
SOCIETY OF ACTUARIES

Exam AFE

Advanced Finance/ERM

Exam AFE

MORNING SESSION

Date: Friday, May 9, 2008

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.

****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.** (8 points) As the new Zoolander CFO, you have just reviewed Sean Basset's 2008 Marketing Plan.

The 2008 Plan provided for only one new product launch, the Enhanced Savings Annuity (ESA), and this product represents 80% of the GIC product line's projected ZIP results. The ESA product is an innovative equity-indexed annuity that Sam Roach believes will attract former GIC investors who are not happy with the current low guaranteed returns, but who are not ready to take on full investment risk in volatile markets. Teresa Cricket believes the ESA could also be a way to retain customers who want an alternative to the Variable Annuity product.

Neither the BingBang product nor the Hedge Fund initiative was contemplated in the 2008 Marketing Plan.

- (a) (1 point) Describe the impacts that a low interest rate environment and weak equity markets can be expected to have on:
- (i) Variable Annuities without benefit guarantees
 - (ii) Equity-Indexed Annuities (EIAs)
 - (iii) Immediate Annuities
- (b) (3 points) Describe the following elements of product strategy and assess whether these elements were adhered to with respect to Zoolander and the BingBang product initiative:
- (i) Target Markets;
 - (ii) Core Competencies;
 - (iii) Risk Profile;
 - (iv) New Markets.
- (c) (1 point) Identify the four stages in the preliminary product design process and describe how Zoolander should have applied each for the BingBang concept.
- (d) (2 points) Describe the product development process for Zoolander's ESA product and assess any deficiencies therein with respect to:
- (i) Product Development Team;
 - (ii) Senior Management Input;
 - (iii) Ad-hoc Product Development Staff.

1. (Continued)

- (e) *(1 point)* Describe the mortality risk and pricing considerations that Zoolander should have considered for:
- (i) The new ESA product;
 - (ii) The single premium life annuity component of the BingBang product;
 - (iii) The term to 100 component of the BingBang product.

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

- 2.** (18 points) The Zoolander Board has decided to proceed with the Eagle joint venture initiative. At the inception date, January 1, 2009, Zoolander and Insuratron will each own a 50% stake in Eagle; however, Zoolander will retain all decision-making authority over Eagle. In return, Zoolander has offered Insuratron a guarantee whereby Insuratron can opt to sell its stake in Eagle to Zoolander on January 1, 2011 for no less than 65% of Insuratron's initial capital contribution accumulated at the risk free rate of 6%.

You are given the following:

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

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

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

$$H_0 = (\alpha P/S_0)\{S_0e^{-dn}\Phi(d_1) - K^{PTP}e^{-m}\Phi(d_2)\}$$

$$\text{Where: } d_1 = \frac{\log(S_0/K^{PTP}) + (r - d + \sigma^2/2)n}{(\sigma\sqrt{n})}$$

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

Table of the Standard Normal Distribution

x	$\Phi(x)$
0.04	0.516
0.11	0.544
0.22	0.587
0.31	0.622
0.41	0.659
0.58	0.719
0.66	0.745
0.72	0.764
0.87	0.808
0.93	0.824

2. (Continued)

- (a) (2 points) Explain how each of the following may or may not resemble either a separate account guarantee or an equity indexed guarantee:
- The guarantee offered by Zoolander to Insuratron
 - The senior management bonus pool arrangement for Eagle
- (b) (3 points) Using the risk-neutral probabilities implied by the Platinum Baggs April report findings, determine the value of the guarantee granted by Zoolander to Insuratron as of January 1, 2009. Explain why portfolio replication may or may not be an appropriate method to value this guarantee. Show your work.
- (c) (4 points) Compute the value of the guarantee Zoolander is granting to Insuratron as of January 1, 2009, using the Black-Scholes formula and the high end of the annual stock return variance estimate provided in the Platinum Baggs report. Compare this value to the value arrived at in (b) and explain why these differ. Show your work.
- (d) (3 points) Provide the SFAS 133 definition of a derivative and explain whether each of the following qualifies as a derivative:
- The guarantee offered by Zoolander to Insuratron
 - The senior management bonus alignment fund
- (e) (2 points) Explain the criteria that must be satisfied for a transaction to qualify for SFAS 133 hedge accounting. Explain the different accounting treatments that apply depending on whether or not the hedging criteria are met.
- (f) (4 points) You are given the following assumptions about Eagle:
- An in-house senior management team is to be hired for January 1, 2009.
 - The senior management team opts for the bonus alignment fund and collectively contribute \$0.5 million.
 - There are 10 million outstanding shares of Eagle.
 - The high end of the annual stock return variance estimate provided in the Platinum Baggs report is expected.
 - There are no dividends.

Using a Black-Scholes valuation approach, determine the expected value of the bonus alignment fund as of January 1, 2009. Show your work.

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

3. (10 points) You are preparing for Zoolander's meeting with Kelly Ratings Agency.

Juan Bass has provided the following details with respect to the GIC operation as of December 31, 2007:

GIC Asset Breakdown:			
Public Bond	IG:	50%	NAIC1
		50%	NAIC2
	BIG:	100%	NAIC3
Private Bonds (all 144A)	IG:	25%	NAIC1
		75%	NAIC2
	BIG:	100%	NAIC3
CMO	All Sequential		

GIC Reserves	
2007	6,658
2006	6,296
2005	4,992
2004	4,417
2003	3,012
2002	2,558

GIC CSV Breakdown:	CSV
No Surrenders Allowed	-
MVA	2,300
SC >= 5%	1,000
SC <=5%	2,100
No SC	1,100

You have recently received e-mails from two Zoolander executives suggesting changes to the GIC portfolio:

- Wanda Fox is recommending a change to the current asset mix backing the GIC product line. She wants to increase exposure levels to junk bonds and CMBS at the expense of investment grade bonds to enhance credited rates on the GIC product line.
- Peter Fish, on the other hand, suggests that the credit cycle has changed, and he strongly recommends purchasing Credit Default Swaps on some of the largest credit exposures in Zoolander's portfolio, all of which reside within the GIC operation.

While you are busy preparing for the Kelly meeting, you are approached by James Garnet, a sales representative from Crimson & Clover (C&C). C&C is a nationally recognized statistical rating organization (NRSRO), and Mr. Garnet suggests that you have C&C rate Zoolander. In particular, C&C has recently developed a new financial product company (FPC) model that incorporates an insurer's management and tolerance of risk into the analysis of capital adequacy.

3. (Continued)

In brief, the FPC develops an RBC charge that is the sum of:

- (i) Market Risk Charge (MRC),
- (ii) Credit Risk Charge (CRC) and
- (iii) Operational Risk Charge (ORC),

where,

- $MRC = \text{Mismatch RC} + \text{Convexity RC} + \text{Liability option RC}$
- $CRC = \text{Nonfinancial market-related credit exposure charge} + \text{OTC counterparty credit risk charge} + \text{credit concentration RC}$
- $ORC = \text{Financial intermediation operational RC} + \text{OTC derivative operational RC}$

C&C would apply the FPC model optionally to Zoolander's non-insurance businesses such as GICs. C&C believes the FPC model will allow Zoolander to earn recognition for any integrated risk management techniques used to manage interest rate, credit, and operational risks of the GIC operations. Garnet has offered to have a preliminary, confidential analysis performed on Zoolander's GIC line, free of charge, to demonstrate the power of the FPC model.

- (a) Based on the information provided by Juan Bass for the current GIC operations, assess whether Kelly's A rating of Zoolander is likely to be maintained or downgraded. Consider liquidity, earnings, and the concerns that Kelly has previously expressed about Zoolander. Show your work.
- (b) Describe the potential advantages and disadvantages to Zoolander of being rated by C&C instead of Kelly Ratings & Analysis.
- (c) With respect to Zoolander's ratings by Kelly and C&C, assess separately the potential impact of:
 - (i) following Wanda's recommendation to increase the allocation of junk bonds and CMBS backing the GIC product; and
 - (ii) hedging the largest credit default risks in the existing GIC bond portfolio, using credit default swaps, as recommended by Peter.
- (d) Recommend a course of action both with respect to the GIC product line and with respect to rating agencies that would likely enable Zoolander to obtain the best rating result. Explain your reasoning for this course of action.

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

- 4.** (10 points) At the preliminary meeting of Zoolander’s Pension Committee, Peter Fish and Juan Bass presented a proposal to revamp the asset allocation and management strategy for Zoolander’s defined benefit (DB) pension plan, Golden Sunset Plan I.

Peter proposes that the assets be brought in house to be managed by his team and transitioned to a 100% allocation to fixed income. Juan supports this move, in particular citing expected changes in pension accounting rules in the future.

However, Wanda Fox strongly supports the current asset mix, which she believes is maximizing long-term expected returns while tolerating acceptable levels of risk.

- (a) Contrast the accounting/actuarial or “opaque” pricing principles for defined benefit pension plans to the financial or “transparent” pricing principles. Include a description of each approach and the implications of each for pension plan investing.
- (b) Describe Treynor’s augmented balance sheet as used by financial economists to analyze corporations with DB pension plans.
- (c) Using the financial approach, calculate the following for Zoolander’s Golden Sunset Plan I:
 - (i) the marked-to-market cost;
 - (ii) the investment return on assets;
 - (iii) the return on liabilities;
 - (iv) the annuity company loss (gain).Show your work.
- (d) Provide three specific arguments that support Wanda’s view and counter these with arguments from the financial model perspective.
- (e) Considering Zoolander specifically, recommend either adopting Peter’s and Juan’s proposal or maintaining the existing asset allocations and management of Golden Sunset I. Support your recommendation with information from the case study as well as your evaluation of the arguments included in the syllabus readings.

- 5.** (7 points) Luxor Re is a reinsurer formed three years ago to reinsure life-contingent immediate annuities. Luxor Re collects periodic premiums from the ceding company based on expected annuity payments and a risk margin, and Luxor Re pays the ceding company the actual annuity payments (i.e., the ceding company is transferring the longevity risk).

Luxor Re has enjoyed great sales growth in its first three years and now has limited capacity to accept additional longevity risk unless the company increases or frees up capital.

Luxor Re's CEO has asked you to investigate securitization of the annuity liabilities as a potential capital solution for Luxor Re.

Outline a report for the CEO that includes the following:

- (a) At the general level, i.e., not specific to Luxor Re's situation, provide a brief description of what securitization is, including the economic rationale for securitizations and the downside of securitizations.
- (b) List and describe the primary categories of securitization for life insurance assets and liabilities.
- (c) Outline a structure that would enable Luxor Re to securitize the future cash flows of the inforce business in order to realize some of the block's future profits immediately. Identify the parties to the transaction and describe the cash flows and role for each party.
- (d)
 - (i) Explain the purpose of credit enhancement in securitization.
 - (ii) Describe how the following types of credit enhancement could be utilized in the Luxor Re transaction you described in (c), and give examples of each type of enhancement:
 - Internal credit enhancement
 - External credit enhancement

- 6.** (7 points) You are the Chief Actuary of a small life insurance company, Flamingo Life, that has no experience with derivatives. The CEO is concerned about Flamingo Life's increasing exposure to market risk from the growing variable annuity line, which has a Guaranteed Minimum Income Benefit (GMIB).

She has asked you to lead the project to implement a new derivatives hedging strategy for the company. Your first step is to create an introductory report informing the Board of best practices in managing the risks inherent in this derivative program.

- (a) Cite five of the Group of 30 (G-30) recommendations and explain what Flamingo Life will need to do to comply with them. Include at least two recommendations related to operational risk and at least two recommendations related to credit risk.
- (b) Detail the optimal role of the Board of Directors with respect to derivative governance and strategy.
- (c) You have decided to use a static replication approach to hedging the GMIB.

Explain how to implement the static replication approach and describe the complications that prevent available derivatives from being a perfect hedge.

- (d) Recommend ways for Flamingo Life to manage the counterparty risk of its new hedging program.
- (e) Calculate the risk-weighted amounts with and without netting for the following potential counterparties to Flamingo Life's derivatives transactions. Show your work.

		Counterparty A		Counterparty B	
		Risk Capital Weight: 30%		Risk Capital Weight: 40%	
	Add-on Factor	Notional Amount	Marked-to-Market Value	Notional Amount	Marked-to-Market Value
1-year equity option	6%	500	-100	800	200
5-year interest rate swap	0.5%	1,000	300	500	-250

****END OF EXAMINATION****
MORNING SESSION

SOCIETY OF ACTUARIES

Exam AFE

Advanced Finance/ERM

Exam AFE

AFTERNOON SESSION

Date: Friday, May 9, 2008

Time: 1:30 p.m. – 4:45 p.m.

INSTRUCTIONS TO CANDIDATES

General Instructions

1. This afternoon session consists of 8 questions numbered 7 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

- 7.** (5 points) You are a professional stock analyst and the financial expert amongst your family and relatives. Your brother-in-law, Bob, asks you, “Why do many actively managed mutual funds routinely underperform the indices that they are supposed to beat? Why do people not only invest in these mutual funds, but stay invested in these funds?”
- (a) Provide a response to Bob, listing and describing at least three reasons from a behavioral finance perspective.
 - (b) Bob owns a significant amount of his employer’s stock. He is excited that the company is increasing the dividends on the stock, after several years of level dividends. However, he appears unconcerned that the special stock dividend that was paid last year will not be paid this year.
 - (i) Explain why Bob might be reacting as he is regarding this dividend news, based on a behavioral finance perspective.
 - (ii) Provide possible behavioral finance explanations for Bob’s company’s current and past dividend actions.
 - (c) Bob proudly tells you that his company is in the process of acquiring a formerly successful, but currently struggling competitor. He speculates that the deal was done for purely competitive marketplace-driven reasons.
 - (i) Explain to Bob other possible reasons for this acquisition from a behavioral finance perspective.
 - (ii) Explain from a behavioral finance perspective how the target firm may have deteriorated from successful to struggling.
 - (iii) Describe to Bob how the shareholders from the two companies typically fare in such an acquisition.

- 8.** (11 points) You are being interviewed for your dream job as Enterprise Risk Manager for Mirage Life, a U.S. insurance company. Your current employer is a Canadian bank for whom you developed the internal controls for managing interest rate risk.

Respond to the following questions posed by the interviewer:

- (a) (3 points) Describe the internal controls that you employed at the bank, assuming you followed the recommendations of Basle's Principles for the Management of Interest Rate Risk, in particular, Principle 10, dealing with internal controls.
- (b) (3 points) For a publicly-traded U.S. company like Mirage, detail the steps required to evaluate the effectiveness of internal controls for actuarial processes.
- (c) (1 point) Briefly show how applicable your banking experience is by commenting on the overlap between (a) and (b).
- (d) (1 point) Demonstrate your knowledge of COSO by naming and briefly describing six of the eight components which apply to evaluating effective internal controls.
- (e) (2 points) The interviewer asks how you would avoid the situations faced by Enron and General American.

Outline the errors that were made and indicate controls that you would implement to address these specific problems.

- (f) (1 point) Explain several ways that ERM can benefit shareholders and policyholders.

9. (6 points) You are a pricing actuary for Caesar's Life Insurance Company. You are analyzing a new non-renewable 4-year term product from a U.S. GAAP perspective. You price this product using a target IRR of Distributable Earnings.

You have developed projected financial results for a block of issues of this product all issued on the same date, based on the following assumptions:

- After-tax investment earnings on Target Surplus are included in Statutory Earnings, but the change in Target Surplus is not.
- GAAP reserves are equal to the Statutory reserves.
- Distributable Earnings are divided out to shareholders as they are earned.
- Target Surplus at issue is 1,000.
- GAAP Equity at issue is 1,000.
- IRR at issue is 12.0%.

	Policy Year			
	1	2	3	4
Statutory Earnings	0	150	100	80
Target Surplus (EOY)	750	500	250	0
DAC Balance (EOY)	150	100	40	0
GAAP Income	150	100	40	40
GAAP Equity (EOY)	900	600	290	0

- (a) Define and calculate the following quantities for each policy year. Show your work.
- (i) Distributable Earnings
 - (ii) GAAP ROE
- (b) Describe the issues management faces when assessing the performance of this block by analyzing:
- (i) the policy year ROE for a single cohort of issues
 - (ii) the calendar year ROE for multiple years of issues
- (c) Assuming the discount rate equals the pricing IRR:
- (i) Define and calculate the Embedded Value for each policy year. Show your work.
 - (ii) Determine the Embedded Value earned rate for each projection year for this discount rate. Show your work.

9. (Continued)

- (d) An unexpected shock lapse of 40% occurs at the end of the second policy year, after experience has emerged as expected up to that point. Assume that this shock lapse does not result in a DAC write-down and does not impact Embedded Value discount rates.

Statutory Earnings and Target Surplus are decreased 40% from their original projections in the applicable periods, as follows:

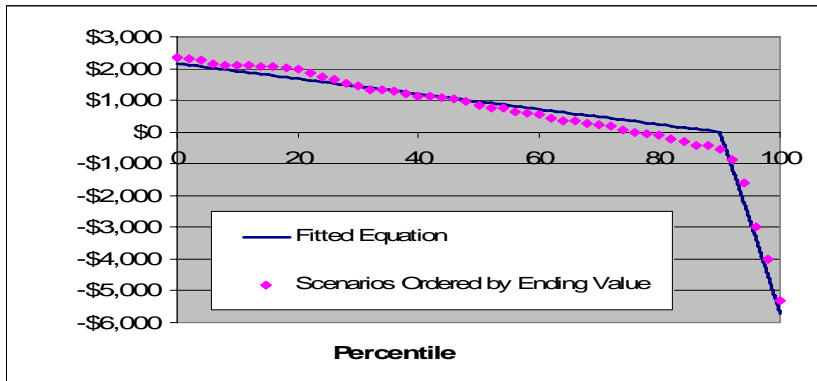
	Policy Year			
	1	2	3	4
Statutory Earnings	0	150	60	48
Target Surplus (EOY)	750	300	150	0
DAC Balance (EOY)	150	100	40	0
GAAP Income	150	100	0	8
GAAP Equity (EOY)	900	400	190	0

- (i) Calculate Distributable Earnings and GAAP ROE for each policy year.
(ii) Calculate Embedded Value and the Embedded Value earned rate for each policy year.
(iii) Describe and explain the change, if any, in the pattern and values of the GAAP ROE and Embedded Value earned rates.

Show your work.

- 10.** (13 points) Your company's portfolio consists of a single annuity product that matures in one year, Product A. At that time the company will dissolve and all stakeholders will be paid off.

After running thousands of one-year scenarios and ordering the scenarios by ending value, you have the following graph of values:

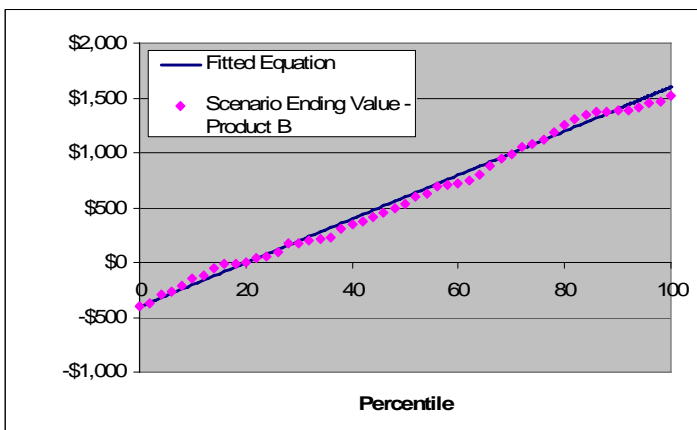


You see that the distribution of ending values can be closely approximated by the following equations:

$$\begin{aligned} \text{Product A: } & \$2,160 - \$24x && \text{for } x \text{ between 0 and 90} \\ & \$24,300 - \$3x^2 && \text{for } x \text{ between 90 and 100} \\ & && \text{for uniformly distributed } x \text{ between 0 and 100} \end{aligned}$$

You are also considering offering Product B, which pays policyholders a maturity value at the end of one year. This product will partially hedge the volatility of Product A.

Employing the scenarios used for Product A, you determine the corresponding values for Product B, which results in the following distribution of values:



10. (Continued)

You see that the distribution of ending values can be closely approximated by the following equation:

$$\text{Product B: } \$20x - \$400 \quad \text{for all } x$$

A portion of Product B's funding will be through non-callable zero coupon debt maturing for \$300 at the end of the year.

Reserve and Regulatory Capital requirements are the negative of the 65 CTE and 90 CTE, respectively, of the ending values, or zero if greater.

- (a) (4 points) Evaluate the reserve and capital implications of these products by completing the following:
- Calculate the Reserve and Regulatory Capital for Product A.
 - Calculate the Reserve and Regulatory Capital for Product B.
 - Calculate the percentage of time the sum of the regulatory capital values for Products A and B, each determined on a stand-alone basis, will be greater than the combined net loss for Products A and B.
 - Explain whether the 90 CTE is an adequate capital requirement level for a company with this product mix.
- Show your work.
- (b) (3 points) The company's risk management function has routinely calculated VaR using a parametric method. Given that the standard deviations of Products A and B are 1,405 and 577, respectively, and that the 99-percentile is 2.33 standard deviations from the mean:
- Calculate and compare the parametric VaR to the Monte Carlo VaR implied by the graph above for Product A. Show your work.
 - Calculate and compare the parametric VaR to the Monte Carlo VaR implied by the graph above for Product B. Show your work.
- (c) (2 points) Compare the results of the two VaR methods and the 90 CTE method and explain why each method does or does not produce an appropriate capital requirement level for each product:
- Product A
 - Product B
- (d) (4 points) Consider Product B as a standalone company and assume that a government guarantee fund will cover 90% of a participant's loss of value.

As of the end of the year, divide the expected ending value of the company between each of these stakeholders, recognizing that policyholders must be paid before bondholders and shareholders:

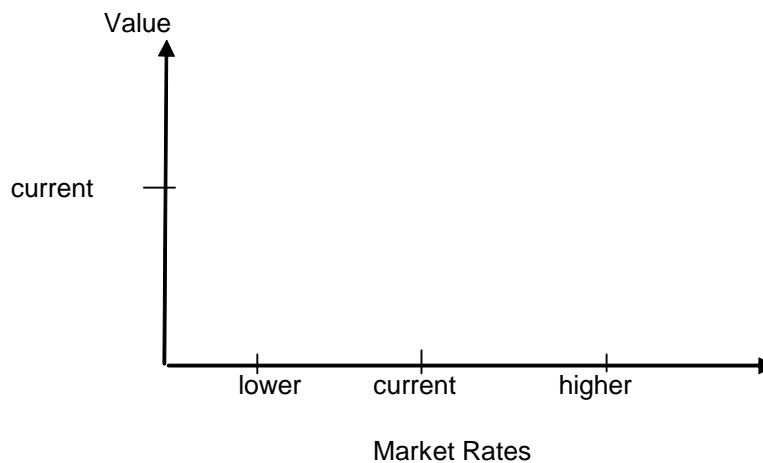
- Shareholders
- Bondholders
- Government Guarantee on Bankruptcy
- Policyholder Losses on Bankruptcy

- 11.** (6 points) You manage a small portfolio of GICs issued by your company. The GICs provide a fixed payment at the end of three years. They are priced to provide a yield of 6% per annum to the purchaser, which is a current market rate.

There are two types of GICs, one which does not allow surrenders and one which permits surrenders at a surrender value equal to the initial deposit plus accrued interest. There is equal exposure to both types.

The GICs are backed by an asset portfolio consisting of 50% Treasury bonds and 50% callable (at par) AAA-rated corporate bonds, both purchased in the current market environment.

You have been asked to explain the characteristics of your asset and liability portfolio to a new employee by illustrating market values and book values (i.e., amortized cost basis).



Use the graph shown above as a template for your answers in (a), (b), and (c). Create a separate graph for each of (a), (b), and (c).

- (a) Qualitatively explain and sketch the relationship of changes in market rates to both book value and market value for the following assets in your portfolio. Label relationships I through IV, as appropriate.
- I Book value of Treasury bonds
 - II Book value of callable corporate bonds
 - III Market value of Treasury bonds
 - IV Market value of callable corporate bonds

11. (Continued)

- (b) Qualitatively explain and sketch the relationship of changes in market rates to market value for the following liabilities in your portfolio. Label relationships I and II, as appropriate.
- I GIC that does not allow surrenders
 - II GIC that allows surrenders
- (c) Qualitatively explain and sketch the relative levels of surplus in relation to changes in market rate for your company's asset and liability portfolio. Label relationships I and II, as appropriate.
- I For market value of surplus
 - II For book value of surplus
- (d) Indicate how the total return for this asset and liability portfolio would be defined. Explain how the current accounting systems of U.S. Statutory and U.S. GAAP fall short in providing measures for the total return of this portfolio, and describe the agency costs created by measuring management's performance based on these accounting measures.

- 12.** (6 points) Excalibur Life and Annuity Company sells single premium variable annuity (SPVA) contracts and traditional life insurance.

The SPVA contracts include Guaranteed Minimum Withdrawal Benefits (GMWB), which provide the policyholder with guaranteed withdrawal amounts even when his account value has decreased. Excalibur wishes to eliminate or mitigate the risk of the GMWB.

Excalibur is considering exiting this annuity market via an assumption transaction and investing more into the core life insurance business, which the company considers less risky.

Following is Excalibur's simplified Balance Sheet prior to the assumption transaction. Statutory reserves for the SPVA contracts are \$12 billion, of which \$10 billion is allocated to the separate account.

Assets	(millions)
General Account Invested Assets	\$50,000
Separate Account	\$10,000
Liabilities	
General Account Reserves	\$40,000
Separate Account Reserves	\$10,000
Capital	\$10,000

You are given the following information for Excalibur:

Tax Rate	35%
Required Capital – Life	6% of total reserve
Required Capital – SPVAs	8% of total reserve
Target Total Capital to Required Capital Ratio	300%

- (a) Describe assumption transactions and explain why assumption could be a better choice than indemnity reinsurance for Excalibur.
- (b) Describe how Excalibur's SPVA policyholders may react to an assumption transaction.

12. (Continued)

- (c) Bally Life and Annuity has made an offer to assume Excalibur's annuity block of business (including assets backing reserves) in exchange for a payment of \$1 billion to Excalibur.

Explain why this may be a desirable transaction for Bally.

- (d) Assume Excalibur accepts Bally's offer. Restate the simplified Balance Sheet after the assumption transaction. Show your work.
- (e) Calculate the amount of free capital that Excalibur could invest in its life business
- (i) prior to the Bally assumption transaction
 - (ii) after the Bally assumption transaction.
- Show your work.
- (f) Provide two reasons for the change in available free capital that would result from the assumption transaction.

13. (8 points) You are the pricing actuary for Bellagio Life Insurance Company. You are assessing the viability of issuing a new block of 3-year non-renewable term policies. You have developed the following information:

- The expected value now of this block over its 3-year life is \$100 million using traditional net present value (NPV) techniques.
- The block's value can either go up by a factor of 1.25 or decrease by a factor of 0.8 per year, depending upon the mortality experience of the policies.
- The risk-free rate is 4% per year.
- The weighted average cost of capital is 12%.

You wish to use real options analysis in your assessment.

- (a) State the three key assumptions underlying the application of option pricing methodologies to real options.
- (b) Calculate the objective and risk-neutral probabilities of both upward and downward movements. Show your work.
- (c) Your investment banker tells you that you will be able to sell this block at issue for \$80 million, in one year for \$76 million, and two years from now for \$72 million.

Calculate the value of the option to sell this block. Illustrate the node values of the decision tree and indicate whether you would sell at each node. Show your work.

- (d) Instead of selling the block, your reinsurance department tells you that you can reduce exposure to this block by reinsuring some of it away at any time. Under this contraction option, in exchange for giving up 30% of the (non-reinsured) value now, you will receive \$35 million.

Calculate the value of the option to reinsure this block. Illustrate the node values of the decision tree and indicate whether you would reinsure at each node. Show your work.

14. (5 points) You are an actuary in a large variable annuity (VA) company, whose products include significant embedded living benefit and death benefit guarantees. You have the following responsibilities:

- (1) investing in equity market derivatives to mitigate risks inherent in embedded product guarantees;
- (2) obtaining reinsurance for those guarantees which cannot be hedged internally;
- (3) performing experience studies; and
- (4) evaluating the feasibility of securitizing an old closed block of variable annuities with an aggressive guaranteed minimum death benefit (GMDB).

In addition to the ongoing projects above, you chair the risk management committee. The committee's objectives are to:

- educate senior management about qualitative and quantitative risk exposures,
- distribute quarterly risk reports to front-line managers, and
- train these managers to identify and gather relevant information for risk assessment.

You personally are responsible for securing financial and authoritative support for your committee from senior management.

At a rating agency meeting the rating analyst criticized your company for not understanding the benefits of a strong Enterprise Risk Management (ERM) policy and culture and, as a result, is considering a downgrade.

You are asked to respond to the rating agency analyst.

- (a) List the organizational objectives that ERM supports and explain how ERM can help a company achieve these objectives.
- (b)
 - (i) Define risk control.
 - (ii) Describe the risk control process.
 - (iii) Describe how each of your current actuarial projects (items (1) through (4) above) fits into the context of the risk control process.
- (c)
 - (i) Define what is meant by a risk management culture.
 - (ii) Describe the risk management culture process.
 - (iii) Describe how your risk management committee work fits into the context of the risk management culture process.

****END OF EXAMINATION****
AFTERNOON SESSION