ERM-GH Model Solutions
Fall 2014

1. Learning Objectives:

5. The candidate will understand the concept of economic capital, risk measures in capital assessment and techniques to allocate the cost of risks within business units.

Learning Outcomes:

(5a) Describe the concepts of measures of value and capital requirements (for example, EVA, embedded value, economic capital, regulatory measures, and accounting measures) and demonstrate their uses in the risk management and corporate decision-making processes.

Sources:

Understanding ORSA before Implementing It – Shapella and Stein

Commentary on Question:

In general, candidates performed well on this question, demonstrating adequate knowledge of ORSA requirements and ERM practices. Most of the candidates understood the benefits to Humber's risk management - part (b) - and many received full credit. Many candidates performed better in part (a) than in part (c).

Solution:

(a) Explain how Humber will need to adjust its current ERM practices in order to comply with the new ORSA requirements.

Commentary on Question:

The following list of three adjustments is an example of what would receive full credit for part (a). Some candidates stated the need to document but spent too much time providing details of the perfect or ideal ERM practice, rather than spending that time on explaining other adjustments that would be required. Some candidates stated that Humber would need to develop an economic capital model; however, an EC model is not an ORSA requirement, so an absolute statement to that effect did not receive credit. Candidates could receive credit for stating that Humber could look into developing an EC model.

1. Continued

(i) Humber will need to document the efficacy of its ERM functions. Humber will likely need to create a formal ERM function to look at the risks across the corporation; otherwise, it will be difficult to document sufficiently to get approval from regulators.

(ii) Humber may need to allocate additional resources to fully investigate the ORSA requirements - more regulatory reporting and more scrutiny.

(iii) Humber will need to conduct ORSA on a company-wide basis:
- Will need to aggregate risks at a company-wide level
- May require additional stress and sensitivity testing of balance sheet financials that the company doesn't now do corporate-wide

(b) Describe how complying with the ORSA requirements could benefit Humber's risk management.

Commentary on Question:
Candidates performed very well on this part and demonstrated that they understood the benefits. They received full marks if they provided two or more complete answers. The list below includes additional items for educational purposes.

- ORSA is meant to be qualitative as well as quantitative, so it is meant to foster a better Enterprise Risk Management framework. This would benefit Humber since the company may have blind spots given its current practices.
- Humber will be required to look at risks / issues important to or specific to the company.
- Humber will have increased awareness of the interrelationships between risks, especially between its two lines of business.
- Humber management will have increased understanding of the relationship between the overall risk exposure and the capital needed to support it and thus have increased capital efficiency.
- Humber management can integrate ORSA requirements into business decisions at the company level rather than just at the line of business level.

(c) Provide arguments for why Humber may not wish to purchase Horton's services.

Commentary on Question:
Below is a list of four arguments. Candidates received full marks if they provided three or more arguments with reasonable explanations. Other arguments besides those listed could receive points, if appropriate. A few candidates wasted time writing arguments in favor of the purchase, as opposed to only writing down arguments against.

1. Continued

1. ORSA will allow companies to implement according to the size and culture of their business.

- It allows a company like Humber to not necessarily have as full-blown a system as a large, internationally-active insurance company would have.
- Humber will incur additional costs and may require additional resources, but it will be in proportion to the size of their business.

2. ORSA will evolve over time and is not expected to be perfect immediately. Since Humber's risk management function will be new, on a group-wide basis, it will be able to evolve along with the evolution of ORSA requirements.

3. Companies do not necessarily need to have an EC model. Horton's package most likely includes an EC model designed for large companies, but Humber may not necessarily need to create this right away to satisfy the ORSA requirements.

4. Small companies like Humber do not need to compete with on the same basis as larger competitors.

- The cost of implementing ORSA should be commensurate with the riskiness of the business – group term products and individual term life products.
- Humber's ORSA should reflect the simplicity of its two primary lines of business.

2. Learning Objectives:

2. The candidate will understand the concepts of risk modeling and be able to evaluate and understand the importance of risk models.

5. The candidate will understand the concept of economic capital, risk measures in capital assessment and techniques to allocate the cost of risks within business units.

Learning Outcomes:

(2b) Evaluate how risks are correlated, and give examples of risks that are positively correlated and risks that are negatively correlated.

(5a) Describe the concepts of measures of value and capital requirements (for example, EVA, embedded value, economic capital, regulatory measures, and accounting measures) and demonstrate their uses in the risk management and corporate decision-making processes.

(5c) Apply risk measures and demonstrate how to use them in capital assessment. Contrast regulatory, accounting, statutory and economic capital.

(5d) Propose techniques for allocating/appropriating the cost of risks/capital/hedge strategy to business units in order to gauge performance (risk adjusted performance measures).

Sources:

ERM-101-12: Measurement of Modeling of Dependencies in Economic Capital (Ch 3-5)

ERM-119-14: Aggregation of Risks and Allocation of Capital (Sections 4-7)

Commentary on Question:

The question was designed to test candidates' understanding of a company's general risk budget profile and various approaches to capital allocation. Candidates are expected to be able to explain risk concepts such as diversification, demonstrate how different capital allocation methods work, comprehend the impact of the capital allocation methods on a company's businesses, and make reasonable recommendations.

Overall, candidates struggled with this question.

Solution:

(a) Describe how diversification helps Simcoe's risk management.

2. Continued

Commentary on Question:
To properly answer this question, a candidate needs to describe how diversification applies to Simcoe and helps Simcoe's risk management practice. To simply describe what diversification means was considered a weak answer. Being able to correctly calculate the diversification benefit alone did not receive full credit. Most candidates were able to state what diversification does in general but few candidates were able to make clear the concept of diversification as applied to Simcoe's risk profile.

Diversification is used to mitigate risk and replies on different levels of correlation between risks to be most effective in the minimization of a company's overall risk exposure.

- Simcoe is in multiple lines of business that are exposed to different risks.
- Being in multiple product lines helps Simcoe find natural offsets to its risks.
- Some of Simcoe's product lines have low correlation to each other, resulting in risk diversification benefits.

(b)

(i) Explain what the Shapley Value allocation method tries to accomplish in risk allocation and the assumptions underlying the method.

(ii) Calculate all missing table values below using the Shapley Value Method:

Commentary on Question:
- In subpart b-i, the majority of candidates attempted to explain the method but gave no statement regarding assumptions.
- Explaining the use of game theory and that Shapley Value is an average of multiple methods in b-i would get full credit.
- In subpart b-ii some of the candidates did not show their work; as a result, even though the answers were correct, they could not receive full credit.
- Many candidates made errors with the first-in calculation in subpart b-ii. Candidates who did show their work were able to earn credits for the remainder of the calculation process, if done correctly.
- The Committee acknowledges that there is a minor typo in the table shown at the bottom of page 2, where the Unscaled Discrete Marginal Contribution for A should have shown as 40.9 rather than 41.0. One candidate noted this discrepancy.

2. Continued

(i) Explanation

Shapley Value uses a combination of Pro-Rata and Discrete Marginal to spread the diversification benefit. Each business benefits from the diversification of being part of a larger whole, but also shares the diversification benefit with the other businesses. (Note: Candidates can use the game theory to explain. Shapley is an average of multiple methods.)

Assumptions

- Assumes there is a coalition and everyone participating is in agreement.
- Needs a whole number of players.

(ii)

Business	1st In Contribution (Pro-Rata)	2nd In Calculations		Last In Contribution (Unscaled Discrete Marg)	2nd In Average	Average Shapley Values
A	40.4	53.84	43.7	41	48.77	43.39
B	24.26	23.77	37.66	21	30.72	25.33
C	48.5	51.76	48.04	35.1	49.9	44.5
Total	113.2	129.4	129.4	97.1	129.4	113.2

Note that the 2nd In Average column was not required to be completed to answer the question as stated in the exam. It is shown here to help explain the calculation that is done to obtain the final answer.

1st in Contribution:

1st in Business A = Diversified Total VaR * (Standalone VaR_A / Undiversified Total VaR) = 113.2 x (50 / 140) = 40.4

1st in Business B = 113.2 x (30 / 140) = 24.26

1st in Business C = 113.2 x (60 / 140) = 48.5

2. Continued

2nd in Calculations:
For Business A:

- Business AB Allocation - 1st in Business B = Total VaR Excl. Business C - Pro-Rata VaR_B = 78.1 - 24.26 = 53.84
- Business AC Allocation - 1st in Business C = Total VaR Excl. Business B - Pro-Rata VaR_C = 92.2 - 48.5 = 43.7

(Note: The 2nd in calculations can be done in a different order. For example, first take out Business A in the first column and then take out Business B in the 2nd column, so it's possible to get different totals in the two 2nd in columns. But the "2nd In Average" would still be the same.)

For Business B:

- Business BC Allocation - 1st in Business C = Total VaR Excl. Business A - Pro-Rata VaR_C = 72.3 - 48.53 = 23.77
- Business BA Allocation - 1st in Business A = Total VaR Excl. Business C - Pro-Rata VaR_A = 78.1 - 40.44 = 37.66

For Business C:

- Business CA Allocation - 1st in Business A = Total VaR Excl. Business B - Pro-Rata VaR_A = 92.2 - 40.44 = 51.76
- Business CB Allocation - 1st in Business B = Total VaR Excl. Business A - Pro-Rata VaR_B = 72.3 - 24.26 = 48.04

Shapley Value = Average (1st In Contribution, Last In Contribution, Average 2nd In Contribution).
Shapley Value for Business A = Average (40.4, 41, Average (53.84, 43.7)) = 43.39
Shapley Value for Business B = Average (24.26, 21, Average (23.77, 37.66)) = 25.33
Shapley Value for Business C = Average (48.5, 35.1, Average (51.76, 48.04)) = 44.5

(c)

(i) Summarize the results of your calculations for the two alternative capital allocation methods, I and II, for the CRO.

(ii) Explain how each line of business leader may react to the potential change in the risk budgeting approach.

2. Continued

Commentary on Question:
In subpart (i), the answer we were looking for related back to the risk budgeting process and how the alternative methods would impact that process. However, the wording just asked candidates to summarize the results – so any appropriate summary could receive credit.

In subpart (ii), however, the question did ask about reactions to the change in risk budgeting. Many candidates made an error by comparing the methods to each other rather than to the current risk budget amount.

(i) Certain lines of business may now be outside of the prior set risk budgets depending on the approach chosen:

- Pro-Rata:

LOB A: Getting allocated less capital now.
LOB B: Getting allocated approximately the same.
LOB C: Getting allocated more capital.

- Shapley Value:

LOB A: Getting allocated less capital now.
LOB B: Getting allocated approximately the same, slightly more.
LOB C: Getting allocated more capital.

(ii) The line of business leaders are concerned with the potential change in the risk budgeting approach and the impact to their businesses and current risk management processes.

- LOB B and C will most likely be accepting or indifferent to a change whereas LOB A will resist the change due to having less capital to deal with the same amount of risk as it had before. Less capital means more likelihood of exceeding its budget.
- Impacts compensation for the business lines if performance is linked to the risk management, so managers won't want to switch if their compensation has the potential to be negatively impacted.

(d) Recommend one of the three approaches to set risk budgets for Simcoe. Justify your answer.

Commentary on Question:
Candidates were expected to select Shapley or to continue with Discrete Marginal, with adequate justifications. Pro-rata is considered a sub-optimal method, but if candidates justified their decision some credit was given. Some candidates chose their methods without giving a justification or by simply stating that it's easy to calculate; these answers were considered insufficient.

2. Continued

For Shapley:

- Allows some sharing of the diversification benefit between each sub-portfolio.
  - Some lines will partially subsidize others.
- No scaling is required.

For Discrete Marginal:

- Allows some sharing of the diversification benefit between each sub-portfolio.
- Need to scale marginal contributions to get back to the total.
- Approximation for continuous marginal.

3. Learning Objectives:

4. The candidate will understand the approaches for managing risks and how an entity makes decisions about appropriate techniques.

Learning Outcomes:

(4a) Demonstrate and analyze applicability of risk optimization techniques and the impact of an ERM strategy on an organization's value. Analyze the risk and return trade-offs that result from changes in the organization's risk profile.

(4c) Demonstrate means for reducing risk without transferring it.

(4h) Analyze funding and portfolio management strategies to control equity and interest rate risk, including key rate risks. Contrast the various risk measures and be able to apply these risk measures to various entities. Explain the concepts of immunization including modern refinements and practical limitations.

(4i) Analyze the application of Asset Liability Management and Liability Driven Investment principles to Investment Policy and Asset Allocation.

Sources:

ERM-112-12: Revisiting the Role of Insurance Company ALM within a Risk Management Framework

ERM-111-12: Key Rate Durations: Measures of Interest Rate Risks

Commentary on Question:

This question focused on whether candidates could apply and interpret Strategic Asset Allocation in the context of a Group Pension product line. Most candidates did not perform well on this question, indicating that they did not recall basic investment concepts such as Efficient Frontier and that they had not focused on this study material in their preparation.

Solution:

(a) Explain why the Approach 1 Efficient Frontier is above and to the left of the current portfolio.

Commentary on Question:

Many candidates stated the obvious conclusion of the graph rather than explaining the rationale.

Employing a broader set of investable asset classes in the expanded universe takes fuller advantage of the benefits of diversification to maximize portfolio efficiency as compared to the narrower asset universe of the current portfolio. New asset classes have higher potential returns as well as higher volatilities, but are not perfectly correlated with the other assets and thus can achieve higher excess portfolio return with lower volatility than the current portfolio

3. Continued

(b) Contrast the "bottom-up" approach used by the investment team in their SAA analysis to your holistic approach.

Commentary on Question:
Many candidates merely described the bottom up approach, but did not really contrast it to the holistic approach. Some candidates clearly did not know what was meant by the "holistic approach" as described in the study material and tried to answer the question based on the generic meaning of "holistic".

"Bottom up" focuses on assets backing reserves independent of surplus. Generally separate investment portfolios back reserves for each major liability type. These portfolios each have an objective of closely matching cash flows or duration of liabilities. The separate surplus portfolio is managed consistently with the goal of preserving capital.

"Holistic" considers the entire asset portfolio in aggregate, which includes assets backing liabilities plus segment surplus. This approach optimizes risk-adjusted returns within capital constraints and risk tolerance levels while simultaneously determining the most effective constraint for ALM.

(c) Construct a portfolio of zero coupon bonds that will replicate a $100 million Group Pension liability. Show your work.

Commentary on Question:
In general, candidates either answered this question very well, or not at all. The solution required more than $100 m in assets which meant that the company needed to borrow money. Many candidates mixed this up and talked about "lending" rather than "borrowing" and received less credit. Candidates could also receive full credit if they rebalanced the weights to eliminate the $15 million shortfall. A few candidates simply computed weights based on duration, which was not correct.

First compute Weights: W(i) = duration/term length or D(i) / T(i), i = 1,2,3,4,5
W(1) = D(1)/T(1) = 0.2/1 = 0.20
W(2) = D(2)/T(2) = 0.6/3 = 0.20
W(3) = D(3)/T(3) = 1.5/5 = 0.30
W(4) = D(4)/T(4) = 4.0/10 = 0.40
W(5) = D(5)/T(5) = 1.5/30 = 0.05

The sum of these weights exceeds 100%, so the balancing cash weight W(0) is derived from: 1 = W(0)+W(1)+W(2)+W(3)+W(4)+W(5)
W(0) = 1 – 1.15 = -0.15 which is a $15 m shortfall

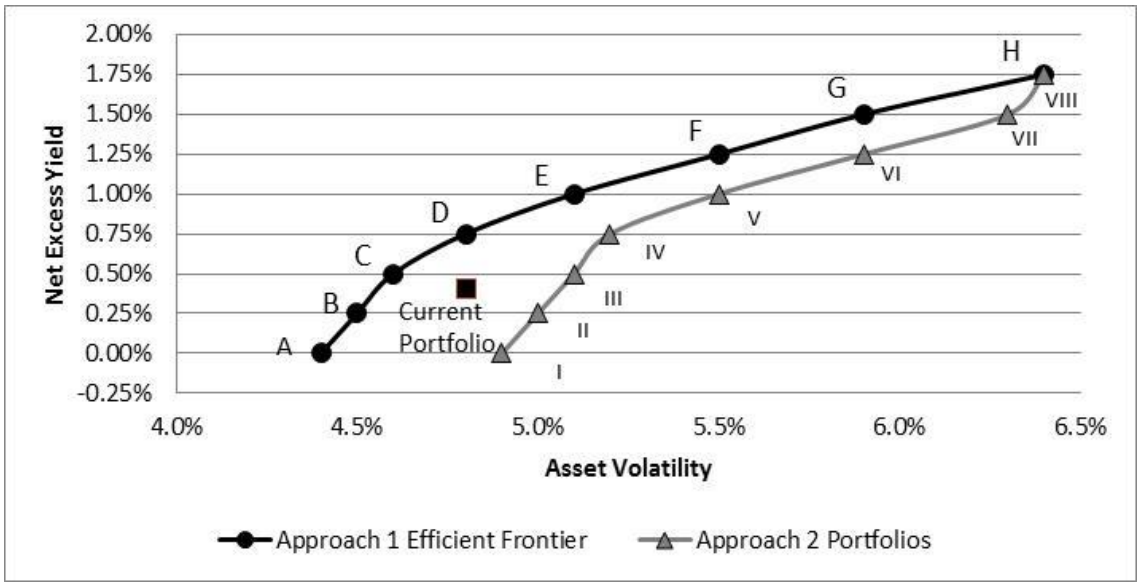
3. Continued

For $V = $100 million liability, invest $VW(i) in zero-coupon bonds maturing at 1, 3, 5, 10 and 30 years based on the weights above:
1-yr: $100(0.20) = $20 million
3-yr: $100(0.20) = $20 million
5-yr: $100(0.30) = $30 million
10-yr: $100(0.40) = $40 million
30-yr: $100(0.05) = $5 million

And finally, cash holding of $100(-0.15) = -$15 million, or short $15 million in cash, completes the liability replicating portfolio.

(d) Sketch approximately where you would expect the Approach 2 portfolios to fall on Chart 1 provided at the beginning of the question. Explain your sketch.

Commentary on Question:
In order to get credit the candidate needed to sketch Approach 2 relative to Approach 1. Many candidates lost points by sketching the graph without providing any explanation. Some candidates had Approach 2 above Approach 1, which was not correct. Some candidates did not follow the question direction (to use Chart 1) and instead changed the labeling of the x-axis to Surplus Volatility, which resulted in a loss of points.



In Chart 1, the risk metric is asset volatility; therefore, in this case the efficient frontier under Approach 1 outperforms Approach 2. Approach 1 is optimal since its efficient frontier was constructed to minimize portfolio asset volatility while Approach 2 minimizes surplus volatility.

3. Continued

(e) Recommend a new efficient portfolio to Yorkton management for each of (i) and (ii):

(i) Approach 1 Efficient Frontier, portfolios A through H

(ii) Approach 2 Efficient Frontier, portfolios I through VIII

Justify your recommendations.

Commentary on Question:
Candidates in general did very well on this question.

(i) While portfolios C through H have higher excess returns, of those, only portfolios C and D do not increase asset volatility risk. As portfolio D has the higher excess return of the two, portfolio D is the most efficient portfolio without increasing asset volatility risk.

(ii) While portfolios III through VIII have higher excess returns than the current portfolio, of those, only portfolios III and IV do not increase surplus volatility risk. As portfolio IV has a higher net excess than portfolio III, Portfolios IV is the most efficient asset mix that does not increase surplus volatility risk.

(f) Indicate how likely it is that each of Approaches 1 and 2 will meet risk management goals with respect to:

(i) Portfolio Risk

(ii) Surplus Risk

(iii) Economic Capital Requirement

(iv) Market Risk Diversification

Commentary on Question:
Candidates "overthought" this question and did not do very well. The question came almost directly from the source material, but candidates should have been able to reason to the answers if they didn't remember the source. In scoring this question, we looked for the candidate to specifically say something about Approach 1 and Approach 2 for each item. Note that the model answer explains "why" but the question does not ask for an explanation so no points were deducted if no reason was given.

3. Continued

(i) Approach 1 is more likely to meet the portfolio risk goal because it focuses on just the assets backing the product and is designed to minimize asset portfolio volatility. Approach 2 is less likely to meet a portfolio risk goal because it is focused on minimizing surplus volatility.

(ii) For the reasons given in (i), Approach 2 is more likely to meet the surplus risk goal than Approach 1. Approach 1 does not focus on surplus.

(iii) Approach 2 is more likely to meet the economic capital requirement goal. Approach 1 is not likely to meet the goal because it only looks at portfolio volatility.

(iv) Approach 2 is more likely to meet the market risk diversification goal than Approach 1, which has a goal of minimizing portfolio volatility. Approach 2 captures the market risk of the liabilities. Approach 1 may be more likely to meet diversification goals than the current portfolio, but not as well as Approach 2.

4. **Learning Objectives:**

2. The candidate will understand the concepts of risk modeling and be able to evaluate and understand the importance of risk models.

3. The candidate will understand how the risks faced by an entity can be quantified and the use of metrics to measure risk.

Learning Outcomes:

(2a) Demonstrate how each of the financial risks faced by an entity can be amenable to quantitative analysis including an explanation of the advantages and disadvantages of various techniques such as Value at Risk (VaR), stochastic analysis, and scenario analysis.

(2c) Analyze and evaluate risk aggregation techniques, including use of correlation, integrated risk distributions and copulas.

(2e) Evaluate the theory and applications of extreme value theory in the measuring and modeling of risk.

(2f) Analyze the importance of tails of distributions, tail correlations, and low frequency/high severity events.

(2g) Analyze and evaluate model and parameter risk.

(2h) Construct approaches to managing various risks and evaluate how an entity makes decisions about techniques to model, measure and aggregate risks including but not limited to stochastic processes.

(3a) Apply and construct risk metrics to quantify major types of risk exposure such as market risk, credit risk, liquidity risk, regulatory risk, etc., and tolerances in the context of an integrated risk management process.

(3d) Analyze risks that are not easily quantifiable such as operational and liquidity risks.

Sources:

Financial Enterprise Risk Management, Sweeting

- Ch. 14 Quantifying Particular Risks

ERM 104-12: Study Note on Parameter Risk, Venter and Sahasrabuddhe

Value-at- Risk: The New Benchmark for Managing Financial Risk, Jorion, 3rd Edition

- Ch. 18 Credit Risk Management

4. Continued

Commentary on Question:
The purpose of this question was to test the candidate's ability to identify risks in using a particular actuarial model for a given catastrophic event. Candidates were asked to demonstrate knowledge of a Poisson model, decide if it was appropriate for the situation, then determine how this distribution compared to other risk assessment approaches.

Most candidates scored well on either the calculation part or the analysis part of the question. Few candidates were able to score well on both aspects. Candidates who tied their answers back to the windmill farm scenario received more points.

Solution:
(a)

(i) Demonstrate that the Maximum Likelihood Estimator (MLE) for the λ parameter of the Poisson distribution is equal to the sample mean.

(ii) Calculate the MLE for the λ parameter relating to natural disasters.

Commentary on Question:
In subpart (i) most candidates provided a partial demonstration, then jumped to the given answer that the mean was to equal the variance. In this case, partial credit was given for the steps shown that were correct. Most candidates received full credit for the subpart (ii) calculation.

(i) The derivation follows:

$$L(\lambda) = \prod_{i=1}^{n} f(x_i;\lambda) = \prod_{i=1}^{n} \frac{e^{-\lambda}\lambda^{x_i}}{x_i!}$$

$$\ln L(\lambda) = \sum_{i=1}^{n} \left[-\lambda + x_i \ln\lambda - \ln(x_i!)\right]$$

The maximum likelihood estimator can be obtained by taking the derivative, setting it equal to zero, and solving.

$$\frac{d}{d\lambda}\ln L(\lambda) = \sum_{i=1}^{n}\left[-1 + x_i/\lambda\right] = -n + \frac{1}{\lambda}\sum_{i=1}^{n} x_i = -n + \frac{n\bar{x}}{\lambda} = 0$$

$$\hat{\lambda} = \bar{x}$$

(ii) $\hat{\lambda} = \frac{2}{160} = 0.0125$

4. Continued

(b) You have confirmed that the risk premium assumed in the hurdle rate did not explicitly consider the risk of natural disaster.

(i) Assess whether the potential for natural disaster alters the decision on whether to accept this investment. Show your work.

(ii) Identify the shortcomings of using a Poisson approach for modeling the risk of natural disaster for this investment.

Commentary on Question:
The subpart (i) question asked candidates to "assess" and "show your work". The intent was that candidates would complete calculations or do some type of analysis in order to make the assessment. Many candidates did not show their work or showed very little. Candidates who only offered an opinion on whether the decision should be altered, without any analysis to support their claim, did not receive any credit. Candidates who drew a reasonable conclusion from incorrect calculations received some credit.

In subpart (ii) at least two appropriate shortcomings were required for full credit.

(i) Probability of no loss by end of year 5 = $\{[e^{(.0125*5)}]*(.0125*5)^0\}/0! = .9394$
Adjusted Beginning of Year 6 Cash Flow = $1,650 * .9394 = $1,550
Adjusted IRR = 25.39%

25.39% vs. 26.97% IRR is not a material enough difference to lead you to change the investment decision. The IRR still exceeds the hurdle rate.

(ii) Shortcomings of Poisson approach:
Sampling Risk - observed sample different than actual natural disaster probability
Model risk - natural disasters may not follow Poisson distribution
Insufficient parameter risk - something other than a natural disaster causes ruin
Want to model frequency and severity, which Poisson cannot do

(c) Explain the analogy between your estimation of ruin relating to natural disaster and credit default risk assessment.

4. Continued

Commentary on Question:
This part asked candidates to show their understanding of ruin modeling by relating it to the more common credit default risk. It was intended to be straightforward, but, for the most part, candidates did not seem to know how to approach the question. Credit was given to a wide variety of answers, as long as some attempt was made to relate the two. Candidates who made valid comparisons between the scenario and the credit default risk assessment approach were awarded full points.

Default credit risk is the risk of default by a counterparty. It is analogous to the risk of ruin by natural disaster.
Default credit risk can be measured by probability of default. This is analogous to the probability of ruin by natural disaster.

(d) Compare and contrast your use of the Poisson distribution to the following default risk assessment approaches:

(i) Credit migration models

(ii) Structural credit risk models

(iii) Altman Z-score

Commentary on Question:
Most candidates were able to accurately define the three approaches. However, only providing a definition did not answer the question and resulted in a small amount of partial credit being awarded. Candidates who compared these approaches to the Poisson model scored more points. Candidates could also receive points for comparing these approaches in the context of the natural disaster scenario, although this was not required (and was not necessary to obtain full credit).

(i) Credit migration models - Use transition matrices to infer default probabilities. Models are significantly more complex than the Poisson model. Unlike the Poisson model, Credit migration models do not have an underlying distribution.
(ii) Structural credit risk models give the probability of default based on an underlying asset value. These models and the Poisson both model the probability of occurrence.
(iii) Altman Z-Score uses a firm's financial ratios to determine a score, which is used to assess whether or not a firm has a high probability of becoming insolvent. The Poisson model was used to estimate the probability distribution of a firm becoming insolvent.

5. Learning Objectives:

1. The candidate will understand the types of risks faced by an entity and be able to identify and analyze these risks.

4. The candidate will understand the approaches for managing risks and how an entity makes decisions about appropriate techniques.

Learning Outcomes:

(1a) Explain risk concepts and be able to apply risk definitions to different entities.

(1b) Explain risk taxonomy and its application to different frameworks.

(1c) Identify and assess the potential impact of risks faced by an entity, including but not limited to market risk, currency risk, credit risk, counterparty risk, spread risk, liquidity risk, interest rate risk, equity risk, hazard/insurance risk, inflationary risk, environmental risk, pricing risk, product risk, operational risk, project risk and strategic risk.

(4d) Demonstrate how derivatives, synthetic securities, and financial contracting may be used to reduce risk or to assign it to the party most able to bear it.

(4e) Develop an appropriate choice of a risk mitigation strategy for a given situation (e.g., reinsurance, derivatives, financial contracting), which balances benefits with inherent costs, including exposure to credit risk, basis risk, moral hazard and other risks.

(4f) Analyze the practicalities of market risk hedging, including dynamic hedging.

Sources:

ERM-107-12: Strategic Risk Management Practice, Andersen and Schroder, 2010, Ch. 7: Strategic Risk Analyses

Financial Enterprise Risk Management, Sweeting

- Ch. 16 Responses to Risk

Commentary on Question:

The goals of this question were

- *to understand, analyze, and address risks in a non-insurance company; and*
- *to understand, analyze, and apply different means of hedging, including financial derivatives.*

The five parts presented a range of difficulty: retrieval of information from the sources, analysis, and knowledge utilization. Most candidates successfully recalled information they had read, but as the question delved more deeply into applying those concepts to a real-life situation, the results were much more varied.

5. Continued

In the knowledge-utilization sections, there was no benefit to listing information from the sources that was indirectly related to the concepts involved; points were only awarded for demonstrating how the concepts related to the specific situation, and directly answering the specific question.

Solution:

(a) The CEO asks you to apply the PESTEL framework to identify the general environmental risks Poutine faces.

(i) Identify each of the risks considered in the PESTEL framework.

(ii) Provide an example for two of the risks identified above which are specific to Poutine.

Commentary on Question:
The PESTEL risks came directly from ERM 107-12. In subpart (ii), each example needed to tie an element of the list in (i) to an aspect of Poutine's situation in order to receive credit. Examples were needed for two risks to get full credit. The response below gives additional examples for educational purposes.

(i) Political, Economic, Social, Technology, Environmental, and Legal

(ii) Examples of answers for each risk:

1. Political issues:
   - Regulations intended to encourage use of "green" energy and discourage use of coal could make coal more expensive

2. Economic issues:
   - General economic conditions (interest rate, futures market, etc.) will affect Poutine's ability to trade

3. Social issues:
   - Protests about Poutine, since its business may pollute the environment around its factory, could lead to loss of business

4. Technological issues:
   - Another company adopts a new, cheaper technology to remove impurities in silver, and Poutine's customers choose to do business with companies using the new technology.

5. Environmental issues:
   - A natural disaster can greatly affect energy prices.

5. Continued

6. Legal issues:
   - Legal costs associated with lawsuits/potential breaking of laws will result in costs.

(b) Identify strategic risks Poutine faces if it implements the CEO's proposal.

Commentary on Question:
For full credit, at least two distinct risks needed to be identified. Candidates were not required to "explain", but they needed to provide enough description that it was clear what the risk was. The solution shows more risks than would be required for full credit.

- Poutine will still face fixed costs if it stops production, which would cause financial problems for the company.
- Competitors may seize the opportunity to become dominant players, known for serving their customers "in good times and bad".
- Restarting production could be expensive.
- There's no guarantee that the coal costs would later be less than the fixed refining fee, so Poutine may be out of its core business indefinitely.

(c) Explain how the CEO's strategy can be described as a financial derivative.

Commentary on Question:
Many candidates had trouble with this part of the question. For full credit, it was necessary to use the analogy of a call or a put, making a clear connection between the instrument and Poutine's specific situation.
The answer could be expressed in terms of a call, because Poutine would buy the coal only when the price was in the acceptable range, or a put, because Poutine would only provide its services when the cost of coal was in an acceptable range. Either approach was acceptable if the connection was explained well.

Very few candidates were awarded full credit for this question.

Income can be described as
- Revenue – Expenses = Fee Charged – Coal (variable) costs – Fixed Costs

When their coal costs are greater than the current cost / fee assessed for refining silver, the company shuts down production. Poutine will still incur its fixed costs when not in production and will need to make this up in the long run in order to stay viable. The strategy is similar to a call option on the Poutine fee with the strike price being the price of coal. The fixed costs are analogous to selling a bond.

5. Continued

(d)

(i) Describe how Poutine could hedge its risk exposure to changes in the price of coal with forward contracts.

(ii) Describe how Poutine could hedge its risk exposure to changes in the price of coal with futures contracts.

(iii) Explain whether you would recommend using futures or forward contracts as a hedging strategy. Justify your answer.

Commentary on Question:
For full credit, it was necessary to demonstrate knowledge of the difference between futures and forwards, make a clear connection to this specific situation, choose between futures and forwards, and justify that choice. Forwards were considered the preferred choice, but points were also given for futures if the reason was well-supported.

(i) Poutine could estimate the amount of coal it will need at a future date and contract with another party to sell Poutine that coal at a predetermined price. Poutine would then know ahead of time not only the cost of the coal but also the cost of the hedge, and could price its product accordingly. Forwards are non-exchange contracts, so they can potentially be customized to match Poutine's underlying assets and timing needs.

(ii) Poutine could estimate the amount of coal it will need at a future date and buy coal futures contracts on an exchange; knowing the future cost as well as the cost of the hedge would enable Poutine to price its product accordingly. There is generally more basis risk under futures, due to trying to fit contracts that are on the market to one's specific needs.

(iii) Forward contracts would be recommended, since the forward can be exactly customized to the risk (size, delivery date, etc.); futures contracts have virtually no flexibility and thus can result in a higher level of basis risk. Poutine needs this since they will not want cash settlement, and they have target dates and order sizes they will want to mitigate.

Alternative answer: Reasons for choosing futures over forwards:
There are administrative costs to set up and track forward contracts and additional costs of settling contracts and making changes to the forward contracts. Forwards involve more counterparty risk.

5. Continued

(e) You are asked to assess the CEO's shutdown strategy versus the CFO's hedging strategy.

(i) Identify the factors you would consider in choosing between the two.

(ii) Explain how these factors will inform your decision.

Commentary on Question:
Full credit was awarded for 3 well-described factors for which both the application to the specific situation and the role the factor would play in making the decision were well explained. The response below includes more factors than required for full credit.

(i) Production costs: the cost associated with stopping and starting the production process periodically

Price volatility: Is the volatility expected to continue or is it a rare occurrence?

Strategic risks associated with stoppage: loss of customers, employee morale

Hedging costs: will the hedging have any additional costs or require additional resources/expertise that would have to be incorporated into future pricing?

Reputational risk: stopping and starting could make customers think the company is in trouble, or at least undependable, employee morale

(ii) In making the decision, some factors can be quantified, such as production costs for start-up, hedging costs, and price volatility. Others need to be evaluated qualitatively and will have to be weighed based on the company's assessment of their importance. The strategic and customer risks should be given careful consideration as those could sink the company permanently.

6. Learning Objectives:

1. The candidate will understand the types of risks faced by an entity and be able to identify and analyze these risks.

Learning Outcomes:

(1a) Explain risk concepts and be able to apply risk definitions to different entities.

(1c) Identify and assess the potential impact of risks faced by an entity, including but not limited to market risk, currency risk, credit risk, counterparty risk, spread risk, liquidity risk, interest rate risk, equity risk, hazard/insurance risk, inflationary risk, environmental risk, pricing risk, product risk, operational risk, project risk and strategic risk.

Sources:

Financial Enterprise Risk Management, Sweeting

- Ch. 7 Definitions of Risk (primary source);

ERM-117-14: AAA Practice Note: Insurance Enterprise Risk Management Practices

Commentary on Question:

This question tested whether candidates understood the various risk categories and could apply them to the given situation. Most candidates did well on this question.

Solution:

(a) Classify each of the ten risk categories as High, Medium, or Low Importance for Yonge Life. Justify your choices.

Commentary on Question:

Most candidates did very well on part (a) of this question. The most commonly misunderstood risk was systemic risk. For full credit, candidates needed to classify each risk and justify the classification. All reasonable classifications with adequate justification were given full credit. The solution below is only an example of appropriate answers.

<u>High Importance:</u>

- Interest Rate Risk – High-yield bonds are sensitive to interest rates
- Liquidity Risk – High-yield bond exposure could pose problem if there is a market disruption and the company needs liquid funds
- Demographic Risk – Significant mortality exposure on term and recent experience has been poor; company has a large exposure to the US market

6. Continued

Medium Importance:

- Systemic Risk – Company is very dependent on US environment; risk could impact investments and reinsurance
- Credit Risk – Reliance on reinsurance where the single reinsurer could default; high-yield bond holdings may default
- Strategic Risk – Consistent management in place; Consistent strategy for multiple years that has been successful, but may indicate that strategy needs to be reviewed and updated

Low Importance:

- Market and Economic Risk – No real exposure to equities
- Non-Life Insurance Risk – Not applicable here due to being only in life insurance business
- Operational Risk – State-of-the-art technology, low turnover, and audited externally with no issues
- Foreign Exchange Risk – No direct exposure as all investments are domestic bonds

(b) Identify which risk categories would be of High Importance if Yonge Life makes the acquisition. Justify your choices.

Commentary on Question:
Many candidates performed well on part (b), but many did not provide justifications worthy of the full 2 points. For full credit, candidates were required to identify increases to strategic, operational, and foreign exchange risks as well as impacts to risks that had already been categorized as high in part (a).

Existing Risks
Investing in Chinese bonds continues to cause interest rate and liquidity risks. These bonds may not be as stable as the domestic US bonds.

Demographic risk continues to be high even though there is more geographical diversification, due to Yonge's inexperience with Chinese mortality.

Operational Risk
There is a completely new company to bring into Yonge's business operations: new people, processes, and technology to integrate. This will require a lot of due diligence and resources to ensure this happens without incident.

Strategic Risk
This is a big change in strategic direction. There are unfamiliar markets that may or may not be a good fit.

6. Continued

Foreign Exchange Risk

The company is incorporating management of new foreign assets and has little to no prior experience doing this. Additionally, profit and loss values will be affected by foreign exchange when Yonge brings the amounts into its financial results.

7. **Learning Objectives:**

2. The candidate will understand the concepts of risk modeling and be able to evaluate and understand the importance of risk models.

3. The candidate will understand how the risks faced by an entity can be quantified and the use of metrics to measure risk.

4. The candidate will understand the approaches for managing risks and how an entity makes decisions about appropriate techniques.

5. The candidate will understand the concept of economic capital, risk measures in capital assessment and techniques to allocate the cost of risks within business units.

Learning Outcomes:

(2a) Demonstrate how each of the financial risks faced by an entity can be amenable to quantitative analysis including an explanation of the advantages and disadvantages of various techniques such as Value at Risk (VaR), stochastic analysis, and scenario analysis.

(2c) Analyze and evaluate risk aggregation techniques, including use of correlation, integrated risk distributions and copulas.

(3a) Apply and construct risk metrics to quantify major types of risk exposure such as market risk, credit risk, liquidity risk, regulatory risk, etc., and tolerances in the context of an integrated risk management process.

(4a) Demonstrate and analyze applicability of risk optimization techniques and the impact of an ERM strategy on an organization's value. Analyze the risk and return trade-offs that result from changes in the organization's risk profile.

(5b) Define the basic elements and explain the uses of economic capital. Explain the challenges and limits of economic capital calculations and explain how economic capital may differ from external requirements of rating agencies and regulators.

Sources:

Financial Enterprise Risk Management, Sweeting

- Ch. 16 Responses to Risk

ERM-106-12: Economic Capital – Practical Considerations

Value-at- Risk: The New Benchmark for Managing Financial Risk, Jorion, 3rd Edition

- Ch. 5 Computing VaR
- Ch. 13 Liquidity Risk
- Ch. 18 Credit Risk Management

7. Continued

Commentary on Question:
This question tests candidates' understanding of the differences between various capital metrics, as well as knowledge of the two types of liquidity risk. Candidates were asked to apply that knowledge to different liability profiles and stress scenarios. The question was divided into four parts, each testing a different concept. Almost half of the question consisted of computation, with the remainder requiring explanation and analysis.

The question asked candidates to look at results from the standpoint of Hamsik, a reinsurance company, and it was continually made clear throughout the question that we wanted an evaluation from Hamsik's perspective. However, some candidates responded in terms of the ceding company rather than the reinsurer; they did not receive credit for those answers.

Solution:

(a) Explain why it is important for Hamsik Re to consider each of the three standalone capital measurements in its assessment of these contemplated transactions.

Commentary on Question:
Full credit on part (a) required an explanation of the purpose of each of the three standalone capital measurements, as well as recognition that Hamsik can't use a single one as the basis for its capital. Overall, candidates did well explaining each of the three measures, but in most cases they did not make the connections needed to tie them all together.

The three capital metrics serve different purposes. Hamsik must consider all of them in order to meet regulatory requirements, maintain its desired credit rating, and feel comfortable that it is holding enough capital for its risks, based upon its internal modeling.

RBC Capital reflects the minimum capital requirement the US regulator will require Hamsik to hold.

S&P Capital reflects the minimum capital required to obtain/maintain a desired credit rating (which is an important criteria used by Hamsik's counterparts to assess whether or not they want to enter into transactions with Hamsik).

Economic capital is a self-assessed capital level developed by Hamsik, reflecting the capital required to support a block of business with a given probability of default.

The capital required to support the contemplated transactions needs to reflect the greatest of these three metrics.

7. Continued

(b)

(i) Determine the value of ρ which equates the aggregate capital required under methods I and II.

(ii) Explain why this same ρ might not equate the aggregate capital required under methods I and II if S&P AA level capital were used rather than economic capital.

Commentary on Question:
To get full credit on part (b-i), candidates were required to set up the equation listed below and solve using the quadratic formula. While a number of candidates got all the way to the correct answer of 38.86%, many made minor setup and/or math errors. Partial credit was given in these situations. Regarding part (b-ii), candidates had difficulty giving a sufficient explanation.

(i) Method I: Aggregate Capital = sqrt(170^2 + 325^2 + 2*(-ρ)*170*325)
Method II: Aggregate Capital = (170+325)*(1-ρ)

Setting them equal:
sqrt(170^2 + 325^2 + 2*(-ρ)*170*325) = (170+325)*(1-ρ)
sqrt(134525 - 110500ρ) = 495 - 495ρ
134525 - 110500ρ = 245025 - 490050ρ + 245025ρ^2
245025ρ^2 - 379550ρ + 110500 = 0

Using the quadratic formula, ρ = 38.86% or 116.04%.
116.04% is not a reasonable value for ρ.
Therefore, ρ = 38.86%.

(ii) The correlation coefficient assumes linear dependence, which is not necessarily the case. The use of one correlation coefficient to equate different levels of required capital assumes that correlation is the same at all levels for which required capital may be set. However, risks may be more or less correlated at the different levels for which required capital may be set. As such, a correlation coefficient which would be appropriate when equating capital at a given level (say VaR(99.5%)) may not be appropriate at some other VaR level. We are not told the level used for the S&P capital or for Hamsik's internal economic capital, and they could well be different.

7. Continued

(c)

(i) Assess the liquidity risk profile associated with each block (i.e., Block A and Block B) from Hamsik Re's perspective.

(ii) Identify the more favorable of the two blocks from a liquidity risk profile perspective. Justify your response.

Commentary on Question:
To achieve full credit on part (c), the answer needed to contain an assessment of both asset (market) liquidity risk and funding liquidity risk. The majority of candidates provided a strong answer for asset liquidity risk. A much smaller number described the funding liquidity risk for each block.

(i) Block A:
Funding Liquidity Risk: This block is susceptible to policyholder cash demands (loans/withdrawals/surrenders), so risk is significant.

Asset Liquidity Risk: Assets are heavily weighted to private placements, which are more thinly traded, increasing liquidity risk.

Block B:
Funding Liquidity Risk: Relatively low given no ability for policyholder to accelerate payment of funds.

Asset Liquidity Risk: Assets are concentrated in Treasuries and high-quality Corporates, which reduces asset liquidity risk.

(ii) Funding Liquidity Risk: Block A has higher risk due to policyholder options to demand funds.

Asset Liquidity Risk: Given mix of asset classes described above, Block A has the worse profile. However, the relatively low economic reserve level relative to the statutory reserve may mitigate this risk to a large extent.

On balance, Block B has the better overall liquidity risk profile.

(d)

(i) Determine which of the two blocks would produce the more favorable LRR. Show your work.

(ii) Explain the shortcomings of Hamsik Re's approach to liquidity risk management.

(iii) Propose improvements to Hamsik Re's LRR approach.

7. Continued

Commentary on Question:
Part (d) was broken up into (d-i), which was largely a computational question, and parts (d-ii) and (d-iii), which required explanation. Regarding (d-i), candidates did very well, calculating the correct LRRs and coming to the right conclusion, that Block B produces the more favorable LRR. Results were mixed for (d-ii) and (d-iii). While most candidates explained several shortcomings and proposed multiple improvements, many of those responses did not address LRR or Hamsik's approach to liquidity risk management and therefore didn't relate directly to the question.

Answers shown below for (d-iii) in particular are examples and other appropriate responses received credit. For full credit in (d-ii) and (d-iii), more than one well-explained shortcoming and more than one well-developed improvement needed to be provided.

(i)

	BV_A	BV_B	Liquidity Haircut		A	B
- Private Placements	412	63	30%		288	44
- Treasuries	84	424	0%		84	424
- Corporates AAA	211	678	5%		200	644
- Corporates AA	134	233	10%		121	210
- Corporates A	99	144	15%		84	122
- Corporates BBB	155	152	25%		116	114
				(a)	894	1,558
				(b)	1,095	1,694
				LRR	82%	92%

Block B (92% LRR) produces a more favorable LRR than block A (82% LRR).

(ii)

- LRR is a function of the statutory reserve, which may be a measure of exposure but does not reflect funding liquidity risk.
- LRR ignores assets backing capital.
- LRR ignores the economic reserve, which is much lower than the statutory reserve for the UL block and is a better reflection of the policyholder liability.
- Finally, without additional management information, LRR is not an actionable metric in its current form.

7. Continued

(iii)

- A ratio should be constructed that is based on the stressed cash obligation over a period of time, as opposed to a percentage of the statutory reserve.
- Thresholds should be set to indicate when the liquidity profile is sub-optimal, as well as what corrective action should be taken when these thresholds are breached.
- The LRR should be supplemented with other metrics, such as a VAR based measure of realized losses upon accelerated disposition of assets assuming stressed market conditions.

8. **Learning Objectives:**

1. The candidate will understand the types of risks faced by an entity and be able to identify and analyze these risks.

3. The candidate will understand how the risks faced by an entity can be quantified and the use of metrics to measure risk.

4. The candidate will understand the approaches for managing risks and how an entity makes decisions about appropriate techniques.

Learning Outcomes:

(1a) Explain risk concepts and be able to apply risk definitions to different entities.

(1c) Identify and assess the potential impact of risks faced by an entity, including but not limited to market risk, currency risk, credit risk, counterparty risk, spread risk, liquidity risk, interest rate risk, equity risk, hazard/insurance risk, inflationary risk, environmental risk, pricing risk, product risk, operational risk, project risk and strategic risk.

(3a) Apply and construct risk metrics to quantify major types of risk exposure such as market risk, credit risk, liquidity risk, regulatory risk, etc., and tolerances in the context of an integrated risk management process.

(4a) Demonstrate and analyze applicability of risk optimization techniques and the impact of an ERM strategy on an organization's value. Analyze the risk and return trade-offs that result from changes in the organization's risk profile.

(4c) Demonstrate means for reducing risk without transferring it.

(4e) Develop an appropriate choice of a risk mitigation strategy for a given situation (e.g., reinsurance, derivatives, financial contracting), which balances benefits with inherent costs, including exposure to credit risk, basis risk, moral hazard and other risks.

(4k) Apply best practices in risk measurement, modeling and management of various financial and non-financial risks faced by an entity.

8. Continued

Sources:
Risk Appetite – Linkage with Strategic Planning;

ERM 513-13: Extending the Insurance ERM Criteria to the Health Insurance Sector

Commentary on Question:
This question tests the candidate's general understanding of risks and risk-mitigation strategies within the context of a health insurance company.

Solution:
(a) Describe the strengths and weaknesses for each of these four components of Lyon's ERM framework, specifically as they relate to AHA.

Commentary on Question:
Candidates did well on this part. In order to receive full credit, candidates needed to provide both weaknesses and strengths for each component of the ERM framework. Generally, there were more weaknesses than strengths.

The sample answer which follows has more responses than are needed for full credit. Full credit required 3 robust comments (either strengths or weaknesses) for each of the items (i) and (iv) and 2 robust comments for each of the items (ii) and (iii).

(i) **Risk Appetite**

Weaknesses

- It is not stated that the Board of Directors reviews the risk appetite statement.
- It is not stated that the risk appetite is consistent with shareholder goals.
- There are no qualitative statements about the broad risk appetite of Lyon and its consistency with overall strategy.
- Risk appetite is not broken down by risk category (e.g. life insurance, individual health, group health, etc.).
- Risk appetite is not defined specifically enough to insure consistency with appropriate risk limits.

Strengths

- The risk appetite statement has quantitative measures.

8. Continued

(ii) **Risk Tolerance**

Weaknesses

- No time horizon has been set for the capital adequacy measure.
- Acceptable risk-reward tradeoffs have not been defined.
- There is no backtesting of model assumptions.

Strengths

- Lyon has set risk tolerances linked to key risk measures, such as capital adequacy, earnings volatility, and agency rating.

(iii) **Risk Limits**

Weaknesses

- Lyon does not have risk limits that are specific enough to constrain individual activities at AHA. Lyon has one set of constraints that are used as risk limits, but could more properly be considered risk tolerances.
- Corrective action is not defined. More direction should be provided from Lyon.

Strengths

- Risk limits do apply to the affiliates individually, rather than merely applying across all affiliates in aggregate.

(iv) **Risk Culture**

Weaknesses

- Adherence to the ERM framework is only reviewed once per year.
- There are no quantitative measures of adherence to the ERM framework (e.g. gap between risk profile and risk tolerance, risk adjusted returns, risked adjusted value, etc.).

Strengths

- Lyon expects all employees to understand the ERM framework and openly discuss any issues, which will likely increase buy-in from affiliates.
- Risk adherence is incorporated in the compensation formula.

8. Continued

(b)

(i) Identify and describe two specific risks under each of I, II, and III that AHA must manage and that Lyon's ERM framework should address.

(ii) Rank the risks identified in (i) in order of importance to AHA. Justify your ranking.

Commentary on Question:
Strong papers generally provided some risks related to ACA, since the question specifically asks about concerns for AHA in 2014. The justification provided for the ranking of the risks identified for subpart (ii) is more important than the identification of the risks in subpart (i). In general, stronger papers typically ranked regulatory and pricing risks as the most important risks. However, full credit could be awarded for a variety of rankings, based on the candidate's justifications. Some candidates ranked the risk categories (i.e. pricing, operational, catastrophe) as opposed to the risks identified in subpart (i) and in these cases only minimal credit was awarded.

The model solution is not exhaustive. Candidates provided many other risks that were acceptable for full credit.

Pricing Risk

- **ACA Rating Restrictions** – ACA prohibits rating with respect to certain characteristics (e.g. gender, small group size, industry or occupation, health status) and has imposed limits on rating with respect to age and tobacco use.
- **Pent-up Demand** – Many people who were previously uninsured are now able to receive coverage and there may be a rush to use these new benefits, especially to treat pre-existing conditions.

Other possible pricing risks include, but are not limited to:

- The impact of the 3R's, and especially that of risk adjustment, is difficult to quantify.
- Medical underwriting is eliminated in the individual and small group markets.
- The field will be given more underwriting authority.

Operational Risk

- **ACA Compliance Project** – The project is behind schedule.
- **Provider Coding** – Providers may not code claims properly, which could preclude an accurate determination of a member's commercial risk score.

8. Continued

Other possible operational risks include, but are not limited to:

- Update of the AHA claim system might lead to compliance and customer satisfaction issues if claims are delayed or paid incorrectly.
- Fraud by providers, employees, or others.

Catastrophe Risk

- **Pandemic** – Widespread disease—or panic resulting from news of a serious communicable disease—could lead to a sharp increase in medical claims costs.
- **Natural Disaster** – A disaster in a geographic area with a high concentration of AHA members could lead to direct medical costs, or could cause providers to close their offices for a prolonged period of time, thereby straining the existing network.

Other possible catastrophe risks include, but are not limited to:

- Terrorist Attack – the immediate effects of which might be similar to those of a natural disaster.

Ranking

Note that the ranking provided below is one of many possible examples that would earn full credit. The justification is the critical component of the answer. Each justification must accurately describe the risk faced by AHA and must logically support the ranking relative to the other risks provided.

1. **Pent-up Demand** – It is very difficult to precisely quantify pent-up demand in 2014 pricing. Greater than expected demand could significantly increase medical cost, which is a major risk for a health insurer. Some mitigation may be provided by the 3R's; however, the commercial reinsurance fund is limited, the political viability of the risk corridor program is questionable, and risk adjustment may not help (and could even hurt AHA) if pent-up demand were significantly greater for the industry in aggregate.
2. **ACA Rating Restrictions** – The inability to rate using actuarially sound characteristics could lead to a serious imbalance between the risk assumed and the rate assessed. This could cause significant anti-selection, especially in 2014 during which the penalties for remaining uninsured are minor.
3. **Provider Coding** – Insufficient provider coding is likely to result in lower commercial risk scores, which would diminish the risk adjustment revenue received or increase required payments.
4. **Pandemic** – Although this risk is unlikely to materialize in any given year, should it occur, there could be an extreme increase in medical claims costs and severe strain to AHA's provider networks.

8. Continued

5. **ACA Compliance Project** – Although the project is behind schedule, major concerns are presumed to have been addressed and the remaining issues should either be resolved in time or are unlikely to cause any material repercussions.
6. **Natural Disaster** – Natural disasters rarely lead to a significant increase in medical costs. AHA's geographic diversification should also provide some immunization to severe financial hardship resulting from a disaster.

(c) Recommend risk monitoring metrics and approaches to setting risk limits for each of the risks you identified in (b)(i).

Commentary on Question:
This part of the question is concerned with how to monitor and set limits for the risks identified in part (b). Note that many candidates provided risk mitigation strategies, which is the topic of part (d). To earn full credit on this part, the answer must relate to risk monitoring and risk limits. In some cases credit was applied to part (d) for mitigation strategies that the candidate included in part (c).

A variety of responses were acceptable for full credit and the answer below is only one of many examples that would earn full credit.

Risk	Monitoring	Limits
ACA Rating Restrictions	Closely monitor demographic mix and variations with respect to pricing assumptions.	Require demographic diversification with respect to in-force premium by market.
Pent-up Demand	Monitor number of previously uninsured and utilization patterns.	Limit the proportion of previously uninsured AHA seeks to insure (indirectly through market participation, marketing efforts, etc.)
ACA Compliance Project	Require regular updates on the project status, including the status and ranking of importance of each deliverable.	Clearly communicate key deadlines, focusing first on the most important of the remaining deliverables.
Provider Coding	Compare actual risk scores with projected risk scores to identify possibly noncompliant providers. Audit a sample of their records to determine accuracy and sufficiency of coding.	Set coding accuracy thresholds required for providers to remain in network.

8. Continued

Pandemic	Monitor current incidence rates of influenza and other communicable diseases in AHA's markets.	Determine the amount of surplus required to sustain the company through a serious pandemic occurring within a specified time horizon.
Natural Disaster	Monitor geographic concentration of insured and provider networks.	Impose limits on geographic concentration of insured population. Limit excessive average proximity of providers within markets especially prone to disaster (e.g. coastal areas, earthquake zones).

(d) Identify strategies to mitigate each of the risks you identified in (b)(i).

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

A variety of responses were acceptable for full credit and the answer below is only one of many examples. The response given is much more complete than would be required for full credit.

- **ACA Rating Restrictions**
  - Closely monitor demographics and promptly update pricing assumptions.
  - File timely rate increases when appropriate.
  - Target marketing efforts to achieve desired demographic mix.

- **Pent-up Demand**
  - Limit Exchange participation in 2014, when pent-up demand is likely greatest.
  - Share risk with providers through capitation agreements.

- **ACA Compliance Project**
  - Clearly communicate who maintains ownership of project and tie compensation to completion.
  - Reassign ownership of project to a more capable, proven leader.
  - Remove any unimportant or non-urgent deliverables from project.
  - Consider outsourcing the project to a company that has more experience with ACA compliance issues (e.g., a consulting firm that has experience working on ACA compliance with other companies).

8. **Continued**

- **Provider Coding**
  - Provide coding training for providers.
  - Tie provider compensation to coding accuracy through bonuses or penalties.
  - Remove noncompliant providers from network.

- **Pandemic**
  - Promptly communicate with members during a pandemic to provide guidance related to prevention, vaccination, and effective treatment.
  - Purchase reinsurance to mitigate extreme losses that could result from a pandemic.
  - Shift some of the risk to providers through capitation agreements.
  - Maintain sufficient risk capital to survive a serious pandemic scenario.
  - Sell catastrophe bonds to shift risk of pandemic to capital markets.

- **Natural Disaster**
  - Communicate alternate medical treatment options and providers to members whose primary care providers have suffered disrupted operations.
  - Contract with provider groups that could be dispatched to locations impacted by disaster, in efforts to ensure availability of care, reduce emergency room visits, and minimize utilization of out-of-network providers.
  - Hold sufficient capital to absorb this risk under reasonably likely scenarios.

9. **Learning Objectives:**

1. The candidate will understand the types of risks faced by an entity and be able to identify and analyze these risks.

2. The candidate will understand the concepts of risk modeling and be able to evaluate and understand the importance of risk models.

4. The candidate will understand the approaches for managing risks and how an entity makes decisions about appropriate techniques.

Learning Outcomes:

(1a) Explain risk concepts and be able to apply risk definitions to different entities.

(1c) Identify and assess the potential impact of risks faced by an entity, including but not limited to market risk, currency risk, credit risk, counterparty risk, spread risk, liquidity risk, interest rate risk, equity risk, hazard/insurance risk, inflationary risk, environmental risk, pricing risk, product risk, operational risk, project risk and strategic risk.

(2d) Apply and analyze scenario and stress testing in the risk measurement process.

(4e) Develop an appropriate choice of a risk mitigation strategy for a given situation (e.g., reinsurance, derivatives, financial contracting), which balances benefits with inherent costs, including exposure to credit risk, basis risk, moral hazard and other risks.

(4k) Apply best practices in risk measurement, modeling and management of various financial and non-financial risks faced by an entity.

Sources:

ERM-511-13: PPACA 3R's Program Description

Commentary on Question:

This question tests the candidates' understanding of various rating provisions of the Affordable Care Act, with emphasis on the Risk Corridor program. Candidates are expected to perform several calculations and use the results to make strategic recommendations.

Solution:

(a) Critique the CEO's proposed strategy.

Commentary on Question:

Opportunities and risks associated with the CEO's strategies should be presented to support a conclusion. Full credit is possible for both favorable and unfavorable assessments of the strategy. Although the conclusion is subjective, it must be logically supported. Candidates generally did well on part (a).

9. Continued

- AHA is likely to attract a large market share, which could be advantageous due to:
  - Greater coverage of fixed expenses
  - Greater leverage over providers when negotiating network contracts
  - Greater name recognition, which may lead to increased business in the future
- However, the strategy could cause the following problems:
  - In order to negotiate provider fees down to the level needed to support sufficiently lower prices, AHA may have to narrow the network to such a degree that operational and reputational risks increase unacceptably.
  - Underpricing could lead to an explosion of membership, which could cause RBC strain
  - New ACA rate filing requirements could threaten AHA's ability to correct underpricing in a timely manner

Although there are risks associated with the CEO's strategy, AHA is sufficiently capitalized to withstand these risks. This strategy may be appropriate in light of the one-time opportunity presented to establish a dominant position in Ohio as the Exchange debuts.

(b)

(i) State any simplifying assumptions you will make in order to calculate a revised premium.

(ii) Calculate the revised premium. Show your work.

(iii) Calculate the contribution to fixed expense coverage and the profit at the premium rate calculated in (b)(ii). Show your work.

Commentary on Question:
A variety of simplifying assumptions is acceptable for subpart (i). These assumptions are directly considered in grading, but are also used to help graders understand subsequent calculations that might deviate from the published solution. Four appropriate assumptions were required for full credit. Most candidates did well on this part.

(i)

1. The increase of 20,000 members results in an increase of 120,000 member-months.
2. Expenses are not affected by the strategy imposed to reduce allowable costs.
3. Fixed expenses remain constant in aggregate, despite the increase of 20,000 members.

9. Continued

4. The target allowable plan cost of $250 includes quality improvement and health IT expenses
5. Taxes are zero.
6. Commercial risk adjustment is zero (or already incorporated in allowable cost).
7. Reinsurance is zero (or already incorporated in allowable cost).
8. Cost of capital is negligible (or incorporated in the expense assumptions).

(ii) Premium (pmpm) = $250 / 0.80 = $312.50

(iii) Membership

$$243{,}098 + 20{,}000 \times 12 = 483{,}098$$

Variable Costs (pmpm)

$$(\$30/\$353) \times \$312.50 = \$26.56$$

Fixed Costs (pmpm)

$$(\$35 \times 243{,}098)/483{,}098 = \$17.61$$

Profit (pmpm)

$$\$312.50 - \$250 - \$26.56 - \$17.61 = \$18.33$$

(c) Calculate the contribution to fixed expense coverage and the profit. Show your work.

Commentary on Question:
The crux of part (c) is the risk corridor calculation. Most candidates neglected this calculation entirely. No penalty was imposed for failing to floor the profit at 3% in the calculation of the risk corridor target amount. Answers are acceptable expressed in total dollars or per member per month (pmpm).

Target Amount (pmpm)

Premium Charged	$312.50
- Administrative Expenses	-($26.56 + $17.61) = -$44.17
- Profit (floored at 3% of premium)	-($312.50) (.03) = -$9.38
Target Amount (floored at 20% of premium)	$258.95

Risk Corridor Ratio
$282.40 / $258.95 = 109.06%

Risk Corridor Received (pmpm)

50% between 103% and 108% of target	(0.5) (108%-103%) ($258.95) = $6.47
80% above 108% of target	(0.8) (109.06% - 108%) ($258.95) = $2.20
Total	**$8.67**

9. Continued

Administrative expenses are unchanged from part (b).

Profit (pmpm)

Premium	$312.50
- Allowed Costs	- 282.40
+ Risk Corridor Received	+ 8.67
- Variable Costs	- 26.56
- Fixed Costs	- 17.61
Total Profit (Loss)	**- $5.40**

(d) Recommend the premium rate PMPM at which AHA should offer its Exchange product. Justify your answer.

Commentary on Question:
Responses were evaluated with respect to the supporting logic. Some candidates reasonably recommended aggressive pricing, while others reasonably recommended more conservative pricing. The answer given is a sample of an appropriate response.

AHA should offer this plan for an average premium of $312.50.

- This would position AHA to seize a large share of initial Exchange business in the first year.
- At this rate, the plan is expected to generate profits of $18.33 pmpm in its first year.
- Due to the risk corridor protection, AHA would only lose $5.40 pmpm in the extremely adverse scenario in which claims are 13% higher than expected.
- The business could be re-priced for 2015.