SOCIETY OF ACTUARIES
Exam AFE
Advanced Finance/ERM

Exam AFE

MORNING SESSION

Date: Friday, April 29, 2011
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 6 questions numbered 1 through 6.

   b) The afternoon session consists of 8 questions numbered 7 through 14.

   The points for each question are indicated at the beginning of the question. Questions 1 - 4 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 - 4 pertain to the Case Study.
Each question should be answered independently.

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1. (*8 points*) You are analyzing the risk profiles of Zoolander's GIC and Term product lines using the "financial view of risk" paradigm. This paradigm categorizes risks as:

        I.   Actuarial Risk
        II.   Systematic Risk
        III.   Credit Risk
        IV.   Liquidity Risk
        V.   Operational Risk
        VI.   Legal Risk

(a)   (*3 points*) For each product line below, rate the importance of each paradigm risk as either "high" or "low" and justify your rating.

        (i)   Zoolander's GIC line

        (ii)   Zoolander's Term line

(b)   (*3 points*) Regarding the Term product line, describe the change in each of the six paradigm risks were Zoolander to enter into each of the following reinsurance arrangements:

        (i)   Amethyst Re

        (ii)   Aquamarine Re

        (iii)   Emerald Re

(c)   (*2 points*) Describe the change in each of the six paradigm risks were Zoolander to manage the duration mismatch for the GIC line by using the interest rate swaps rather than by buying and selling bonds.

2.   *(13 points)* You are concerned about the risks posed by Zoolander's over-reliance on the GIC block, which is an institutional product focused on Group Pension sales.

To assess Zoolander's liquidity risk over a three-month horizon under a "panic scenario" whereby Zoolander is downgraded to below-investment-grade, you estimate the following values:

Product Line:	Net Surrender Value (in millions)	Going Concern Surrender Rate Assumption	Panic Scenario Surrender Rate Assumption
GIC (non-surrenderable)	0	0%	0%
GIC (with downgrade covenant)	4,700	0%	100%
GIC (fully surrenderable)	1,100	10%	90%
Variable Annuity	3,350	15%	50%
Term Insurance	10	7%	10%
Disability	0	0%	0%

Realizable Market Value of Assets Under Stress Scenarios (in millions):

Private Bonds	Public Bonds	Commercial Mortgages	Equities	Real Estate	Cash & Short Term Assets	Other Assets
1,000	5,100	750	0	100	36.2	3.8

Estimated total net cash flow from operations over three months is $40 million.

(a)   *(1 point)* Identify five considerations specific to Zoolander's institutional GIC business when assessing liquidity risk.

(b)   *(3 points)* Calculate Zoolander's Liquidity Ratio under the going concern scenario and under the panic scenario. Assess the degree of the liquidity threat to which Zoolander is currently exposed based on your results. Show your work.

2. **Continued**

(c) *(3 points)* Describe how liquidity risk led to the General American crisis, including:

- the nature and degree of exposure to liquidity risk

- sequence of events

- management actions or inactions

- financial impact and general consequences

(d) *(2 points)* Assess similarities and differences between the General American crisis and Zoolander's situation were Zoolander to be downgraded to below-investment-grade.

(e) *(2 points)* Recommend two product-based strategies that Zoolander should pursue to reduce its liquidity risk and explain how each strategy improves Zoolander's liquidity profile.

(f) *(2 points)* Recommend two investment-based strategies that Zoolander should pursue to reduce its liquidity risk and explain how each strategy improves Zoolander's liquidity profile.

3. (*8 points*) Zoolander will start reporting Embedded Value (EV) for the Term Life block beginning December 31, 2010.

    (a)   (*1 point*) Identify the elements Zoolander must consider when rolling forward EV from one valuation date to the next.

    (b)   (*5 points*) Calculate the expected EV and Value of Inforce (VIF) of the Term Life block as of December 31, 2010. Assume the following:

- VIF and EV as of December 31, 2009 are $58.9 million and $73.9 million, respectively;

- Sam Otter's assumption change related to statutory required capital was implemented as of January 1, 2010;

- Adjusted net worth did not change throughout 2010;

- All 2010 new business is issued on December 31;

- First year premiums on 2010 sales equal $20 million; and

- Value of new business (VNB) is 5% of first year premiums.

    (c)   (*1 point*) Explain how EV is related to the company's stock price.

    (d)   (*1 point*) Describe the insights gained by Zoolander in computing EV.

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4. (*15 points*) You are assessing the effectiveness of Zoolander's current risk management approach for the GMDB feature associated with the old VA product. Using the tables provided by John Badger, you analyze a sample policy having a single premium paid at issue of $100. The policy is issued to a male issue age 50 and offers a 2-year GMDB that guarantees the return of 100% of premium upon death. You assume the Fund Value at $t = 0$ (at policy issue) was $100.

t	Down Scenario		Up Scenario	
	S_t	CTE(95)	S_t	CTE(95)
0	100	0.18	100	0.18
1	90	0.20	110	0.15
2	80	0.00	120	0.00

You are given the following:

- The dynamic GMDB hedge uses a replicating portfolio invested in both the risky and risk-free asset.

- $BSP_0(T)$ denotes the cost at $t = 0$ of a put option maturing in T years.

- The discrete approximation to the GMDB hedge cost at time $t = 0$, using annual time steps is:

$$H(0) = \sum_{t-1}^{n} BSP_0(t)_{t-1} p_x \, q_{x, t-1}$$

- The unconditional hedging error at time t is:

$$HE_t = H(t)^+{}_{t-1} p_x \, q_{x, t-1}((G - F_t)^+) - H(t^-)$$

- Deaths occur at the end of the policy year.

- There are no lapses.

- Ignore all policy loads and fund based charges (i.e. $F_t = S_t$).

4. **Continued**

(a) (*1 point*) Complete the following table of preliminary values:

		Down Scenario		Up Scenario	Decrements		
t	S_t	GMDB Payout: $(G-F_t)^+$	S_t	GMDB Payout: $(G-F_t)^+$	$_{t-1}p_{50}$	$q_{50,t-1}$	$_{t-1}p_{50}\,q_{50,t-1}$
1	90		110		1.0000	0.0035	
2	80		120			0.0040	

(b) (*5 points*) Assume that the policy is dynamically hedged with annual rebalancing. Using Badger's option pricing data, complete the following table. Show your work.

	Down Scenario		Up Scenario	
t	S_t	Hedge Error (HE$_t$)	S_t	Hedge Error (HE$_t$)
1	90		110	
2	80		120	

(c) (*4 points*) Assume that the GMDB risk is managed initially using the actuarial approach (consistent with Zoolander's current risk management approach) using Badger's option pricing data where applicable.

Apply Badger's dynamic hedging CTE(95) trigger criteria to determine the balance of assets invested in bonds and equities for each scenario and for both time periods. Show your work.

(d) (*2 points*) Propose reasonable capital requirements for the dynamic hedging approach. Compare these to Zoolander's capital requirements under the current actuarial approach.

(e) (*3 points*) Provide one advantage and one disadvantage for each of the following GMDB risk-management approaches:

(i)   Dynamic hedging;

(ii) Actuarial using CTE(95);

(iii) Badger's hybrid approach.

5. (*13 points*) You are the CFO at Mofongo Indemnity (MI), a small start-up issuing a single policy on January 1. This policy requires a single premium of $400,000 to be paid at the beginning of the year and pays the following benefits at the end of the year:

Benefit Payment	Probability
$0	80%
$525,000	16%
$2,625,000	4%

You are given for MI:

- There are no operating expenses.

- The asset earned rate equals 5%.

- Corporate tax rate is 40%. Taxes are applicable on earnings of -$525,000 and greater.

- The Board of Directors requires a return on shareholder equity (ROE) of 9% on beginning of the year equity.

- Debt lenders do not charge a risk premium above expected losses due to default. Assuming no probability of default, MI lenders will make loans at 6%.

- There are no transaction costs for raising capital or issuing debt.

- Bankruptcy costs are estimated at $21,000.

The liability for the insurance contract is equal to the premium received. The total asset required to fund business operations is set at the CTE(98) of the distribution of the present value of pre-tax cash flows. You are reviewing capital funding options for MI.

(a) *(1 point)* Calculate the funds needed (in addition to the premium) as of the beginning of the year to meet the total asset requirement. Show your work.

(b) *(3 points)* Assuming MI uses 100% equity to provide the additional funds determined in part (a):

 (i) Calculate the expected after-tax profit for the year. Show your work.

 (ii) Determine whether the expected ROE is sufficient to meet Board requirements. Show your work.

5. **Continued**

    (c)   *(1 point)* Explain why increased risk may be costly to shareholders.

    (d)   *(4 points)* Assuming MI uses 85% equity and 15% one-year debt to provide for the additional required funds:

        (i)   Determine the minimum interest rate at which MI could issue such debt. Show your work.

        (ii)   Calculate the expected after-tax profit assuming debt is issued at the rate determined in part (d)(i). Show your work.

        (iii)   Determine whether the expected ROE is sufficient to meet Board expectations. Justify your response.

    (e)   *(1 point)* Explain why non-linear tax schedules can make risk costly to shareholders.

Stop loss reinsurance that pays all benefits above $525,000 is available from Sofrito Reinsurance Company. Sofrito has no debt and can receive tax refunds on up to $10,000,000 of pre-tax losses.

    (f)   *(1 point)* Describe how reinsurance can be used to eliminate the tax inefficiency at MI.

    (g)   *(2 points)* Sofrito has offered this reinsurance coverage at a cost of $250,000.

        (i)   Calculate the funds needed (in addition to the premium net of reinsurance cost) as of the beginning of the year to meet the reduced total asset requirement with reinsurance in place.

        (ii)   Assuming MI uses 100% equity to provide the additional funds, determine whether the expected ROE is sufficient to meet Board requirements.

6. (*3 points*) You are hired to lead Condado Life's ALM department. Condado sells only traditional non-participating whole life insurance. The duration of liabilities exceeds 20 years. Achieving target profitability requires earning 7% pre-tax return on invested assets.

Below are the current investment strategy guidelines and current yields:

	Target Weight	Weighted Average Life	Current Yield
Investment Grade Corporate Bonds	15%	10 years	5.00%
High Yield Corporate Bonds	45%	5 years	8.00%
Commercial Mortgage Loans	10%	5 years	5.50%
Agency-Backed MBS	30%	5 years	7.00%

Based on the above data:

(a) (*1 point*) List four key elements of a successful ALM program.

(b) (*2 points*) Describe the interest rate and credit risks of Condado's asset portfolio and the potential impacts to profitability.

END OF EXAMINATION
Morning Session

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