
SOCIETY OF ACTUARIES

Exam AFE

Advanced Finance/ERM

Exam AFE

AFTERNOON SESSION

Date: Friday, April 27, 2012

Time: 1:30 p.m. – 4:45 p.m.

INSTRUCTIONS TO CANDIDATES

General Instructions

1. This afternoon session consists of 6 questions numbered 7 through 12 for a total of 60 points. The points for each question are indicated at the beginning of the question. There are no questions that pertain to the Case Study in the afternoon session.
2. Failure to stop writing after time is called will result in the disqualification of your answers or further disciplinary action.
3. While every attempt is made to avoid defective questions, sometimes they do occur. If you believe a question is defective, the supervisor or proctor cannot give you any guidance beyond the instructions on the exam booklet.
2. Write on only one side of a sheet. Start each question on a fresh sheet. On each sheet, write the number of the question that you are answering. Do not answer more than one question on a single sheet.
3. The answer should be confined to the question as set.
4. When you are asked to calculate, show all your work including any applicable formulas.
5. When you finish, insert all your written-answer sheets into the Essay Answer Envelope. Be sure to hand in all your answer sheets since they cannot be accepted later. Seal the envelope and write your candidate number in the space provided on the outside of the envelope. Check the appropriate box to indicate morning or afternoon session for Exam AFE.

Written-Answer Instructions

1. Write your candidate number at the top of each sheet. Your name must not appear.
6. Be sure your written-answer envelope is signed because if it is not, your examination will not be graded.

Tournez le cahier d'examen pour la version française.

****BEGINNING OF EXAMINATION****

Afternoon Session
Beginning with Question 7

- 7.** (5 points) The compensation plan for Tubbs Life's CEO will be changed to one of the following alternatives:
- I. Flat salary plus bonus that is a function of Tubbs' stock price growth.
 - II. Flat salary plus bonus that is a function of the baseline company value (the present value of distributable cash flows), as projected by the actuarial department.

In both alternatives, the bonus is a material component of the compensation package.

- (a) (1 point) Describe two reasons why alternative I may not align the CEO's interests with those of shareholders.
- (b) (1 point) Identify three practices that would promote integrity in the calculation of the baseline company value in alternative II.

The CEO is planning to retire in two years, regardless of which plan is chosen. The CEO assumes that Tubbs' stock price follows a constant Price-to-Earnings ratio over time.

- (c) (3 points) For each compensation plan alternative (I and II), assess whether the CEO is likely to approve or deny the recommendation for each scenario below (A, B, and C) assuming the CEO acts solely to maximize her wealth. Justify each of the six responses.
 - A. Based on recent asset adequacy testing, the Chief Actuary recommends strengthening reserves toward the conservative end of a range of reasonable reserve levels.
 - B. The Controller recommends extending the amortization period for the capital expenditure for an administrative system Tubbs purchased a few years ago.
 - C. The Chief Financial Officer recommends issuing debt for the first time to support new sales. New policies exceed company profitability standards but will reduce company earnings in the coming year.

8. (13 points) Hamsik Bank operates exclusively in a small, unregulated jurisdiction. Hamsik's only product is a savings deposit account which:

- Credits a fixed interest rate for specified periods of time;
- Places some restrictions on depositor access to funds; and
- Offers a \$25,000 life insurance benefit free of charge to qualifying depositors.

The life insurance benefit automatically applies if the depositor has satisfied the minimum balance requirement for each of the past 365 days.

Currently Hamsik has 5,000 depositors that have qualified for the life insurance benefit. Over the two years since the first depositor qualified for the benefit, Hamsik has experienced a total of two claims.

Hamsik's balance sheet includes:

- Assets with book value of \$500 million, comprised of cash, short-term fixed income securities and long-term loans.
- Short-term liabilities of \$425 million, the aggregate deposit account balance.
- Required capital of \$5 million for default risk, determined as 1% of assets.

You are given $\Phi(1.96) = 0.975$ from the cumulative standard normal distribution.

The Hamsik management team has limited experience managing insurance risks and has hired you to advise them on the financial implications of the insurance program.

- (a) (1 point) Identify three recent regulatory developments which might encourage Hamsik to adopt financial reporting and management of its business on an economic basis.
- (b) (3 points) Describe changes to be made to the Hamsik balance sheet in order to restate it on an economic basis. Justify your changes.

8. Continued

Hamsik proposes using the Binomial approximation to the Normal distribution to calculate an additional capital requirement for the mortality risk, holding capital consistent with VaR 97.5. Hamsik estimates the annual claims rate as $(2 \text{ claims} / 2 \text{ years}) / (5,000 \text{ lives}) = 0.0002$.

- (c) (2 points) Calculate the required capital for mortality risk using this approach.
- (d) (3 points) Describe four concerns you have with the method used to calculate the mortality risk capital component in part (c).
- (e) (2 points) Recommend two ways in which Hamsik could better manage its exposure to the mortality risk associated with the insurance benefit it provides. Justify your recommendations.
- (f) (2 points)
 - (i) Describe each of the following approaches for calculating aggregate capital.
 - A. Correlation Matrix Approach
 - B. Copulas
 - (ii) List the advantages and disadvantages for each of these approaches.

9. (8 points) You are given the following balance sheet and related items for Cavani Corp (CAV), a public utility:

Date	31 Mar 2008	30 Jun 2008	30 Sep 2008
MV Assets	1,480	1,542	1,604
Short-Term Liabilities	400	424	449
Long-Term Debt	700	714	728
Stock Price (CAV)	47.12	43.55	38.68
Annual Dividend %	4.24%	4.59%	5.17%
σ_{CAV}	30%	32%	50%
VIX (S&P Volatility Index)	20.74	24.01	73.35

- σ_{CAV} is the implied volatility of Cavani stock derived from option prices with average maturity of 3 months.
- You are given the following values for the cumulative standard normal distribution, $\Phi(x)$:

x	0.500	0.800	0.900	1.000	1.645	2.000
$\Phi(x)$	69.1%	78.8%	81.6%	84.1%	95.0%	97.7%

- (2 points) Describe how structural credit risk models, like the KMV model, differ conceptually from reduced form credit risk models.
- (2 points) Compute the one-year theoretical expected default frequency (EDF) for Cavani as of 30 Sep 2008 under the assumption that asset values are normally distributed with standard deviation σ_{CAV} . Show your work.
- (3 points) Provide reasons why the EDF computed in part (b) may be overstated and reasons why it may be understated.
- (1 point) Describe how the approach taken in part (b) differs from the approach taken by the KMV model to determine an EDF for Cavani.

- 10.** (14 points) You work for Kootenai Indemnity, a start-up property-casualty insurer considering establishing operations either in a European country subject to Solvency II or in the U.S.

You are given the following information:

Liability Characteristics

Block of Business:	One-year policies, all issued on the same day; \$10 million single premium; Not geographically diversified
Claims Distribution:	Evenly distributed throughout the year
Average Length of Claim Settlement:	6 months
Loss and Claims Expense Ratio:	70%
Internal Model's Results:	Losses and claims expenses do not vary with interest rate levels

Distribution of Combined Losses and Claims Expenses

Probability	Combined Losses and Claim Expenses
95.00%	\$9,210,000
97.50%	\$9,525,000
99.50%	\$10,150,000
99.75%	\$10,950,000

Asset Characteristics (at time of purchase)

Assets:	Liquid, option-free high-quality corporate bonds
Time of Purchase:	At issue, including investment of capital
Book/Market Value:	\$13 million
Asset Duration:	2 years
Risk-Free Rate:	3% per annum

Kootenai will purchase no reinsurance and has no outstanding debt.

Question 10 Continued on Next Page

10. Continued

Defining U.S. required capital as 100% Company Action Level RBC, the U.S. balance sheet on the day that the policies are issued is:

<u>Assets</u>	<u>U.S.</u>	<u>Solvency II</u>
Bonds	\$13,000,000	
<u>Liabilities</u>		
Policy Reserve	\$7,000,000	N/A
Best Estimate Liability	N/A	
Cost of Capital Margin	N/A	
Unearned Premium Reserve	\$5,000,000	N/A
<u>Capital</u>		
Available Capital	\$1,000,000	
Required Capital	\$800,000	
Free Capital	\$200,000	

Regarding Solvency II, you are given:

SCR(PR) = the Solvency Capital Requirement for premium and reserve risk

SCR(CAT) = the Solvency Capital Requirement for catastrophe risk
= \$1,500,000

Basic SCR = $\left[\sum_i \sum_j \rho(i, j) \times \text{SCR}(i) \times \text{SCR}(j) \right]^{(1/2)}$, for $i = \text{PR}, j = \text{CAT}$

$\rho(\text{PR}, \text{CAT}) = 0.25$

Solvency II Valuation Parameters

Operational Risk Capital Charge: 30% of the Basic Solvency Capital Requirement

Required Return on Capital: 6% per annum

- (a) (1 point) Explain how to calculate the Solvency Capital Requirement of Solvency II using an insurer's economic balance sheet.

10. Continued

- (b) (7 points) Fill in the Solvency II balance sheet for the block at issue by computing:
- (i) Best estimate liability
 - (ii) SCR(PR)
 - (iii) Cost of capital margin
 - (iv) Available, required, and free capital

Show your work.

- (c) (3 points) Assume a market shock on the day following the policy issue day results in the risk-free rate increasing by 2% and credit spreads increasing by 1%. Assume that this market shock does not affect the required return on capital.

For each of the following regulatory capital regimes, describe and, where applicable, calculate the effect of the market shock on each line item of the balance sheet:

- (i) U.S.
 - (ii) Solvency II
- (d) (3 points) Identify three advantages and three disadvantages of each of the following regulatory capital regimes for Kootenai:
- (i) U.S.
 - (ii) Solvency II

- 11.** (5 points) Shoshone Life Insurance Company sells only term life insurance in the U.S., cost-effectively marketed via popular media and employer-sponsored intranet sites. The organization is very hierarchical, with centralized strategic control and decision-making. The company uses a formal, centralized ERM framework, including extensive strengths-weaknesses-opportunities-threats (SWOT) and scenario analysis.

Shoshone is planning to expand abroad to a new territory, which is an emerging world economic center. The expansion presents considerable added complexity and uncertainty compared to Shoshone's current business. However, the Board of Directors feels that establishing Shoshone quickly in the new territory is critical to its long-term success.

(a) (2 points)

- (i) Describe how Shoshone's current risk management framework may not be sufficient for the expansion.
- (ii) Describe elements of acting mindfully, which is a capability of High Reliability Organizations (HROs).

(b) (3 points)

- (i) Describe two approaches for creating strategic options.
- (ii) Recommend which of these approaches Shoshone should adopt. Justify your recommendation.

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12. (15 points) Russet Indemnity, a small P&C company, insures California households against earthquake losses. It is seeking to hedge its insurance risk using one of the following mechanisms:

- I. Stop-Loss Reinsurance with Yukon Gold Re
- II. Over-the-Counter (OTC) Catastrophe Options based on an index derived from worldwide earthquake experience
- III. Catastrophe Bonds based on an index derived from all California catastrophe losses

(a) (3 points)

- (i) Describe credit risk for each of I, II and III.
- (ii) Rank, from Russet's perspective, the credit risk of I, II and III from lowest to highest. Justify your response.

(b) (2 points)

- (i) Describe two techniques Russet can apply to reduce credit risk when choosing reinsurance.
- (ii) Describe why mark-to-market may not be an effective tool in mitigating credit risk when choosing Catastrophe Options.

(c) (2 points)

- (i) Describe the basis risk for each of I, II and III.
- (ii) Rank the basis risk of I, II and III from lowest to highest. Justify your response.

(d) (1 point) Describe one alternative that would reduce basis risk for Russet when choosing Catastrophe Options or Catastrophe Bonds.

12. Continued

- (e) (4 points)
 - (i) Define ex-ante and ex-post moral hazard.
 - (ii) Describe moral hazard for each of I, II and III.
 - (iii) Rank the moral hazard of I, II and III from lowest to highest. Justify your response.
- (f) (1 point) Describe what Yukon Gold could do to mitigate moral hazard.
- (g) (2 points) Regarding the Reinsurance option:
 - (i) Describe the two insurability conditions of earthquake risk from Yukon Gold's perspective.
 - (ii) Describe how Yukon Gold can construct exceedance probability curves and use them to analyze its risk on Russet's liabilities.

****END OF EXAMINATION****
Afternoon Session

USE THIS PAGE FOR YOUR SCRATCH WORK