severity level at which to recognize the condition.
- The impact of comorbidities.
  - Two comorbid conditions together may cost more than the sum of each condition separately.
- The degree of certainty with which the diagnosis has been identified (confirmatory information).
  - Sensitivity versus specificity.
- The extent of coverage of the data.
  - Self-reported data won't usually cover all the members.
- The type of benefit design that underlies the data.
  - If, for example, the employee is part of a high deductible plan, certain low cost, high frequency services may not be reimbursed through the health plan and therefore not generate the necessary claims-based diagnoses.

(c)   Construct a code grouping system for the codes given above using exactly four severity levels, and calculate the average and relative costs of those severity levels using the average of all codes in each level. Justify your code groupings, and show your work

Commentary on Question:
Candidates were given full points for answers which grouped the codes into exactly four severity levels, calculated the averages of those four severity levels, calculated the relative costs of those four severity levels using the average of all codes in each level, justified the code groupings with an emphasis on cost, and showed their work.

Divide the codes into four severity levels:

Severity Level	Diagnosis Codes Included
1	402.11, 404.91, 428.20
2	402.91, 428.10,428.30, 428.90
3	402.01, 404.11, 428.40
4	404.01
Total	*All Codes*

4. Continued

Calculate the averages and the relative costs of the different severity levels.

Severity Level	Diagnosis Codes Included	Average Cost	Relative Cost
1	402.11, 404.91, 428.20	$16,467	55.2%
2	402.91, 428.10, 428.30, 428.90	$24,700	82.8%
3	402.01, 404.11, 428.40	$41,300	138.4%
4	404.01	$56,100	188.0%
Total	All Codes	$29,836	100.0%

An example justification of the groupings is below:

"I reviewed the codes for relative costs, and noted that there seemed to be clusters of average costs in the high teens, mid-twenties, high thirties/low forties, and above 50 thousand dollars in average PMPM expense. Expenses were included in the severity levels around these clusters, from 1 to 4. The only significant outlier that didn't fit well in any category was 428.30, which was put in severity level 2 as part of a judgment call."

Since this exercise is about financial risk adjustment, we gave more points for justifications that centered on grouping the conditions by cost.

(d)

    (i)   Calculate what Mr. Jones' new predicted cost would be after his condition changed, and

    (ii)   Calculate the difference between Mr. Jones' actual versus expected new cost.

Show your work.

Commentary on Question:
Full credit was given for those candidates who were able to use the framework they just created in a practical sense. The basic steps should be identifying any change in severity tier, scaling up Mr. Jones original claim costs by the relationship, and calculating the difference from the $35k actual.

Mr. Jones changes from severity tier 2 to 3. So expected cost would be $7,000 x (138.4% / 82.8%) = $11,700. Difference from expected is $35,000 - $11,700 = $23,300.