SOCIETY OF ACTUARIES
Exam AFE
Advanced Finance/ERM

Exam AFE

MORNING SESSION

Date: Friday, May 1, 2009
Time: 8:30 a.m. – 11:45 a.m.

INSTRUCTIONS TO CANDIDATES

General Instructions

1. This examination has a total of 120 points. It consists of a morning session (worth 60 points) and an afternoon session (worth 60 points).

   a) The morning session consists of 5 questions numbered 1 through 5.

   b) The afternoon session consists of 6 questions numbered 6 through 11.

   The points for each question are indicated at the beginning of the question. Questions 1 - 3 pertain to the Case Study, which is enclosed inside the front cover of this exam booklet.

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.

Written-Answer Instructions

1. Write your candidate number at the top of each sheet. Your name must not appear.

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.

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.

CASE STUDY INSTRUCTIONS

The case study will be used as a basis for some examination questions. Be sure to answer the question asked by referring to the case study. For example, when asked for advantages of a particular plan design to a company referenced in the case study, your response should be limited to that company. Other advantages should not be listed, as they are extraneous to the question and will result in no additional credit. Further, if they conflict with the applicable advantages, no credit will be given.

Questions 1 - 3 pertain to the Case Study.
Each question should be answered independently.

1.   (*8 points*) You are reviewing three proposed actions with respect to Zoolander's term
portfolio.

       I.   YRT Reinsurance designed to protect against poor mortality experience.
The reinsurer in this case uses actuarial assumptions and profit margins
similar to what Zoolander used in pricing the portfolio.

      II.   Financial reinsurance that reduces capital strain for new issues, which
allows Zoolander to increase new business volume. This reinsurance
transaction effectively redistributes first policy year capital strain to future
years. This transaction is deemed to transfer enough risk that it qualifies
as reinsurance.

      III.   Attempting to reduce expense volatility for this block by utilizing a Third
Party Administrator (TPA) working for a fixed contractual amount to
administer policy transactions. Although expenses will be higher on an
expected basis, Zoolander's expense level would not be subject to
fluctuations in transactional activity (e.g., new business issues, lapses,
etc.).

    (a)   (*2 points*) You decide to use a conventional Discounted Cash Flow (DCF)
analysis to begin your review.

        (i)   Describe the Value of Equity and the Value of Firm. Compare these two
measures for Zoolander.

        (ii)   Explain how risk is typically reflected in the calculation of these measures.

    (b)   (*1 point*) Explain the four drivers of DCF value.

    (c)   (*5 points*) For each of the three possible actions (I, II, III) above:

        (i)   Explain the impact on each of the four drivers of DCF value identified in
part (b).

        (ii)   Explain the impact on Value of Firm.

        (iii)   Explain whether the action hedges firm-specific risk, hedges market risk,
or is a general risk management activity. Justify your answer.

2.   (*18 points*) As the CFO of Zoolander, you want to ensure effective management of Zoolander's interest rate risk. You are particularly concerned that Zoolander's ALM practices with respect to the GIC product line may be exposing Zoolander to significant, unmanaged interest rate risk.

In an effort to assess Zoolander's ALM practices with respect to its GIC product line, you have applied your key rate duration (KRD) model to Zoolander's GIC assets and liabilities as of year-end 2008. Results are shown in the following table:

	Key Rate Durations Terms in Years				
	1	**2**	**3**	**5**	**10**
GIC Assets	0.2	0.3	1.2	1.5	1.5
GIC Liabilities	0.1	0.2	0.9	3.5	0.0

You are given:

Market Value of Assets: 6,800 Million
Market Value of Liabilities: 6,600 Million

(a)   (*2 points*) Describe three sources of Zoolander's GIC interest rate risk exposure and cite a specific example for each.

(b)   (*2 points*) Explain the chain of events that would result from a spike in market interest rates and how those events could threaten Zoolander's surrenderable GIC products without MVA.

(c)   (*1 point*) Describe the limitations of Macaulay duration as an interest rate risk management measure for Zoolander.

(d)   (*1 point*) Calculate the effective durations of Zoolander's GIC assets and liabilities using the results of your KRD model. Show your work.

(e)   (*2 points*) Calculate Zoolander's GIC product line surplus and assess the effects on surplus value of the following spot curve shifts at years 1, 2, 3, 5, and 10.

(i)   Curvature shift: (+2.00%, +1.00%, 0.00%, +1.00%, +2.00%)
(ii)   Steepening shift: (-2.00%, -1.00%, 0.00%, +1.00%, +2.00%)

Show your work**.**

2. **Continued**

    (f)   (*2 points*) Construct a portfolio of zero-coupon bonds that has the same value and KRDs as Zoolander's GIC liabilities.

    (g)   (*3 points*) Determine the "buys" and "sells" in terms of zero-coupon bonds necessary to match the GIC asset value and KRDs to the GIC liability value and KRDs.

    (h)   (*3 points*) Recommend three principles for the measurement and monitoring of interest rate risk that Zoolander should incorporate for its GIC product line and identify specific actions that Zoolander should take to follow each of these principles.

    (i)   (*2 points*) Identify and describe three advantages that Key Rate Durations have over other duration measures.

3.   (*14 points*) You are preparing for Zoolander's senior management offsite 2009 Strategy Review. You feel that there needs to be a particular focus on Zoolander's VA Plus product line.

You have also considered how Kelly Ratings may view Zoolander's Strategic Risk profile and Risk Control Processes. Kelly is known to closely follow S&P's perspective on these topics.

(a)   (*3 points*) You are reviewing the preliminary Strategic Risk Map produced by Cobalt Management Consultants (CMC) and determining how it can be applied to the VA line.

   (i)   Identify the three risk categories in the Strategic Risk Map that are most significant for Zoolander's VA product line and describe how each of these risks is present in the VA line.

   (ii)   Identify any countermeasures Zoolander is already taking to address these risks.

   (iii)   Recommend further measures Zoolander could take to counter these risks.

(b)   (*2 points*) Identify and describe the next steps that Zoolander should perform to complete its Strategic Risk Management (SRM) process once the Strategic Risk Map is completed. Your response should be specific to Zoolander's situation.

(c)   (*2 points*) Differentiate the Strategic Risk Management practices relating to capital that would lead to each of the following S&P classifications in (I) through (IV). Based on Zoolander's capital management practices, determine the category in which Zoolander would likely fall. Justify your assessment.

   (I)   Weak SRM
   (II)   Adequate SRM
   (III)   Strong SRM
   (IV)   Excellent SRM

(d)   (*4 points*) Your Strategic Risk Analysis has identified a certain level of acceptable equity risk. Assume Kelly follows S&P's risk control process for the equity risk emanating from the VA line.

   Describe how Kelly would evaluate Zoolander with respect to each element of that process.

3. **Continued**

(e)   (*3 points*)

   (i)   Identify elements of sound practices in New Product Risk Control identified by S&P.

   (ii)   Assess which, if any, of these have been demonstrated in the development of Zoolander's VA Plus Product.

   (iii) Describe the pricing process Zoolander should follow for the VA Plus product in order to appeal to Kelly from a strategic risk perspective, assuming Kelly agrees with S&P's approach.

4. (*15 points*) You have been hired as a consultant for Cypress Company (CC) to help implement an operational risk management process. Mr. Pele, the CEO of CC, has stated that he aims to have a "zero tolerance" approach to operational risks. To date, the CC Executive Committee has conducted extensive interviews with each business unit manager to identify operational risks. The business unit managers have utilized the laws of probability based solely upon historical data to forecast expected operational losses for each risk. A subset of these independent risks is presented in the table below:

Risk ID (i)	Expected Occurrences per annum $(\lambda)_{(i)}$	Expected Loss Per Occurrence $(\theta)_{(i)}$ (in thousands)
1	100.0000	$3
2	0.5000	$100
3	0.0010	$2,500
4	0.0001	$25,000

You are given the following information:

- The exponential probability density function (pdf) with mean μ is given by:
$$f(x) = (1/\mu)e^{-x/\mu} \qquad \text{for } x > 0$$

- Integration by parts formula: $\int u \, dv = uv - \int v \, du$

- The 95$^{\text{th}}$ percentile of the cumulative distribution function of the standard normal distribution is approximately 1.64.

- The CTE formula for the Normal distribution is given by
$$CTE_\alpha = \mu + \frac{\sigma}{1-\alpha}\Phi\left(\frac{Q_\alpha - \mu}{\sigma}\right)$$

Where $\Phi(z)$ denotes the pdf of the standard normal distribution:
$$\Phi(z) = \frac{1}{\sqrt{2\pi}} e^{-\frac{1}{2}z^2}$$

(a) (*4 points*) Assume that the distribution of losses for each of the risks listed in the table above is given by the exponential distribution $f(x)$ with mean $\mu_i = \lambda_i \theta_i$.

Compute the following items for the risks listed above:

(i) Expected loss per annum for the entire portfolio of risks;

(ii) $CTE_{0.95}$ for the loss distribution corresponding to risk 3;

(iii) $VaR_{0.90}$ for the loss distribution corresponding to risk 2.

Show your work.

4. Continued

(b) (*5 points*) Assume that the distribution of losses for each of the risks listed in the table above is given by the Normal distribution $\Phi(z)$ with mean $\mu_i = \lambda_i \theta_i$ and standard deviation $\sigma_i = (\$25,000)(i)$ for $i = 1, 2, 3$ and 4.

Rank the four risks identified in the table above from most risky to least under each of the following approaches:

(i) CC takes a COSO based approach to ranking operational risks;

(ii) CC takes an actuarial approach to ranking operational risks and defines "unexpected loss" using $CTE_{0.95}$.

Show your work for determining your rankings. Identify the criteria for ranking the risks under both approaches.

(c) (*2 points*) Recommend to Pele either the COSO or the actuarial approach for the purposes of ranking key operational risks. Justify your recommendation by identifying the relative strengths and weaknesses of these two approaches.

(d) (*1 point*) Pele's "zero tolerance" approach aims to eliminate the possibility of operational losses at CC.

(i) Assess the viability of Pele's zero tolerance approach to operational risk management.

(ii) Propose an alternative objective in place of the zero tolerance approach for CC in managing operational risks.

(e) (*2 points*) Explain to Pele the difference between "expected" and "unexpected" operational losses by:

(i) Determining and justifying which of these two should be the main focus of the operation risk management process;

(ii) Describing the best way to manage the risk of the type of loss identified in (i).

(f) (*1 point*) Advise the business unit managers on the appropriateness of relying solely on historical data to perform their forecasts.

5. (*5 points*) The Chief Actuary of Boggy Creek Casualty (BCC), a property-casualty company, has requested that you determine the company's market value. You are given the following values in millions:

2008 Net Income (Before Tax)	13.96
2008 Net Income (After Tax)	9.08
Book Value of Assets at 31 Dec 2008	1,000.00
Market Value of Assets at 31 Dec 2008	1,050.00
Book Value of Liabilities at 31 Dec 2008	900.00
Market Value of Liabilities at 31 Dec 2008	850.00

You are also given the following assumptions:

Risk-free rate of return	5%
Risk-adjusted rate of return	10%
Annual probability of reorganization	5%
Annual earnings growth rate	7%

(a) Calculate the market value of BCC using:

  (i) the cross-sectional approach.

  (ii) the longitudinal approach.

(b) Compare the values obtained in (a) and explain any differences.

(c) Critique the use of a risk-free rate in a longitudinal valuation model.

END OF EXAMINATION
MORNING SESSION