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**SOCIETY OF ACTUARIES**  
**Exam AFE**  
**Advanced Finance/ERM**

**Exam AFE**  
**MORNING SESSION**

**Date:** Thursday, October 30, 2008  
**Time:** 8:30 a.m. – 11:45 a.m.

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**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 7 questions numbered 1 through 7.
  - b) The afternoon session consists of 7 questions numbered 8 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.

**\*\*BEGINNING OF EXAMINATION\*\***  
**ADVANCED FINANCE AND ENTERPRISE RISK MANAGEMENT**  
**Morning Session**

Questions 1 – 4 pertain to the Case Study.  
Each question should be answered independently.

- 1.** (4 points) You are a management consultant hired by Zoolander to assess the Operational Risk attributable to the BingBang project.

Assuming that system implementation will be outsourced, use the Risk Assessment Framework below to analyze the operational risks of the computer systems aspect of the BingBang project.

- (i) Identify and explain three separate operational risk exposures.
- (ii) Categorize these operational risk exposures as either internal or external dependencies. If internal, further categorize as people, process or technology related.
- (iii) Qualitatively categorize the probability of incidence and justify your assessment.
- (iv) Qualitatively categorize the severity of the risk exposure and justify your assessment.

Operational Risk Exposures	Operational Risk Categories				Probability (High, Med, or Low)	Severity (High, Med, or Low)
	Internal Dependencies			External Dependencies		
	People	Process	Technology			

Questions 1 – 4 pertain to the Case Study.  
Each question should be answered independently.

- 2.** (7 Points) Bill Buck has reviewed Sam Otter's term projections and he is concerned about the aggressive pricing for the term block. He has decided to apply the Enterprise Risk management (ERM) risk control process to this block.

In order to make the scope of this task more manageable, he had decided to focus on risks affecting significant line items on the term block income statement projection. He defined significant line items as those projected to be greater than \$100 million in 2008.

- (a) (1 point) Describe the eight steps of the ERM risk control process, in general.
- (b) (3 points) Apply the ERM risk control process to the existing business of Zoolander's term block and explain the results.
- (c) (3 points) Recommend future steps for Zoolander to better handle the risks that are based on any specific shortcomings illustrated in this assessment.

Questions 1 – 4 pertain to the Case Study.  
Each question should be answered independently.

- 3.** (19 points) As part of the new VA Plus product line, you are considering the addition of a GMMB to a single premium deferred variable annuity contract offered by Zoolander. The guarantee being considered would provide a minimum maturity benefit equal to 100% of the premium deposited for all funds invested in the Zoo Balanced Fund. The contract maturity is in 10 years.

You are provided with the following items:

$$P_0 = Ge^{-rT} \Phi(-d_2) - S_0(1-m)^T \Phi(-d_1)$$

$$d_1 = \frac{\log(S_0(1-m)^T / G) + (r + \sigma^2 / 2)T}{\sigma\sqrt{T}}$$

$$d_2 = d_1 - \sigma\sqrt{T}$$

$$S_0 = F_0 = 100$$

- The risk free rate of return is 6% per annum
- Combined annual mortality and lapse is assumed to be a constant 5% per annum.

You are given the following normal distribution values:

$x$	$\Phi(x)$	$\Phi(-x)$
0.15	0.5596	0.4404
0.32	0.6255	0.3745
0.45	0.6736	0.3264
0.59	0.7224	0.2776
0.78	0.7823	0.2177
0.92	0.8212	0.1788

- (a) (1 point) In the email trail between Danielle Wolfe and Wanda Foxx, Wanda suggests that ALM testing might be appropriate for the VA Plus products while Danielle suggests otherwise.

Explain whether you think ALM testing is appropriate for these products. Justify your response.

**Question 3 continued on next page**

Questions 1 – 4 pertain to the Case Study.  
Each question should be answered independently.

**3. Continued**

- (b) (3 points) Wanda Foxx’s email dated September 26, 2008 states that ALM risk can be managed using more than just investment strategies.
- (i) Define three non-investment strategies available to Zoolander for managing the ALM risk associated with the VA Plus products.
  - (ii) For each of these strategies, provide examples of how it could be used by Zoolander to mitigate the ALM risk for these products.
- (c) (1 point) Zoolander has decided to manage the risks associated with the VA Plus products using a dynamic hedging program. Wanda Foxx has computed the cost of offering these benefits using a Black-Scholes approach and as a result, recommends limiting the mutual funds for which the VA Plus features will be offered.

Explain why Wanda might make such a recommendation.

- (d) (3 points) Compute the value of the GMMB replicating portfolio using the formula provided above and assuming all funds are invested in the Zoo Balanced Fund. Show your work.
- (e) (4 points) For each of the Greeks below,

Delta	-0.10295
Gamma	0.00283
Vega	56.68582
Theta	0.30096
Rho	-144.63635

- (i) Describe the impact on the value of the GMMB for a change in the corresponding financial variable.
- (ii) Describe how the exposure measured by each Greek can be hedged.

**Question 3 continued on next page**

Questions 1 – 4 pertain to the Case Study.  
Each question should be answered independently.

**3. Continued**

- (f) (4 points) For each of the changes listed below, describe the effect that each of these would have on the value of the replicating portfolio. Provide a conceptual explanation of why such an effect would occur.
- (i) An increase in the fund management fee for the Zoo Balance Fund from 3% to 5%.
  - (ii) A change to the GMMB to provide a minimum maturity benefit equal to 90% of the premium deposited.
  - (iii) A decrease in the contract maturity from 10 years to 5 years.
  - (iv) A decrease in the risk free rate from 6% to 2%.
  - (v) A decrease in the combined mortality and lapse rate from 5% per annum to 3% per annum.
  - (vi) An increase in volatility from 20% to 25%.
- (g) (3 points) Identify four components that Zoolander should incorporate in its processes to achieve “best practices” in Asset/Liability Management. Explain the benefits of incorporating these components into practice. Comment on whether, based on the case study information, Zoolander has or has not implemented these components.

Questions 1 – 4 pertain to the Case Study.  
Each question should be answered independently.

- 4.** (9 Points) Zoolander is presented with the following investment opportunity, “Project Zebra”, which involves the purchase of a block of business during 2008. Zoolander intends to raise the necessary \$1,000 million purchase price entirely through debt, at 5% interest, after tax, which reflects prevailing credit market rates for Zoolander’s current financial condition. None of this debt would be paid down during 2008.

At the end of 2008, there is a probability of

- 1/3 that Project Zebra will result in an after-tax loss of \$1,050 million;
- 1/3 that Project Zebra will result in an after-tax gain of \$750 million;
- 1/3 that Project Zebra will result in an after-tax gain of \$1,500 million.

Zoolander has also been presented with an opportunity to hedge the uncertain Project Zebra results. The hedge will yield the project’s expected value with certainty for a cost of \$25 million.

In completing your analysis, assume the following:

- 5% growth in 2008 over 2007 distributable earnings for Zoolander’s existing business, one third of which will be paid out as cash dividends to shareholders during the year.
- Bankruptcy costs will be \$100 million, if applicable.

- (a) (5 points) Calculate the expected value of both equity and debt stakeholders at December 31, 2008, assuming Zoolander invests in Project Zebra, for
- (i) the hedged scenario, and
  - (ii) the non-hedged scenario.

Show your work.

- (b) (1 point) Explain whether shareholders would prefer to take on this project or not, and, if so, whether they would choose to hedge or not, based purely on their financial perspective.
- (c) (1 point) Explain the rational viewpoint of the potential bondholders toward this transaction and the ramifications if Zoolander is able to convince the bondholders that a hedging strategy will be used.
- (d) (2 points) Explain the ramifications of Zoolander instead using retained earnings for all or most of the capital requirements for Project Zebra, rather than issuing new debt, with respect to both the hedged and unhedged scenarios.

- 5.** (4 points) You are the Chief Financial Officer of Great Big Insurance Company, a publicly held U.S. insurance company. Great Big is considering increasing its dividends to shareholders.

Great Big has historically used Earnings Per Share (EPS) to measure value. You have suggested using Economic Value Added (EVA) to determine value instead.

- (a) Describe how EVA is determined and explain the principal aims of EVA measurement.
- (b) With respect to dividends:
  - (i) Explain the considerations that enter into the decision of whether or not to increase dividends to shareholders.
  - (ii) Explain the impact on the EVA calculation if dividends are increased.
- (c) Describe deficiencies in the current EPS measurement approach.

**6.** (11 points) You are conducting a risk assessment of the various current product offerings of EZ Life Insurance (EZL). EZL is currently offering or developing the following product lines:

- Individual and Group Annually Renewable Term Insurance: a longstanding core product line with a substantial block of Group Insurance with particular success in the High-Tech affinity groups. EZL has YRT reinsurance treaties with BigRe covering these products. As a way to better control mortality risk, the company is considering revising its underwriting process by introducing new risk classes.
  - The Universal Life (UL) product is being revamped with a death-benefit focus. The new UL is to provide a secondary guarantee and a maturity extension to remain competitive. EZL also intends to offer a Long-Term Care Insurance (LTCI) rider in combination with their UL product to increase market share.
  - EZL is currently repricing its Variable Annuity (VA) product and adding additional guaranteed minimum benefits in order to at least maintain market share in this highly competitive market segment.
  - EZL is not changing its Equity-Indexed Annuity (EIA) this year. EZL hedges this block with a combination of fixed instruments and equity options whose payoff will match that of the EIA product at the time of maturity.
- (a) (1 point) Explain the considerations in the selection of risk characteristics and risk classes under Actuarial Standard of Practice 12.
- (b) (2 points) Compare the potential severity of a modern day pandemic to the 1918 Spanish Flu.
- (c) (1 point) Explain how EZL's term block exposes EZL to pandemic risk and identify options for EZL to control exposure to this risk.
- (d) (2 points) For the new UL product:
- (i) Identify the two structures that EZL may have used to provide secondary guarantees and the advantages and disadvantages of each.
  - (ii) Identify three product development challenges that EZL is facing in developing a death-benefit focused UL.
  - (iii) Identify four considerations in the pricing of LTCI accelerated death benefit riders to Universal Life plans.

**Question 6 continued on next page**

**6. Continued**

- (e) (3 points) EZL has produced the following data with respect to the repricing of the VA product:

<b>RBC C3 Component</b>	<b>Fee Level</b>					
<b>Asset Allocation Strategies:</b>	<b>10 bps</b>	<b>15 bps</b>	<b>20 bps</b>	<b>25 bps</b>	<b>30 bps</b>	<b>35 bps</b>
<b>Conservative</b>	1.31%	0.78%	0.13%	0.06%	0.02%	0.01%
<b>Moderate Conservative</b>	1.79%	1.32%	0.81%	0.27%	0.19%	0.11%
<b>Moderate</b>	2.93%	1.78%	1.30%	0.93%	0.44%	0.27%
<b>Moderate Aggressive</b>	4.01%	2.94%	1.77%	1.32%	1.01%	0.62%
<b>Aggressive</b>	5.56%	4.24%	2.91%	1.79%	1.55%	1.29%

- (i) Explain the policyholder behavior risk present in EZ’s VA product.
- (ii) Recommend a fee structure for EZ’s new VA to control policyholder behavior risk.
- (iii) Identify the potential concern with this fee structure.
- (f) (2 points) With respect to EZL’s new EIA product:
- (i) Identify the “missing risk” in the pricing of EIAs that EZL should consider in its new product.
- (ii) Calculate the exposure after one year of the new EIA to this risk assuming:
- \$100,000 premium
  - 5-year term to maturity
  - 3% guaranteed interest per year on 90% of premium
  - Participation rate: 60% of S&P Index
  - 5% Sales Commission
  - Early Withdrawals permitted at Minimum Guaranteed Value
  - Risk-free rate is 4%
  - There has been no change in the equity market after one year
  - Fixed rates have risen 3% after one year

Show your work.

- 7.** (6 points) Your company, ABC Insurance Company, is a regional variable annuity writer that would like to expand. You have been told that a fixed annuity writer QRS may be up for sale. The CFO has asked you to lead the evaluation of this possible acquisition.
- (a) Describe the benefits and risks to ABC of the potential acquisition.
  - (b) Describe the types of sales processes that QRS might utilize to execute its sale.
  - (c) Explain the steps that you should take to evaluate this acquisition.
  - (d) Compare and contrast surplus notes and equity offerings as financing instruments for this acquisition.
  - (e) Identify the types of synergies that can occur from an acquisition, and explain whether each of these synergies is likely to be realized in this situation.

**\*\*END OF EXAMINATION\*\***  
**Morning Session**

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**SOCIETY OF ACTUARIES**  
**Exam AFE**  
**Advanced Finance/ERM**

**Exam AFE**  
**AFTERNOON SESSION**

**Date:** Thursday, October 30, 2008

**Time:** 1:30 p.m. – 4:45 p.m.

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**INSTRUCTIONS TO CANDIDATES**

**General Instructions**

1. This afternoon session consists of 7 questions numbered 8 through 14 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.
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**\*\*BEGINNING OF EXAMINATION\*\***  
**ADVANCED FINANCE AND ENTERPRISE RISK MANAGEMENT**  
**Afternoon Session**

- 8.** (7 Points) You are the Enterprise Risk Manager for West Coast Bank. The CFO would like to take steps toward Integrated Risk Management. He has assigned you the task of outlining the theory and laying out the framework for implementation.

Currently there is a Board Committee that approves the amount of risk that the bank is willing to take and then delegates authority to the Chief Risk Officer. The Chief Risk Officer interacts with the Business Managers.

West Coast Bank has three business units: Alpha, Beta, and Gamma. In an effort to establish risk limits for liquidity management, the CFO would like to begin charging each business for the liquidity risk it generates.

You are given the following data:

Type of Liquidity Supplier	Supplier Rank Score	User Rank Score
Low	1	-1
Medium Low	2	-2
Medium	3	-3
Medium High	4	-4
High	5	-5

Business Unit	Liquidity Used	Liquidity Supplied
Alpha	\$4M low	\$8M high
		\$8M high
Beta	\$2M high	\$0.50M low
		\$1.75M high
Gamma	\$10M low	\$3M medium low
		\$2M medium high

- (a) Define integrated goal-congruent risk management.
- (b) Outline a suggested risk management framework to present to your CFO using the three-pillar framework.

Question 8 continued on next page

**8. Continued**

(c) Recommend changes to the current roles and reporting structure in West Coast Bank to move the Bank to an ideal integrated risk management framework.

(d) For each business unit, a business unit mandate is required.

Explain why this is essential and describe what steps you would take to obtain approval of a business unit mandate.

(e) Calculate the liquidity rank of each business unit.

9. (16 Points) Last year, Omega Life decided to expand beyond its life insurance products and begin offering 1-year and 2-year GICs as a pilot project. The pilot was designed as a one-year learning experience to assess the viability of offering a full complement of GIC products.

After one year, detailed research into the GIC market was to be completed and an analysis of the profitability of the one-year pilot based on Omega's new Total Return economic approach was to be performed.

The current investment staff had capacity to manage the assets of the pilot, but any substantial increase in volume of new business would require either an increase in in-house investment management staff or outsourcing of the investment management function. For the one-year pilot, investment management followed a conservative, immunized approach.

Omega is now ready to decide among the following alternatives:

- Launch with an expanded GIC product suite of term offerings,
- Launch with a more limited range of GIC offerings,
- Exit the GIC product line altogether.

The following data is available at the end of the one-year pilot project:

Risk-free rate	3.00%
Investment expenses	0.10%
Liability expenses	0.20%
OAS	0.60%
$\Delta$ OAS	0.00
Required OAS (ROAS) at $t=0$	0.50%
Rich/cheap rate ( $r/c$ ) =	0.20%
Portfolio adjustment return ( $pa$ ) =	0.00

Key Rate Duration (KRD)	Assets	Liabs	$\Delta r(i)$
D(1)	0.6	0.5	-0.50%
D(2)	1.1	0.9	-0.25%

The market research report has gathered the following information:

- The NPV of the project is 100.
- The project can go up by a factor of 130% or down by 80%.
- Expansion costs \$30 but increases value of project by 30%.
- Abandonment value is \$90.

**Question 9 continued on next page**

## 9. Continued

- (a) (1 point) Describe the four steps to the Total Return approach that Omega will use for analyzing the GIC assets and liabilities on a consistent basis.
- (b) (2 points) Assuming zero surplus, calculate the total return on the portfolio compared to the total required return on the GIC liabilities. Show your work.
- (c) (2 points) Calculate the attribution of the Net Profit under the Total Return approach to its various components. Show your work.
- (d) (1 point) Assess the performance of the 1-year GIC pilot project on a Total Return basis.
- (e) (2 points) Explain five real options available to management at any point for the GIC initiative and identify the corresponding financial market product equivalents that may be used to value each of them.
- (f) (5 points) Calculate independently the value of each of the following real options that Omega has, using a two-year Binomial tree approach:
  - (i) abandonment option;
  - (ii) expansion option.

Show your work.

- (g) (3 points) Calculate the value to Omega of the two real options in (f) on a combined basis for the GIC project, using a two-year Binomial tree approach. Show your work.

- 10.** (6 points) You are the appointed actuary for ABC Life Co., a Canadian company that sells variable annuities. You have decided to use a stochastic lognormal model to value the guarantees embedded in these products.

The calibration table of maximum acceptable quantiles established by the CIA (2000) Task Force is:

Accumulation period	Percentile		
	2.5 <sup>th</sup>	5 <sup>th</sup>	10 <sup>th</sup>
1-year	0.76	0.82	0.90
5-year	0.75	0.85	1.05
10-year	0.85	1.05	1.35

In addition, calibration requirements state that the mean of the one-year accumulation factor must lie in the range of 1.10 to 1.12, and the standard deviation of the one-year accumulation factor should be at least 0.175.

You are given the following values from the standard normal distribution,

$$\Phi(-1.96) = 2.5\%$$

$$\Phi(-1.645) = 5\%$$

$$\Phi(-1.28) = 10\%$$

- Outline the required calibration procedure if it is decided that the model parameters should reflect historical data up to September 2008.
- Calculate lognormal model parameters  $\mu$  and  $\sigma$  (annualized) using the 1-year 2.5<sup>th</sup> and 10<sup>th</sup> percentiles. Show your work.
- Identify the drawbacks of the approach used in (b) and propose a better approach to calibrate the lognormal model.
- A consultant recommends that a stochastic volatility model be used as this model provides a fatter tail distribution than the log-normal model. As there is no closed-form formula for the percentiles, you determine that calibration must be done by the simulation method, and you recall that the CIA calibration stipulates that the fitted values must be adequate with a 95% probability.

Determine if the calibration criteria for the 2.5<sup>th</sup> percentile of the one-year accumulation factor is met, given that for 50,000 stochastic simulations, 1,312 give values of the one-year accumulation factor lower than 0.76.

- 11.** (11 points) Your company, Diversified Financial Services (DFS) has just adopted an internal economic capital approach to managing risk. DFS's old approach to managing credit risk involved applying an internal ratings process and deriving an internal capital charge equal to four times the sum of the VaR at the 99.5% confidence level for spread risk, downgrade risk and default risk over a 1-year horizon. This factor approach has been replaced with a sophisticated credit risk model that uses a risk-neutral valuation approach.

You are currently assessing the credit impact to your portfolio of the purchase of a 2-year, 5% annual coupon TechNix corporate bond that was purchased at 100.05. This split-rated bond has an A3 rating from Moody's and a BBB+ rating from S&P. DFS has not invested in TechNix before, and has limited exposure to the technology sector overall.

To assess the credit risk of the potential TechNix bond acquisition, you have gathered the following information:

- Moody's most recent study has produced the following 1-year transition matrix:

Initial Rating	Rating at Year-end (%)							
	Aaa	Aa	A	Baa	Ba	B	Caa	Default
Aaa	90.80	8.30	0.70	0.07	0.13	0.00	0.00	0.00
Aa	0.70	90.70	7.80	0.60	0.06	0.14	0.00	0.00
A	0.09	2.30	91.00	5.50	0.75	0.30	0.01	0.05
Baa	0.02	0.30	5.90	87.00	5.30	1.20	0.10	0.18
Ba	0.03	0.15	0.65	7.75	80.55	8.80	1.00	1.07
B	0.00	0.10	0.25	0.45	6.45	83.45	4.05	5.25
Caa	0.25	0.00	0.20	1.30	2.35	11.25	64.85	19.80

- You have derived the following one-year forward zero curves (%) for various credit ratings:

Category	Year 1	Year 2
AA	3.65	4.20
A	3.70	4.30
BBB	4.10	4.70
BB	5.60	6.00

**Question 11 continued on next page**

## 11. Continued

- Your internal credit risk model indicates the following values associated with each credit rating as follows:

Year ( $t$ )	$Q_t^A$	$Q_t^{BBB}$	$LGD^A$	$LGD^{BBB}$
1	2.0%	3.0%	40%	50%
2	15.0%	18.0%	40%	50%

where  $Q_t$  is the risk-neutral expected default frequency at the horizon  $t$ .

- The risk-free rate is 3%.
- Recall:  $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ 
  - (1 point) Identify possible shortcomings with DSF's old internal economic capital approach to credit risk.
  - (1 point) Define the four elements of credit risk according to the AAA Report to the NAIC on risk mapping and assess DFS's exposure to each in its purchase of the TechNix bond.
  - (2 points) Interpret the meaning behind each of Moody's and S&P's ratings of TechNix's 2-year issue. Suggest possible explanations for the difference in ratings from the two agencies.

Question 11 continued on next page

## 11. Continued

- (d) (3 points) Complete the following table with respect to the expected value of the TechNix bond in one year, using Moody's initial rating.

Year-End Rating	Probability of State: $p(\%)$	1-Year Forward Price: $V(\$)$	Change in Value: $\Delta V(\$)$
AAA		106.35	
AA			
A			
BBB			
BB			
B		103.96	
CCC		96.30	
Default		50.00	

Show your work.

- (e) (4 points) Using the risk-neutral valuation approach of your credit risk model:
- Calculate TechNix's credit spread under each of Moody's and S&P's ratings.
  - Determine which rating is more consistent with the market.

Show your work.

- 12.** (7 points) Your company is considering three major projects as part of the strategic growth plan, of which it can only undertake one because of the significant initial required capital outlay. None of these projects involves managerial flexibility.

In the past, your company has used the IRR method exclusively to select projects.

The following table provides the cash flows for these projects.

	Pre-tax Cash Flows		
Year	Project A	Project B	Project C
0	-2,000	-1,200	-1,500
1	1,400	800	1,600
2	800	200	400
3	200	150	-600
4	100	400	400

You are given the following information:

- Tax Rate is 35%
- Cost of Capital is 12%
- Pre-tax cash flows are equal to pre-tax accounting income

You have calculated the following IRRs for these projects

	Project A	Project B	Project C
IRR	15%	14%	17%

You have been asked to prepare a presentation for the 5-year Planning committee as to how your company determines which projects maximize shareholder value.

- Compare and contrast economic profit and accounting profit.
- Explain the objective of capital budgeting techniques and the criteria that any appropriate capital budgeting technique should satisfy.
- Besides the IRR method, identify and describe three other widely-used techniques used to analyze projects with cash flow certainty for capital budgeting purposes, including their shortcomings. Explain how to calculate IRR and the three other measures you have identified.
- Show the calculations for each of the three methods you identified in (b) above, for each of Projects A, B, and C.

**Question 12 continued on next page**

## **12. Continued**

- (e) Recommend which project, if any, should be undertaken from a shareholder value perspective. Justify your recommendation.
- (f) If any of the four capital budgeting techniques you evaluated above lead to different optimal projects, describe why you did not use those results as the criteria for your recommendation in (d).

- 13.** (8 points) You are the Chief Risk Officer (CRO) of Stakeholder Property and Casualty Insurance Company (“SP&C”). SP&C is a major writer of P&C business in Florida and hence is exposed to natural catastrophes.

Your risk department has provided you with the following information for SP&C:

Risk Element	Amount	Capital Ratio
Stocks	200	0.20
Bonds	1000	0.05
Affiliates	100	0.20
Loss Reserves	800	0.10
Property UPR	100	0.20

Correlated Risk Elements		Correlation Coefficient
Stocks	Bonds	0.2
Stocks	Affiliates	1.0
Bonds	Affiliates	0.2
Bonds	Loss Reserve	0.3
Affiliates	Loss Reserve	-1.0

SP&C currently has a catastrophe Stop-Loss reinsurance arrangement in place.

- (a) (1 point) The estimated Loss Reserves have elements of “Reserve Risk”. Define this risk and identify the factors that affect it.
- (b) (1 point) The Capital Ratio for SP&C’s Loss Reserves is based on the Expected Policyholder Deficit (EPD) metric. Loss Reserves are assumed to follow a one-year binomial stochastic process, such that they will either increase by 20% or decrease by 20% over the next year, with equal probability.

Show how the 10% Capital Ratio given above was derived using an EPD ratio of 0.05.

- (c) (4 points) You wish to assess the impact of correlation effects on SP&C’s amount of RBC.

Calculate the RBC levels that result assuming that the risk elements are:

- (i) perfectly positively correlated instead of having the correlations shown in the table
- (ii) totally uncorrelated instead of having the correlations shown in the table
- (iii) correlated as shown in the table and have zero correlation in all other cases.

Show your work.

**Question 13 continued on next page**

### 13. Continued

- (d) (2 points) SP&C is considering hedging some of its catastrophic risk exposures to Florida through the purchase of Florida State index-based catastrophe options that trade on the Chicago Board of Trade.

Compare and contrast SP&C's existing reinsurance program against this alternative hedge with respect to each of the following:

- (i) Credit risk
- (ii) Basis risk
- (iii) Moral hazard

14. (5 points) A U.S. based company is planning to introduce a 10-year equity-indexed annuity (EIA) product with annual resets. You have been asked to provide advice on the hedge accounting implications under FAS 133.

- (a) Contrast the accounting treatment for hedge instruments that qualify as fair value hedges with that of hedge instruments that qualify as cash flow hedges.
- (b) Identify the elements which should be part of the formal documentation of the hedge at its inception.
- (c) Outline the disclosure requirements that must be satisfied in order to utilize FAS 133.
- (d) Describe the accounting treatment of the embedded derivative in the EIA product, assuming FAS 133 applies.
- (e) Explain how the EIA could be designed to avoid having it subject to FAS 133.

**\*\*END OF EXAMINATION\*\***

**Afternoon Session**

# AFE Complete Illustrative Solutions

## November 2008

### 1.

#### Learning Objectives:

- 7 – f. Describe operational risks and governance issues including market conduct, audit, and legal risk.

#### Source:

Risk Management by Michel Crouhy, Dan Galai and Robert Mark; Ch. 13, pp. 494-501.

#### Questions Description:

This question tested candidates' understanding and application of the Risk Assessment Framework step of the Four-Step Measurement Process for Operational Risk. The students were asked to apply this framework to the computer systems aspect of the BingBang project.

#### Grader Comments:

This question specifically asked for the operational risk of computer systems aspect assuming the system implementation is outsourced. Some candidates provided non-computer system risks and also confused operational risk with other types of risk, e.g. legal or regulatory.

#### Solution:

<u>Operational Risk Exposures</u>	<b>Operational Risk Categories</b>				<b>Probability (H, M, L)</b>	<b>Severity (H, M, L)</b>
	<b>Internal Dependencies</b>			<b>External Dependencies</b>		
	<b>People</b>	<b>Process</b>	<b>Technology</b>			
<u>Implementation – Outsourcing:</u> short timeframe to find consultants to implement system				<b>X</b>	M (short timeframe to find consultant and no experience w/new consultant)	M (significant implementation costs)
<u>Systems Maintenance:</u> Existing staff is inadequate (knowledge, skills, capacity)	<b>X</b>				H (existing staff doesn't know the requirements of new system)	L (training is given to be "cheap")
<u>Computer System:</u> current systems are not adequate for application			<b>X</b>		L (existing system is described as "robust")	H (if existing system doesn't work, new system will be expensive)

# **1. continued**

## Notes

1. Other Probability/Severity responses were considered for the answers above, as long as they were rationally justified.
2. Other Operational Risk Exposure answers were considered on a case-by-case basis. However, to qualify they must be (1) operational risks and (2) related to the computer systems.

## 2.

### Learning Objectives:

- 6 – Enterprise Risk Management Framework
- 6 – a. Define Enterprise Risk Management
- 6 – b. Describe the fundamental concepts of financial and non-financial risk management and evaluate a particular given risk-management framework.
- 6 – e. Describe how an organization can create a risk management culture including: risk consciousness, accountabilities, discipline, collaboration, and communication.
- 6 – f. Articulate risk objectives and a risk philosophy.

### Source:

P. 26 of ERM Specialty Guide, May 2006.

### Question Description and Grader Commentary:

This question asked the candidate to apply the Risk Control Process to Zoolander's term business and then provide recommendations based on that analysis. The candidates were asked to focus on line items greater than \$100 million, namely premiums and death benefits which are impacted by mortality and lapse. To score well candidates needed to relate the case study to the Risk Control Process. A candidate could score better by robustly integrating the facts of the case study with an incorrect Risk Control Process than by correctly identifying the steps of process with limited application. The best papers were able to incorporate information from throughout the case study, for example noting that the coverage provided by Rose Reinsurance was expiring at the end of the year.

### Solution:

(a)

Eight Steps of the Risk Control Process

- Identify the Risk
- Risk Evaluation
  - Identify manager to manage each priority risk
- Monitor the Risks
  - Period reporting, centralized reporting process
- Risk Limits
- Risk Avoidance
- Offsetting Risks
- Transferring Risks
- New Product Review

## 2. continued

(b)

Apply the Risk Control Process to the Zoolander term business

- Gross premiums and benefits meet the materiality test
  - For premiums, the lapse assumption is the primary driver
  - For benefits, the mortality assumption is the primary driver (lapse assumption secondary)
- Lapse and mortality information derived from experience studies covering a rolling three year period
- Nobody is assigned responsibility yet within Zoolander
- There does not appear to be a centralized reporting process
- Mortality risk is currently transferred through reinsurance

(c)

Recommend future steps for Zoolander to better handle the risks

- Assign a senior level company manager to be responsible to manage risks
- Run scenarios to determine the severity of mortality and lapse risk
- Run exposure studies more frequently
- Expand mortality study to include cause of death
- Set risk limits based on the above analysis
- Study whether mortality risk is offset by other products
- Rose Reinsurance will need to be replaced for the following year

### 3

#### **Learning Objectives:**

- 2 – d. Identify the goals and methodologies of rating agencies and how their rating activities affect financial institutions.
- 5 – b. Identify and describe means for reducing risk without transferring it (internal hedges)
- 5 – c. 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.

#### Question Description/Purpose:

This question was designed to test the student's knowledge of ALM practices as they apply to variable annuity products with ancillary benefits. The question asked for general recommendations on whether ALM was appropriate (part A), what non-investment strategies could be used to mitigate ALM risk (parts B and C), specific application on internal hedging knowledge (parts D, E and F) as well as a conceptual question on ALM best practices (part G).

#### Grader Comments on student performance:

- Part A: Most students agreed ALM was required for these products however relatively few justified this recommendation with anything other than the presence of ancillary benefits.
- Part B: Most students identified the non-investment strategies however few if any students discussed or provided examples of how these strategies might be used. For example, people identified reinsurance as a strategy but failed to say much beyond this.
- Part C: Most students identified volatility of certain funds as being a concern however few students explained why volatility is a problem.
- Part D: This question was answered well by most students with a small portion of the students forgetting to make the "tpx" adjustment to the option cost reflecting persistency to maturity.
- Part E: Students did rather poorly here with most students simply defining the Greek and not describing how it could be hedged and not making use of the actual values provided.
- Part F: Students did well to identify whether the cost would increase or decrease with some trouble on sub-part (i) and (iii). Students did not do well in discussing conceptually why the effect would be an increase or decrease to the portfolio cost.
- Part G: Students did well to list the four components but did poorly to explain the benefits and more specifically, the benefits for Zoo and whether Zoo had implemented these items or not. In general, students fail to pull relevant information from the case study when answering case study questions.

### 3. continued

#### Solution:

(a)

ALM is required/appropriate for these products

- ALM can help understand/manage revenue risk
- ALM can help understand/manage the funding requirements of the ancillary benefits
- ALM can help understand the effects of policyholder behavior
- Zoo is targeting return performance in the range of historical average returns, this level of guarantee is rather aggressive.

(b)

The non-investment strategies are:

1. Product design

- Establishing a balance between the degree of investment risk that is acceptable in exchange for the benefits of selling a competitive product
- Do not rely on investment strategy to mitigate poorly designed product. Rather coordinate product design with investment strategy
- Suggestions for Zoo include:
  - Zoo can offer less aggressive
  - Zoo can work in conjunction with outside financial intermediaries to design products which can be easily hedged/standardized
  - Zoo can impose restrictions which limit ALM risk e.g. limit funds available for investment guarantees

2. Reinsurance

- Cession of investment risk either through traditional or non-proportional reinsurance (whereby reinsurer indemnifies ceding company for specific benefit costs)
- Securitization of risk
- Suggestions for Zoo:
  - Zoo can seek a reinsurer with cheaper/more efficient means to hedge the ALM risk
  - Zoo can seek a reinsurer with experience in pricing such guarantees

### 3. continued

3. Holism
- Focus on enterprise level risk rather than product level or seek to write complementary products
  - Suggestions for Zoo:
    - Zoo to determine how these benefits line up with their core competencies, strategic vision, corporate level risk tolerances
    - Zoo to undertake ERM type assessment to understand how these risks relate to other corporate level risks

(c)

- Wanda is concerned with fund volatility as increased volatility increases cost of offering puts to VA policyholders
- Making all funds eligible for guarantees encourages antiselective behavior by policyholders
- Increase volatility means increase in rebalancing costs

(d)

$$P_0 = Ge^{-rT} \Phi(-d2) - S_0(1-m)^T \Phi(-d1)$$

$$d1 = \frac{\log(S_0(1-m)^T / G) + (r + \sigma^2 / 2)T}{\sigma\sqrt{T}}$$

$$d2 = d1 - \sigma\sqrt{T}$$

$$d1 = 0.78 = 0.5 / 0.63$$

$$d2 = 0.15$$

$$P_0 = (100)(0.55)(0.44) - (100)(0.74)(0.22) = 8.17$$

$$\text{Decrement cost} = (0.95 \wedge 10)(8.17) = 4.89$$

(e)

Delta

- For every \$1 increase/decrease in the underlying fund/index, the value of the GMMB will increase/decrease by 10.295 cents
- Hedge by selling shares or take similar short position in futures contract

Gamma

- For every \$1 increase/decrease in the underlying fund/index squared the value of the GMMB will increase/decrease by 1/2 of 0.00283
- Hedge portfolio will need to contain option/derivatives on the underlying since stocks and futures have zero gamma

### 3. continued

#### Vega

- For every 1% increase/decrease in volatility, the value of the GMMB will increase/decrease by 0.56685
- Hedge portfolio will need to contain option/derivatives on the underlying since stocks and futures have zero gamma

#### Rho

- For each 1% increase/decrease in the level of the risk free interest rate, the GMMB value will decrease/increase by 1.44636 due to rho
- Rho typically hedged with interest rate swaps

#### Theta

- For each day/year that passes, the GMMB value will increase by 0.00082/0.30096
- Time decay occurs with certainty and is not hedgeable

#### (f)

- (a) Increase portfolio cost/increase option cost
  - Zoo is offering put which is dependent on performance of underlying funds
  - As fund fees increase, fund performance deteriorates and put value increases
- (b) Decrease portfolio cost/option cost
  - Reducing guarantee value reduces likelihood of put offered by Zoo being in the money
- (c) Increased Option cost
  - Shorter duration reduces opportunity for market recovery and for decrements to reduce liability
  - Longer duration increases likelihood that “average” returns will be earned
- (d) Increase portfolio cost/increase option cost
  - Put value can be thought of as  $p_v(\text{Guar}) - p_v(\text{Equity Growth})$  adjusted for likelihood
  - As risk free rate drops, the  $p_v$  of the guarantee payment increases in value
- (e) No change to option cost – value of the put is unchanged but overall portfolio cost will increase as lower decrements translate into more policyholders around to collect potential benefits

### 3. continued

- (f) Increase portfolio cost/increase option cost
- Increased volatility translates into higher uncertainty which increase value of put offered by Zoo

(g)

1. Secure Senior Management Commitment
  - Senior management must understand the important linkages between ALM & both the company's near-term financial results and its L-T viability
  - Zoo has done this (according to Kelly report)
2. Ensure a Clear Assignment of Roles & Responsibilities
  - The ALM process touches a large number of internal constituents, all with primary business responsibilities that lie elsewhere hence effective communication required
  - Zoo has not done this, Zoo has assigned this to the "entire management team" rather than specific individuals
3. Leverage CFT Platform
  - While regulatory-inspired measures of asset or capital adequacy do not usually coincide with ALM objectives, the CF testing platform can be made ALM-ready with relatively little marginal effort
  - Zoo seems to have done this
4. Select the Most Appropriate Metrics
  - A number of ALM metrics are in wide use, in keeping with insurers' specific circumstances, needs and objectives
  - Traditionally, the metrics of duration and convexity have been used to measure sensitivities of assets, liabilities, and surplus to changes in interest rates however more recently VaR and CTE are more common
  - No evidence that Zoo has done this
5. Ensure a Responsive and Effective Mitigation process
  - Metrics should drive mitigation actions whose goal is to adjust risk exposures and thereby bring them back into an acceptable range
  - No evidence that Zoo has done this



#### 4. (a)(i) continued

Ending Equity + Debt = Total initial value + distributable earnings – debt servicing + outcome of project – expected bankruptcy cost

$$= 2033 + 45 - 50 + 375 - 0 = 2403$$

Debt Value = Min[(Ending Equity + Debt) and Initial Debt] =  
 $\min(2403, 1000) = 1000$

Equity Value = (Ending Equity + Debt) – Debt Value  
 $= 2403 - 1000 = 1403$

(ii) Without Hedging

Probability of occurrence of each scenario is 1/3

Use same formulas as above, but

- exclude hedging cost, and
- calculate within each scenario

Scenario 1: Outcome of project = (1050)  
Expected bankruptcy cost = 100  
Ending Equity + Debt =  $2033 + 45 - 50 + (1050) - 100 = 878$   
Debt Value = 878  
Equity Value = 0

Scenario 2: Outcome of project = 750  
Expected bankruptcy cost = 0  
Ending Equity + Debt =  $2033 + 45 - 50 + 750 - 0 = 2778$   
Debt Value = 1000  
Equity Value = 1778

Scenario 3: Outcome of project = 1500  
Expected bankruptcy cost = 0  
Ending Equity + Debt =  $2033 + 45 - 50 + 1500 - 0 = 3528$   
Debt Value = 1000  
Equity Value = 2528

Expected Value = Mean of (Ending Debt + Equity) across scenarios  
 $= [(878 + 0) + (1000 + 1778) + (1000 + 2528)] / 3 = 2395$

Expected Debt = Mean of Debt Value across scenarios  
 $= (878 + 1000 + 1000) / 3 = 959$

Expected Equity = Mean Equity Value across scenarios  
 $= (0 + 1778 + 2528) / 3 = 1435$

#### **4. continued**

**(b)**

This section directed the student to articulate the basic principle of the agency conflict problem from the shareholders' point of view. Most students were at least somewhat successful in achieving this. Ideally, the student was able to refer to the specific results of section (a), but it was not necessary to do so in order to convey understanding of the principle.

Shareholders would choose to take on this project because they stand to lose nothing on an expected value basis and can only gain.

The shareholders would choose not to hedge because they lose nothing either way and have a bigger expected gain with the non-hedged scenario.

**(c)**

This section was the analog of section (b) with respect to the bondholders. Ideally, the student was able to refer to the specific results of section (a), but it was not necessary to do so. Most students were able to convey some understanding of the basic principle.

If Zoolander does not convince the bondholders that a hedging strategy will be used, the bondholders will assume that a hedging strategy will NOT be used, and that the value of the debt at the end of the year will be only 959, less than the investment. They will not want to invest, or will require a higher return.

If Zoolander does convince the bondholders that a hedging strategy will be used, the bondholders will expect the full 5% yield on their investment, and the investment will be attractive to them.

**(d)**

The intent of this section was for the student to revise the calculations in (a) substituting retained earnings for debt, and then to reconsider the questions in sections (b) and (c). Very few students actually performed the revised calculations. The focus was supposed to continue to be the comparison of the hedging versus non-hedging scenario; however, many students focused on other ideas. Several students focused on the pros and cons of using retained earnings instead of debt. These off-the-mark responses seemed to be more likely to show a general weakness in understanding the practical application of financial statements.

The shareholders have a higher expected return with no hedging, but they have the potential for a large loss if they do not hedge. The expected equity value is higher for less debt, since there is no debt servicing.

## 5.

### Learning Objectives:

- 4 – c. Describe how an organization can create a risk management culture including: risk consciousness, accountabilities, discipline, collaboration, and communication.

### Questions Description:

This question considers two performance measurement approaches, EPS and EVA. The culture developed by each approach is compared and contrasted, while applying EVA to a real world decision of whether or not to increase dividends to shareholders.

### Solution:

(a)

Describe how EVA is determined and explain the principal aims of EVA Measurement:

- EVA is economic Value Added. It is the net operating profits after taxes less a charge for capital representing its cost. This cost of capital represents the amount that shareholders & debtholders require for the use of their funds.
- The principal aim of EVA is to align management performance incentives with the interests of shareholders giving managers the feeling of ownership (for example, leveraged stock options).

(b)

With respect to dividends:

(i)

Explain considerations that enter into the decision of whether or not to increase dividends to shareholders

- Increasing dividends acknowledges that management cannot find a better use for its cash.
- Management can consider buying back stock rather than paying out dividends
- Dividends not paid will show up as capital gains
- Some shareholders like dividends for consumption
- Stock price will drop as a result of paying dividends

(ii)

Explain the impact on the EVA calculation if dividends are increased

- EVA view on Dividends: Dividends do not matter when it comes to determining value
- By paying dividends, management has less money to fund growth

## **5. continued**

(c)

Describe deficiencies in the current EPS measurement approach

- EPS does not encourage projects that add economic value. Focused on quantity of earnings rather than quality.
- EPS causes a disconnect between management incentives and shareholder needs. Management not empowered to feel and act as stewards of investor capital
- EPS assumes a constant P/E ratio
- EPS discourages R&D as cost and contribution to value exhausted in period incurred

## 6.

### Learning Objectives:

- 1 – b. Identify all risks, including all hidden and embedded risks, categorize, and evaluate potential sources of risk in products offered by both insurance companies and other financial institutions.
- Define insurance risk as related to product design and pricing risk, mortality risk, morbidity risk, lapse risk, interest rate risk, liquidity risk, and expense risk.
  - Identify exposure triggers of the sources of risk. (i.e. what do you need to watch)
  - Identify the direct and indirect consequences of risk
- 1 – c. Describe how and why risks are correlated. (re product risks vs. firm)

### Source Materials:

ASOP 12  
Influenza/Pandemic study note  
DB focused study note  
Designing LTCI study note  
Managing Variable Policyholder Behavior Risk study note  
FE-C103-07

### Questions Description:

The question focused on identifying risks and recommending solutions related for several products including Individual and Group ART insurance, UL with secondary guarantees & LTCI, variable annuities with GMB's, and Equity-Indexed Annuities.

### Grader Comments:

Candidates rarely did well on all the sections, rather they generally got a majority of their points from 3-4 sections (though which 3-4 sections they did well on varied from candidate to candidate.) The calculation in part (f) was not difficult but very few candidates go full credit for this subsection.

### **Solution:**

(a)

#### Risk Characteristics

- Relationship of risk characteristics and expected outcomes
- Causality
- Objectivity
- Practicality
- Applicable law
- Industry practice
- Business practice

## 6. continued

### Risk Classes

- Intended use
- Actuarial considerations
- Other considerations

#### (b)

Pandemic more severe due to:

- Increased international travel
- Medical advances have not yet identified the virus completely
- ICUs will be quickly overrun with patients
- Many bacteria are building resistance to currently available antibiotics
- More people live in urban areas
- Greater impact on economy with more people < 40 years old with key positions

Pandemic less severe due to:

- ICUs and other advancements in patient care
- Germ theory has advanced
- Antiviral drugs are now available
- International cooperation & communication has improved (e.g. WHO)

#### (c)

Exposure to pandemic risk

- Risk to insurers writing mainly group life or other ART-based products is high
- EZ Life has a large, core block with age exposures similar to those affected in 1918
- EZ Life has all its ART business reinsured with one counterparty

Options to control exposure

- Reinsure with multiple reinsurers to spread counterparty risk
- Catastrophe reinsurance
- Cat Bonds/secure with capital markets
- Diversify to other products with offsetting risks
- Diversify group life by industry, geography, etc
- Pursue Government reinsurance program

#### (d)

- (i) Premium Based structure – provides secondary guarantee as long as specified premium requirement has been satisfied

Advantages

- Easy to understand for consumer & agent
- Easier to administer

## 6. (d)(i) continued

### Disadvantages

- Less flexibility for adapting to elements of UL products such as face amount increases, death benefit option changes, etc

Shadow Account structure – provides a secondary guarantee as long as the net shadow acct is positive (where shadow acct is a hypothetical CSV determined using UL processing and a specified basis)

### Advantages

- More flexibility for adapting to elements of UL products such as face amount increases, death benefit option changes, etc
- Had a lower reserve than premium-based under Reg XXX; level playing field with Guideline AXXX

### Disadvantages

- More difficult to understand for consumer & agent

## (ii) PD Challenges

- (1) Continued commoditization of the secondary guarantee premium
  - Pressure to reduce price has increased
  - This will impact margins and add to the relative level of risk assumed
- (2) Impact of “locking in” pricing factors embedded in the secondary guarantee
  - The company is at a long term risk for the protection provided under the secondary guarantee
  - This “locking-in” makes it critical that the actuary fully understands the reasonableness & appropriateness of the underlying pricing assumptions
- (3) Risk exposure to changes in interest rates
  - A long term pattern of low interest rates can result in spread compression and future losses as policyholder realizes the full value of the secondary guarantee

**6. (d) continued**

- (iii) LTCI considerations (note – any 4 would get full credit)
  - (1) Understanding the benefit structure
    - Are LTCI acceleration payments based on original specified amount, or the DB at time of acceleration?
    - Pattern of COI charges
  - (2) Mortality
    - The assumed difference in mortality rates between non-disabled and disabled insureds that make up the aggregate mortality is a key driver of the ultimate value of the acceleration benefit
  - (3) Guaranteed Minimum Benefits
    - If a combo policy offers any kind of GMDB regardless of L-T care utilization, even more detailed modeling is required
  - (4) Additional Reserves
    - The pricing actuary must know how these benefits should be reserved
    - For pure acceleration benefits, the tendency is not to hold explicit additional active life reserves, since in most cases, no additional level charge involving pre-funding is being made for this benefit
  - (5) Claim Reserves
    - Once an insured is receiving acceleration benefits, a disabled life reserve should be held, calc's in a consistent manner for L-T care insurance claims
    - However, an offset reserve is the exp value of the reduction of future DBs due to the anticipated acceleration payments
  - (6) Co. Taxation Issues
    - How will LTCI rider reserves be treated with regards to qualifying for life insurance reserves used in insurance company tax laws?
    - It would appear that acceleration benefit charges assessed against the CV of a UL contract would not attract prem tax or Fed DAC tax
  - (7) Other acceptable answers would also get credit

## 6. continued

### (e)

#### (i)

- Guaranteed minimum benefits are risky to insurers partly because contracts typically give ph's great control of their policies
- VA buyers control their asset allocation for VA subaccounts as well as other behaviors such as annuitization, withdrawals & lapses
- Under unfavorable scenarios, EZ is exposed to a significant net amount at risk
- Another example: aggressive policyholder's who switch to a conservative asset allocation after incurring an investment loss; they lock in the loss because of the lower (less volatile) investment return

#### (ii)

- Recommend making the rider premium a function of policyholder behavior
- Set the benefit fee structure to manage the risk in asset allocation by aligning fees with costs and RBC C3 Phase II capital requirements
- The fee structure should level the C3 components of RBC
- The data in the table indicates that an approx. 1.30% RBC C3 level can be achieved by charging the following fees for each of the strategies:

○ Conservative	10 bps
○ Moderate conservative	15 bps
○ Moderate	20 bps
○ Moderate aggressive	25 bps
○ Aggressive	35 bps

#### (iii)

- Insurers that maintain a level fee structure may be exposed to anti-selection as policyholder's intent on risky asset allocations choose a level-fee company
- If EZ goes with a variable fee structure, they may attract more of the conservative policyholders, and make less profit, and will attract fewer of the more profitable risky asset allocators

### (f)

#### (i)

- The "missing risk" is early withdrawal risk
- If the hedge is set up so the payoff matches at maturity that might not mean the payoff matches prior to maturity
- This exposes the company to loss if  $MV < BV$  at the time of the early withdrawal

## 6. (f) continued

(ii)

- The fixed component of the hedge may be a risk-free 5-year security maturing at a value equal to  $\$100,000 \times 90\% \times 1.03^5 = \$104,335$
- The current value of a zero coupon risk-free bond maturing in 5 years with a value of \$104,335 will be  $\$104,335 / (1.04)^5 = \$85,756$
- Any premium value remaining ( $\$100,000 - \$85,756 = \$14,244$ ) can be used to cover of issuing the product and to purchase equity options that mature at a value equal to the excess of the promised equity returns over the guarantees
- $5\% \times \$100,000 = \$5,000$  is used to pay commission, and the remaining amount, \$9,244 is used for the purchase of equity options after 1 year, since there has been no equity increase or decrease, the excess value to the customer from the equity component of the product is currently zero ( $60\% \times \text{S\&P appreciation} = 0\%$ )
- However, the policyholder is still entitled to receive a minimum value of  $\$100,000 \times 90\% \times 1.03^1$  or \$92,700
- Thus product guarantees are “in the money”, and the policyholder might be motivated to withdraw
- As fixed rates have increased 3%, the current book (after 1 year) value of the zero-coupon risk-free bond maturing in 4 years  
 $= \$85,756 \times 1.04^1 = \$89,186$
- But its current market value will only be  $\$104,335 / 1.07^4 = \$79,597$
- Since the current value of the equity component of the hedge is at best \$9,244 plus the bond component MV of \$79,597 or \$88,841 is not sufficient to cover the current guarantees (\$92,700)
- Thus there is a risk of additional loss associated with early withdrawals that is not covered by the hedge in all cases

## 7.

### Learning Objectives:

- 2 – i. Describe the process, methods and effects of a potential acquisition or reinsurance of a business including its effect on capital structure, return on equity, price/earnings multiples, and share price.

### Question Description and Graders Comments:

This is a question on the topic of acquisition. Part (a) and (b) are essentially lists taken from the source. For Part (c), some candidates answered the question from the perspective of the seller (QRS). Partial marks were given to the extent where the steps were common between the buyer and seller's perspectives. Again Part (d) is basically a straight list question taken directly out of the source. For part (e), marks were given to all answers that reasonably explained whether each of these synergies is likely to be realized in this situation.

### Solution:

(a)

#### Benefits/Risks of M&A

(1) Describe the benefits and risks to ABC of the potential acquisition.

- Diversification
  - Less volatile earnings because variable annuity sales and fixed annuity sales are inversely correlated
- Revenue and/or earnings growth
  - Growing “top line” more rapidly than their peers
- Revenue synergies from increased sales of different products

(2) Risks of M&A

- Financial risks
  - Including overpaying due to overly optimistic cost saving or revenue synergy assumptions or insufficient due diligence of the seller's liabilities
- Strategic risks
  - Such as creating “channel conflict”
- Execution risk
  - Failure to integrate the transaction properly can cause disruption to the orderly business of the combined firm

## 7. continued

(b) Describe the types of sales processes that QRS might utilize to execute its sale.

(1) Public Auction

- Seller issues a press release announcing the sale of the company
- Advantages
  - All prospective buyers would be put on notice and hence maximizing the number of potential bidders
  - Could lead to a public, heated bidding environment leading to big payoffs for the seller's shareholders
- Disadvantages
  - The announcement of potential sale could damage the business by unnerving suppliers, distribution channels, rating agencies, and customers
  - If the deal falls through, the company would be perceived as "damaged goods"

(2) Privately Negotiated Transaction

- Involves discussions with one potential buyer in a non-competitive / one-to-one environment
- Advantage
  - If the transaction does not work out, the core business is protected from damage since confidentiality is maintained
- Disadvantages
  - The seller's board is subject to second guessing themselves
  - Due to the Sarbanes-Oxley Act in 2002, this type of transaction is less attractive from a seller's perspective

(3) Modified Public Auction

- Targeted marketing campaign aimed at only the most likely candidate to acquire the seller
- Advantages
  - Uses more flexible bidding and due diligence schedule with no "drop dead" dates, has to do with time
- Disadvantages
  - Many potential bidders would be noncommittal in the absence of certain key information, such as identity of the seller
  - The problem of "window shopping" remains, where potential buyers are not sincerely interested in acquiring the seller but there to gather competitive information

## 7. continued

(c)

Explain the steps that you should take to evaluate this acquisition

- Pre-screen the opportunity
  - Request a copy of Confidential Information Memorandum (CIM) and negotiate and execute the Confidential Agreement (CA)
- Market Analysis
  - Evaluate both the short- and long-term market potential for the combined company, including competitive pricing issues, the forecasted demand for the combined company's services
- Preliminary valuation of the target
  - Valuation methods include public company comparable valuation, comparable transaction valuation
- Financial modeling
  - Shows if the acquisition makes sense within a range of potential offer prices, demonstrates the impact of different capital structures
- Due diligence of the seller ("vetting")
  - Decide whether or not to submit bid, ascertain information needed to formulate a meaningful bid, protect itself from potentially devastating downside risks
- Confirmatory due diligence
  - Dispatch team on-site for investigation
- Deal financing
  - Raising financing for the acquisition

(d)

Compare and contrast surplus notes and equity offerings as financing instruments for this acquisition.

- (1) Surplus notes
- Debt securities
    - Claim seniority being subordinate to all debt holders
  - Regulatory approval is often required before a payment can be made
  - Advantages
    - Statutory accounting treatment – counts as statutory surplus, principal amount raised counted towards meeting the RBC requirement
    - The interest expense was tax deductible
    - Enjoyed a lower cost of capital (vs. straight equity)
  - Disadvantage
    - Sufficient lead time for regulatory approval at issuance is needed

## 7. continued

### (2) Equities

- Raise money by selling ownership rights to earnings and assets
  - Lowest claim seniority
- Advantages
  - No limit on amount of capital raised
  - No requirement to repay principal amount raised
  - Viewed favorably by rating agencies
  - For investors, dividends may receive preferential tax treatment
- Disadvantages
  - Dividends not tax deductible to the payor
  - Potential for dilution in ownership
  - Dilution to earnings, reducing P/E ratio, reducing ROE
  - May send negative signals to markets

### (e)

Identify the types of synergies that can occur from an acquisition, and explain whether each of these synergies is likely to be realized in this situation

- Cost saving
  - Can come from eliminating jobs, facilities and related expenses when functions are consolidated
  - Positions eliminated may not mean full salaries reduction
  - Projections can be overly optimistic, may overlook cost categories
  - Underestimate how long it will take to realize cost savings because of insufficient integration details or managers delay making tough decisions
- Revenue enhancements
  - Achieve higher level of sales growth for ABC and QRS together, gains sufficient critical mass to attract revenue neither company would have been able to realize alone
  - Difficult to estimate because they involve external variables beyond management's control, i.e. Customer base of QRS may react negatively, competitors may lower prices in response to acquisition
- Process improvements
  - Occur when managers transfer best practices and core competencies from one company to another
  - Most calculations of synergy value occur under time pressure, information is limited and confidentiality must be maintained. Conditions are far from ideal
- Financial engineering
  - Increase size of company to a level where there are clear economic benefits to pooling working-capital finance requirements and surplus cash, and netting currency positions
- Tax benefits
  - Goal of tax structuring is to avoid as many onetime tax costs as possible, i.e. change-of-ownership that can trigger capital gains or prevent tax losses from being carried forward

## 8.

### Learning Objectives:

- 6 – b. Describe the fundamental concepts of financial and non-financial risk management and evaluate a particular given risk-management framework
- 6 – f. Articulate risk objectives and a risk philosophy
- 6 – h. Describe and assess the elements of a successful risk management function and recommend a structure for an organization's risk management function.

### Question Description:

This question tested the candidates' knowledge of the fundamental elements of an Enterprise Risk Management framework. The candidates were provided with a risk management framework at a hypothetical financial institution, West Coast Bank. Parts (a) and (d) of the question tested the candidates' knowledge of key ERM concepts. Parts (b) and (c) of the question asked the candidates to evaluate and recommend changes to the ERM framework, roles and reporting structure at West Coast Bank. Lastly, the candidates' ability to rank liquidity between business units were tested in part (e).

### **Solution:**

(a)

An integrated goal-congruent risk management process is one that uses optimal firm-wide management of risk.

This process is “integrated” in the sense that all risks are looked at, and a fragmented approach is avoided.

“Goal-congruent” refers to the need to make sure consistency exists between all policies and methodologies.

(b)

#### Pillar #1: Best Practice Policies

Risk tolerance set by policies must be consistent with the firm's business plan and risk/return targets.

Create a Market Risk Policy

- Quantify sensitivity to shifts in the yield curve
- Decide how to allocate capital while balancing profit and risk
- Specify types of market risks the company will assume

## 8. (b) continued

Create a Credit risk Policy

- How much credit to supply, for how long, and to whom
- State limits and diversification needed
- Policy should be consistent with the firm's target credit rating

Create an Operational Risk Policy

- Policy for how to review the introduction of new products
- Decide which risks to insure and which to manage

### Pillar #2: Best Practice Methodologies

Appropriate models should be used for risk measurement. Measurement tools should ensure that the firm's investments are on the efficient frontier of the trade-off between risk and reward.

Risk measurement methodologies should encompass all sources of risk.

Use pricing and valuation methodologies. Illiquid positions require a pricing model to value.

Account for portfolio effects across the entire organization.

### Pillar #3: Best Practice Infrastructure

- People
- Quality data
- Systems and technology

## (c)

An ideal organizational layout should be as follows:

The Board of Directors should set up enterprise wide risk management goals and targets. The Board should also delegate authority to the CEO. Moreover, the Board should contain a risk management committee.

The risk management committee should approve business units' risk management plans and risk limits, and delegate to the CRO.

The Chief Risk Officer (CRO) should independently monitor the risk limits of the company.

The business unit manager is responsible for the risk management and performance of the business unit.

## 8. continued

(d)

Having a business unit mandate will give each business clear risk objectives so that they can meet their business needs and remain compliant with firm-wide risk management objectives.

Steps to take:

- Get approval from Board of Directors/ALCO
- Business unit manager provides updates on key decisions
- Manager outlines future initiatives

(e)

Liquidity Rank

$$= \sum (\$Amount_i) \times (\text{Liquidity User Rank}_i) + \sum (\$Amount_j) \times (\text{Liquidity Supplier Rank}_j)$$

Business Unit Alpha

$$\text{Liquidity Rank} = (\$4M \times -1) + (\$8M \times -5) + (\$8M \times 5) = \$ - 4M$$

Business Unit Beta

$$\text{Liquidity Rank} = (\$2M \times -5) + (\$0.5M \times 1) + (\$1.75M \times 5) = \$ - 0.75M$$

Business Unit Gamma

$$\text{Liquidity Rank} = (\$10M \times -1) + (\$3M \times 2) + (\$2M \times 4) = \$4M$$

Therefore, Alpha uses the most liquidity and Gamma uses the least, as Gamma > Beta > Alpha in terms of liquidity rank.

Next step would be to charge each business unit for the liquidity risk it generates. A positive liquidity rank would be given a liquidity credit.

## 9.

### Learning Objectives:

- 4 – d. Describe how the performance of a given firm or venture may be evaluated against its objectives including total returns
- 7 – a. Describe how risk and opportunity influence the selection of a firm's vision and strategy.
- 7 – b. Describe how ERM is able to contribute to shareholder value creation.

### Solution:

#### (a)

Determine fair value of liabilities

- Use a risk free curve to discount the liabilities cash flows
- Arbitrage free approach

Create a liability benchmark

- The required option-adjusted spread (ROAS) is the spread added to the pricing curve such that present value of liabilities is equal to the single premium paid for the GIC.
- The liability model is decomposed into a portfolio of cash flows with options.

Create an asset benchmark

- 3 steps
  - Specify investment guidelines
  - Construct asset benchmark
  - Construct sector benchmark

Return attribution process

- Attribute the return to sources of risk and decision.

#### (b)

$$r_L = r_F + \text{ROAS} - \sum D(i) \times \Delta r(i) + e_L = 4.175\%$$

$$r_A = r_F + \text{OAS} - D_{\text{OAS}} \times \Delta \text{OAS} - \sum D(i) \times \Delta r(i) + r/c + pa - e_A = 4.275\%$$

## 9. continued

(c)

	Assets	Liabilities	Net = assets – liabilities
$r_F$	$r_F = 3.00\%$	$r_F = 3.00\%$	0%
C1 Risk	$OAS - D_{OAS} \times \Delta OAS$ = 0.60%	0%	0.60%
C2 Risk	0%	ROAS = 0.50%	-0.50%
C3 Risk	$-\sum D(i) \times \Delta r(i)$ = 0.575%	$-\sum D(i) \times \Delta r(i)$ = 0.475%	0.100%
Intra year changes	$r/c + pa = 0.20\%$	0%	0.20%
Expenses	$-e_A = -0.10\%$	$+e_L = 0.20\%$	-0.30%
Total	4.275%	4.175%	0.100%

(d)

One year net profits of 10bps

- The credit risk exceeds the pricing risk by 10bps
- Intra year changes indicate positive contribution from asset management

(e)

Exit option

- After phase 1 assess the cost/benefit of exiting the GIC product line
- Equivalent to a put option

Growth option

- Option to expand the GIC product offering
- Equivalent to a call option

Learning option

- Experience will be gained from the 1 year pilot
- Equivalent to a call option

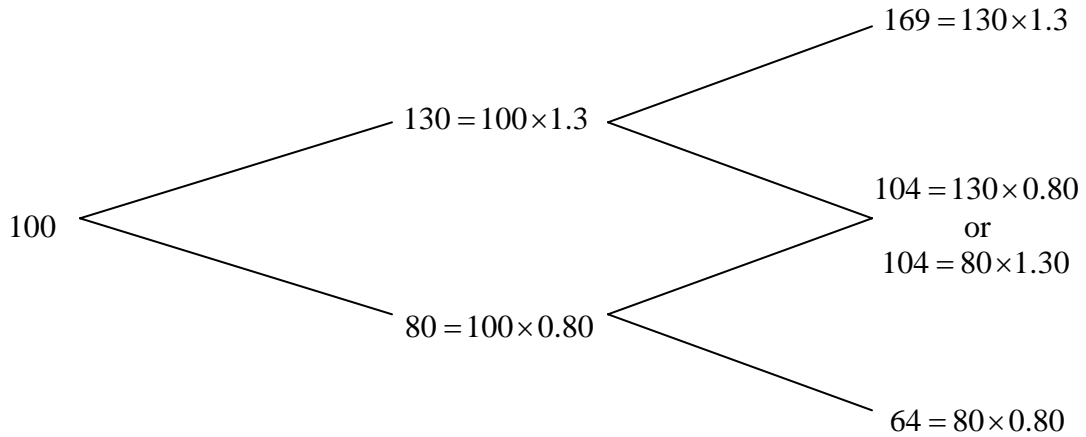
Staging option

- Delay offering of the complete GIC range
- Equivalent to a call option

**9. continued**

**(f)**

Independent valuation:

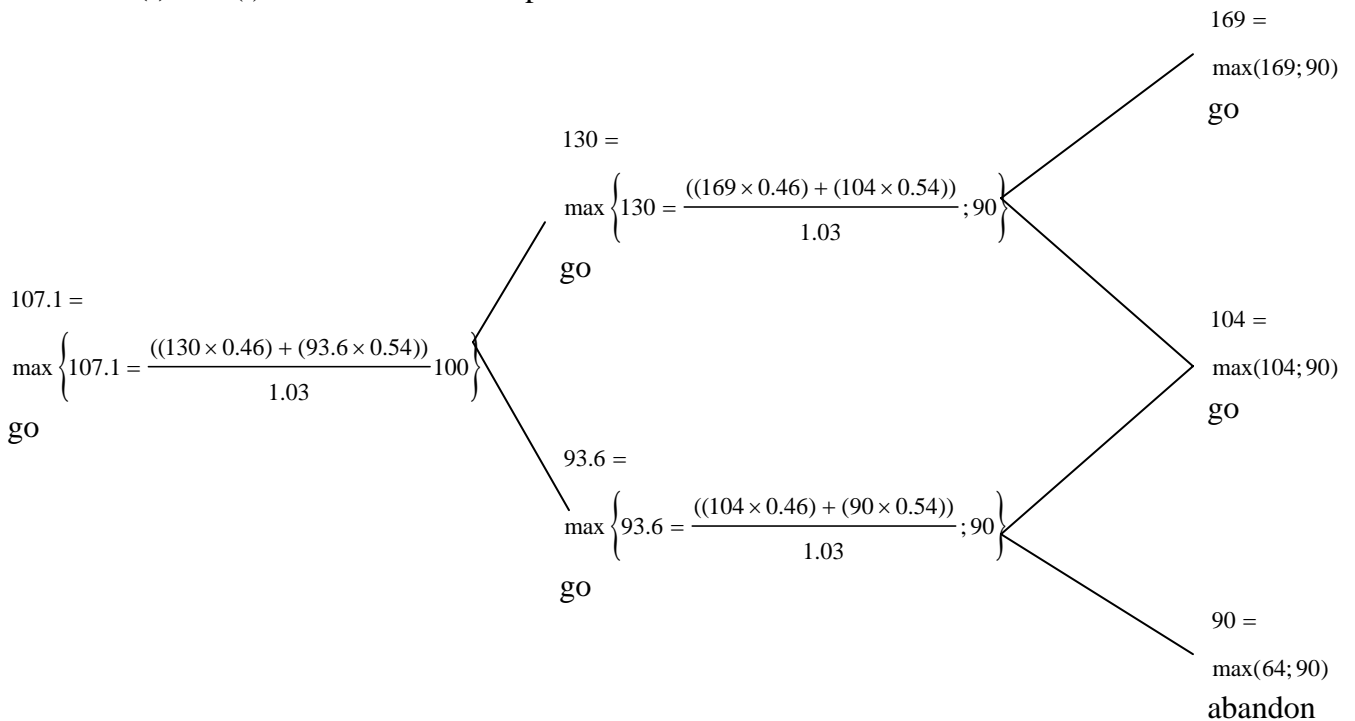


Risk neutral probabilities:

$$q = (1 + r_f - d) / (u - d) = (1.03 - 0.8) / (1.3 - 0.8) = 0.46$$

$$p = 1 - q = 0.54$$

**(f)** (i) abandonment option:



Thus abandonment option value = 107.1 - 100 = 7.1

## 10.

### Learning Objectives:

7 – b. Describe how ERM is able to contribute to shareholder value creation

### Solution:

(a)

- Need to calibrate the model
- Determine  $\mu$  and  $\sigma$  from historical data
- Adjust parameters to meet calibration criteria
- Update  $\mu$  and  $\sigma$  with the current data

(b)

- Solve 2 equations
- $\ln(0.76) - \mu + 1.96\sigma = 0$
- $\ln(0.90) - \mu + 1.28\sigma = 0$
- $\sigma = 25.5\%$
- $\mu = 22.1\%$

(c)

- Poor fit to the overall distribution
- Particularly poor in the right tail
- Better approach is to fix the mean then adjust the volatility parameter

(d)

- $p = 1312 / 50,000 = 2.6\%$
- $p_{0.95} = p - 1.645 \times \{[p \times (1 - p)] / m\}^{1/2}$
- $p = 2.51\%$
- Since 2.51% is greater than 2.5%, the condition is met

# 11.

## Learning Objectives:

- 8 – a. Define and evaluate credit risk as related to fixed income securities
- 8 – c. Describe best practices in credit risk measurement, modeling and management
- 8 – d. Describe the use of credit and underwriting policies, diversification requirements

## Solution:

(a)

Shortcomings of the old EC model:

- Doesn't factor in the tail risk (>99.5%)
- Simple addition ignores correlation between the 3 types of risk
- Doesn't capture interaction between spread and market liquidity risk
- Default is a special case of downgrade and should be treated consistently

(b)

4 elements of credit risk and DFS's exposure:

- Business credit risk
  - Counterparty can default on its obligations
  - Present – TechNix could default
- Invested asset credit risk
  - Includes risk of rating downgrade
  - Present
- Political risk
  - Not significant
- Concentration risk
  - Minimal exposure because DFS has little in same industry / sector as TechNix

(c)

Moody's and S&P ratings are different

Moody's A3:

- A denotes mostly favorable, upper-medium grade obligation. Principal and interest are adequately secure, but it could become risky in the future.
- 3 means lower-end ranking within the A category.
- Corresponding S&P rating would be A-

S&P's BBB+:

- BBB denotes adequate protection, but adverse economic conditions more likely to weaken the issuer's ability to meet its financial commitment
- Modifier + means it is at the higher end of the BBB rating

## 11. continued

### Corresponding Moody's rating w/b Baa1

- Both ratings are investment grade; Moody's is slightly higher
- Small differences in ratings are not uncommon; rating agencies have different methods, definitions, focus, and information
- E.g., Moody's ratings primarily reflect default probabilities, not severity of loss if default occurs
- They may have rated at different times; one may be due for a revision
- Rating agencies can form different opinion/judgment about a company's financial strength based on same info

(d)

Year-End Rating	Probability $p(\%)$	Forward Price $V(\$)$	Change in Value: $\Delta V(\$)$	<b>Exp Value</b>
AAA	0.09	106.35	0.10	<b>0.096</b>
AA	2.30	106.30	0.05	<b>2.445</b>
A	91.00	106.25	0	<b>96.688</b>
BBB	5.50	105.86	-0.39	<b>5.822</b>
BB	0.75	104.43	-1.82	<b>0.783</b>
B	0.30	103.96	-2.29	<b>0.312</b>
CCC	0.01	96.30	-9.95	<b>0.010</b>
Default	0.05	50.00	-56.25	<b>0.025</b>
				<b>106.180</b>

1-year forward price:

$$V(AA) = CF_1 + CF_2 / (1 + rf_1(AA)) = 5 + 105 / 1.0365 = 106.3$$

Similarly,  $V(A) = 5 + 105 / 1.037 = 106.25$ ;  $V(BBB) = 5 + 105 / 1.041 = 105.86$ ; and  $V(BB) = 5 + 105 / 1.056 = 104.43$

$$\Delta V = V - V(A)$$

$$EV = \sum pV = 0.0009 \times 106.35 + 0.023 \times 106.3 + \dots + 0.05 \times 50 = 106.18$$

## 11. continued

(e)

Risk-neutral value:

$$PV = \sum_t (1 - LGD_t) \frac{CF_t}{1 + r_t} + \sum_t (1 - Q_t) LGD_t \frac{CF_t}{1 + r_t}$$

For Moody (A):

$$\begin{aligned} PV(A) &= (1 - 40\%) \times (5/1.03 + 105/1.03^2) + 40\% \times ((1 - 0.02) \times 5/1.03 + (1 - 0.15) \times 105/1.03^2) \\ &= (60\%) \times (103.827) + (40\%) \times (88.883966) = (62.2962 + 35.5536) = 97.8498 \end{aligned}$$

For S&P (BBB):

$$\begin{aligned} PV(BBB) &= (1 - 50\%) \times (5/1.03 + 105/1.03^2) + 50\% \times ((1 - 0.03) \times 5/1.03 + (1 - 0.18) \times 105/1.03^2) \\ &= (50\%) \times (103.827) + (50\%) \times (4.7087 + 81.1575) = 51.9135 + 42.9331 = 94.8466 \end{aligned}$$

Credit spread:  $CS = y - r$ , where  $y$  = yield,  $r$  = risk-free rate

$$PV = 5/(1 + y) + 105/(1 + y)^2$$

$$\begin{aligned} \text{For Moody: } 97.8498 &= PV = 5/(1 + y) + 105/(1 + y)^2 \\ y &= 0.061757 \rightarrow CS = 0.061757 - 0.03 = 0.031757 \end{aligned}$$

$$\begin{aligned} \text{For S\&P: } 94.8466 &= PV = 5/(1 + y) + 105/(1 + y)^2 \\ y &= 0.078853 \rightarrow CS = 0.078853 - 0.03 = 0.048853 \end{aligned}$$

Market yield is under 5% (bond purchased at a premium), so Moody's (A) spread is closer.

## 12.

### Learning Objectives:

- 2 – b. Evaluate various profitability measures including IRR, NPV and ROE, etc.

### Solution:

(a)

#### Economic profit

- Profit is measured based on cash flow
- Equal to  $\text{Rev} - \text{W\&S} - \text{I}$   
Rev is revenue  
W&S is the expenses incurred to produce the revenue (wages, salaries, etc.)  
I is investment outlay

#### Accounting profit

- Measures income using accounting rules and capitalizes investment capital outlay and instead deducts depreciation (i.e., it amortizes the investment capital expense)
- Equal to  $\text{Rev} - \text{W\&S} - \text{change dep}$   
Change dep is the depreciation of the capital outlay

(b)

Objective: capital budgeting techniques should help company choose projects that would increase firm value

#### Criteria:

- It should consider all cash flows
- It should discount the cash flows using the firm's cost of capital (it should consider time value of money)
- In mutually exclusive projects, it should choose projects that give the highest value to the firm
- Managers should be able to analyze each project separately with the combination of any two not changing the ending result or decision

(c) Payback method

- Measures how soon the project is able to recover its initial cash outlay. For any project, it is the year wherein total simple sum of cash (including the first negative outlay) becomes positive.
- Does not consider all cash flows (after payback period point) and does not consider time value of money

## 12. (c) continued

Accounting rate of return

- Get the average after-tax profits for each project
- Problem is that usually cash flow does not equal accounting profits, so it does not consider cash flows. Also, it does not consider time value of money.

Net present value

- Discounts the cash flows of the project using the firm's cost of capital, which is the correct discount rate to use since it is at this rate that we will be able to get capital from market.
- No shortcomings for no managerial flexibility case. If there is real option though, then not able to consider that flexibility.

IRR

- Rate that will make  $NPV = 0$  for the project
- Not correct because it assumes that cash flows reinvested at IRR, which is not the cost of capital for the firm

(d)

Payback method:

- A: 2<sup>nd</sup> year
- B: 4<sup>th</sup> year
- C: 1<sup>st</sup> year

Accounting rate of return:

- A:  $[(-2000 + 1400 + 800 + 200 + 100) \times (1 - 0.35) / 4] / 2000 = 4.1\%$
- B: 4.7%
- C: 3.3%

Net present value

- A:  $(-2000 + 1400/1.12 + 800/1.12^2 + 200/1.12^3 + 100/1.12^4) = 93.66$
- B: 34.70
- C: 74.59

(e)

Project A should be considered since it has the highest NPV and the NPV is the increase in shareholder value since we discounted using the firm's cost of capital

## 12. continued

(f)

Payback method recommended project C. Not followed because failed to consider -600 cash flow in year 3.

Accounting rate of return recommended project B. But did not use as basis because fails to take account of time value of money.

IRR recommended project C. Did not take into account because it assumes that cash flows can be refinanced at 17%, but the firm's cost of capital is actually 12%.

# 13.

## Learning Objectives:

- 2 – c. Identify regulatory capital requirements and describe how they affect decisions
- 2 – h. Describe the process, methods and uses of insurance securitizations and recommend a structure that is appropriate for a given set of circumstances
- 7 – a. Describe how risk and opportunity influence the selection of a firm's vision and strategy

## Solution:

(a) Reserve risk is the risk that the actual costs of losses will defer from expected  
It is a function of:

- Randomness of claims
- Inflation in claim costs
- Incompleteness of data

(b) Loss reserves (currently 800) can go up 20% to 960 or down 20% to 640  
If assets are equal to  $800 \times (1 + C)$  then...

- $EPD / L = 0.05$
- $[960 - 800 \times (1 + C)] / 800 = 0.05$
- $C = 0.10$

(c) RBC calculation

- Stocks =  $200 \times 0.20 = 40$
- Bonds =  $1000 \times 0.05 = 50$
- Affiliates =  $100 \times 0.20 = 20$
- Loss Reserves =  $800 \times 0.10 = 80$
- Property UPR =  $100 \times 0.20 = 20$ 
  - Total Capital = 210

Fully correlated

$[40, 50, 20, 80, 20] \times$	1	1	1	1	1		40
	1	1	1	1	1		50
	1	1	1	1	1	x	20
	1	1	1	1	1		80
	1	1	1	1	1		20

$$\text{Capital} = \text{sqrt} \{44,100\} = 210$$

### 13. continued

Zero correlation

[40, 50, 20, 80, 20]×	1	0	0	0	0		40
	0	1	0	0	0		50
	0	0	1	0	0	x	20
	0	0	0	1	0		80
	0	0	0	0	1		20

$$\text{Capital} = \sqrt{11,300} = 106.3$$

Correlations as stated

[40, 50, 20, 80, 20]×	1	0.2	1	0	0		40
	0.2	1	0.2	0.3	0		50
	1	0.2	1	-1	0	x	20
	0	0.3	-1	1	0		80
	0	0	0	0	1		20

$$\text{Capital} = \sqrt{13,300} = 115.33$$

Correlations give an RBC amount between fully correlated and zero correlation

**(d) Reinsurance**

- Credit risk – risk that reinsurer is unable to pay
- Basis risk – not applicable since reinsurance is based on SP&C's portfolio
- Moral hazard – because SP&C has no incentive to avoid claims that reinsurer will pay

**Catastrophe Option**

- Credit risk – lower due to spread among investors
- Basis risk - larger because payoff is based on an index that may not match SP&C's losses
- Moral hazard – reduced because SP&C paid on index, lower direct losses helps SP&C

## 14.

### Learning Objectives:

- 3 – a. The candidate will be able to analyze a specific company financial situation by demonstrating advanced knowledge of balance sheet and income statement structures.

This is a short question on FAS 133. The first part of this question tests candidates' knowledge in hedge accounting. Parts (b) and (c) come directly from the source in terms of listing out elements of formal documentation at inception and disclosure requirements for FAS 133. Parts (d) and (e) test the candidates' understanding in FAS 133 implementation issues regarding EIA.

### Solution:

(a)

Contrast the accounting treatment for hedge instruments that qualify as fair value hedges with that of hedge instruments that qualify as cash flow hedges

- In both cases derivatives are always carried at fair value on balance sheet
- For instruments that qualify as fair value hedges
  - The gain on derivative instruments as well as the offsetting loss on the hedged item is recognized currently in earnings in the same accounting period.
  - The “ineffective portion” is effectively forced through earnings
- For derivative instruments that qualify for cash flow hedges
  - The effective portion of the gain is reported as a component of other comprehensive income
  - Reclassified into earnings in the same period or periods during which the hedged forecasted transaction affects earnings

(b)

Identify the elements which should be part of the formal documentation of the hedge at its inception

- Hedge relationship, nature of risks
- Entity's risk management objective and strategy for undertaking the hedge
- Identification of the hedging instrument, the hedged item and the nature of the risk being hedged
- How the effectiveness of the hedge will be measured

## 14. continued

(c)

Outline the disclosure requirements that must be satisfied in order to utilize FAS 133.

- Disclosures must be segregated to fair value, cash flow, and hedges of investment in a foreign operation
- Show objectives and strategies for holding/issuing derivative
- Description of the risk management policy
- Net gain/loss recognized in earnings representing the total amount of the hedge's ineffectiveness
- Events that will result in recognition of gains/loss deferred in Accumulated OCI
- Estimate of amount of deferred gains/losses that will be recognized in earnings in the next 12 months
- Maximum period over which entity is hedging cash flows associated with forecasted transactions

(d)

Describe the accounting treatment of the embedded derivative in the EIA product, assuming FAS 133 applies.

- Host contract is debt-like
- The appreciation in account value arising from the equity-indexed feature is the series of embedded derivative requiring bifurcation and recording at fair value.
- The embedded derivative should value the difference between the anticipated equity appreciation and the floor – like a “long” call on the equity index
- All periods should be included in the embedded derivatives and are to be valued.

(e)

Explain how the EIA could be designed to avoid having it subject to FAS 133. The cash surrender value must be adjusted for equity performance.