****BEGINNING OF EXAMINATION****
FINANCE AND ENTERPRISE RISK MANAGEMENT; CORE SEGMENT
MORNING SESSION

1. *(5 points)* You are a consulting actuary reviewing the Asset Liability Management practices of Retro Life, a small life insurance company with two lines of business: Non-participating Whole Life and Single Premium Deferred Annuities.

Retro Life backs each line of business with a segmented portfolio of assets. Currently, both portfolios are composed of a mix of long term bonds and commercial mortgages.

Retro's Investment Policy includes the following two requirements:

- For each portfolio, the difference between the duration of assets and liabilities shall not exceed 2.0 as of December 31st of each year.
- No less than 92% of all investments must be investment grade.

(a) Identify the embedded risks in Retro's liabilities and in Retro's assets.

(b) Describe the weaknesses in Retro's current ALM methodology and Investment Policy that lead to poor measurement and control of these risks.

(c) Explain how Dynamic Financial Analysis (DFA) can overcome the shortcomings of duration matching the portfolios.

(d) Outline the challenges Retro will face in implementing DFA.

2. *(9 points)* You are the Product Development Actuary for Deep Pockets Life Insurance Company. You have been asked to evaluate an opportunity to market a new product. The new product requires an immediate investment of \$3,500,000 and an additional expected investment in four years of \$2,000,000. In four years, the new product is expected to be worth \$8,121,500 if market acceptance is high and \$3,827,000 if market acceptance is low.

You have identified a twin security for the new product. This security currently sells for \$100 per share. In four years, the twin security will be worth either \$174.90 or \$52.20.

The new product has been designed to offer Deep Pockets the flexibility to react to market conditions. Specifically,

- If market acceptance is high, Deep Pockets can increase the \$2,000,000 expected investment in four years to \$7,000,000 to double the value of the product.

- If market acceptance is low, Deep Pockets can reduce the \$2,000,000 expected investment in four years to \$1,400,000 by reducing the scale (and value) of the project by half.

You are given the following:

Probability of high market acceptance	$q = 0.55$
Probability of low market acceptance	$1-q = 0.45$
New product beta	$b = 1.50$
Market return	$r_m = 12\%$
Risk-free rate	$r_f = 6\%$

(a) *(1 point)* Determine the risk adjusted discount rate for assessing this opportunity if the options to expand or contract are ignored. Show your work.

(b) *(2 points)* Calculate the current value of the product using a traditional discounted cash flow (DCF) technique if the options to expand or contract are ignored. Show your work.

(c) *(6 points)* Re-calculate the current value of the product including the options and using a contingent claims analysis (CCA) approach. Show your work.

3. *(5 points)*

(a) Contrast the securitization of assets (such as mortgage loans) and the securitization of liabilities (such as insurance policies).

(b) Describe how securitization of assets and liabilities affects the income statement and balance sheet of a life insurance company.

(c) Compare securitization with traditional YRT reinsurance of XXX reserves.

4. *(8 points)* You are a consulting actuary who has been asked by MI Health to estimate the fair value of an in-force block of health insurance.

You are given the following projection information for the block as of December 31, 2006:

	2007	2008	2009
Premiums	1500	1350	1275
Expenses & Commissions	225	210	200
Expected Claims	1050	940	900

Risk free rate:	4.5%
Corporate Tax Rate:	40%
Rate of Return on assets:	7.5%
Asset to Liability ratio:	125%
Capital Structure:	15% debt, 85% equity
Cost of debt:	8%
Expected rate of return on market:	11%
MI Health's beta:	1.1

(a) State the principles underlying the use of present values to compute the fair value of insurance liabilities and explain how they are applied.

(b) Determine the fair value of the liability using a cost of capital approach. Assume all cash flows occur at the end of the year. Show your work.

(c) Calculate the market value margins that should be added to each year's cash flow for the risk of insurance claims differing from the expected amount. Show your work.

5. *(7 points)* Atlantic Life (AL) is a monoline life insurance company selling variable universal life. It is considering the acquisition of Northeastern Annuity (NA), which sells only fixed annuities.

AL currently has $40 million in expected profits on $100 million in risk capital. Risk capital is held in proportion to the standard deviation of the firm's returns. AL has a 20% deadweight cost of capital.

AL has assessed that NA has $10 million in expected profits on $100 million in risk capital. NA's deadweight cost of capital is also assessed at 20%. NA's expected profits are assumed to have zero correlation with AL's expected profits.

(a) Identify and explain the sources of deadweight costs. Indicate how a firm might mitigate those costs.

(b) Calculate the change in the following items for AL if AL were to acquire NA:

(i) expected profits
(ii) risk capital
(iii) deadweight cost of capital
Show your work.

(c) Using the analysis in (b), recommend whether AL should proceed with the acquisition of NA. Support your recommendation.

(d) Assuming AL has acquired NA, calculate the return on capital for each of the variable universal life and fixed annuity business units and for the total combined company on the following bases:

(i) stand-alone risk capital
(ii) fully allocated risk capital
(iii) marginal risk capital
Show your work.

(e) Compare the approach used above to "standard" RAROC for financial firms. Determine what the "standard" RAROC method would conclude about the acquisition decision if AL had a 15% hurdle rate requirement. Show your work.

6. *(7 points)* You work for a bank that uses the CreditMetrics™ approach to measuring credit risk. You are given the following information for a selected corporate bond:

Years to Maturity	4 years
Coupon Rate	5% paid annually (next coupon payment is about to be paid)
Face Value	$100.00
Current Credit Rating	BBB
Seniority Class	Senior subordinated

Table A.1 – One Year Transition Matrix:

	Rating at Year End							
Initial Rating	AAA	AA	A	BBB	BB	B	CCC	Default
AAA	92.05%	7.27%	0.53%	0.09%	0.06%	0.00%	0.00%	0.00%
AA	0.72%	90.98%	7.53%	0.57%	0.06%	0.11%	0.02%	0.01%
A	0.08%	2.11%	91.62%	5.25%	0.65%	0.22%	0.01%	0.06%
BBB	0.02%	0.29%	5.11%	88.46%	4.82%	0.97%	0.12%	0.21%
BB	0.03%	0.09%	0.61%	6.94%	82.78%	7.49%	1.00%	1.06%
B	0.00%	0.11%	0.26%	0.43%	5.89%	84.26%	3.80%	5.25%
CCC	0.18%	0.00%	0.24%	1.01%	1.98%	9.70%	66.32%	20.57%

Table A.2 – One-year forward rates for a BB rated corporate bond:

Time	**Rate**
1	5.29%
2	6.33%
3	7.75%

6. Continued

Table A.3 – Recovery Rate by Seniority Class (% of face value)

Seniority Class	**Mean (%)**
Senior Secured	56.22%
Senior Unsecured	52.43%
Senior Subordinated	39.71%
Subordinated	33.29%
Junior Subordinated	18.11%

Table A.4 – Expected one-year forward values for the BBB bond plus coupon:

Year End Rating	Value ($)
AAA	$106.67
AA	$106.53
A	$106.12
BBB	$105.24
BB	X
B	$98.10
CCC	$84.53
Default	Y

(a) Using the CreditMetrics™ methodology, calculate the missing values in Table A.4. Show your work.
  (i) X
  (ii) Y

(b) Using the CreditMetrics™ methodology, calculate the standard deviation of the expected value of the bond at the end of one year. Show your work.

(c) Explain two challenges in estimating portfolio credit risk (credit VaR) as compared to the determination of market VaR.

(d) The bank's CFO is interested in establishing an internal risk rating system. Indicate the key components of the financial assessment that would be the starting point for a risk rating system.

(e) Outline other factors to consider in the bank's risk rating system that could modify the rating developed based on the financial assessment.

7. *(4 points)* Spencer Financial operates a spread lending business. It issues Medium Term Notes (MTNs) into the capital markets and invests the proceeds into higher yielding assets.

Spencer Financial has the following instruments on the Balance Sheet:

	Par or Notional Value	**Maturity**	**Coupon**	**Current GAAP Accounting Treatment**
BBB Corporate Bond	100	5 years	6.50%	Classified as Available for Sale under FAS 115. Held at market value on the balance sheet with changes in market value directly impacting the equity statement.
MTN	100	5 years	3 month LIBOR + 50bp	Held at Amortized Cost on the balance sheet.
Receive Floating/Pay Fixed Swap	100	5 years	Receive 3 month LIBOR and pay 5%	Based on FAS 133 rules with no hedge accounting provisions being utilized.

(a) Explain how FAS 133 accounting creates GAAP income statement volatility assuming that no hedge accounting provisions are utilized.

(b) Explain how the hedge accounting provisions allowed for under FAS 133 could be applied in each of the following two ways to minimize GAAP income statement volatility:

(i) using the interest rate swap and the corporate bond.
(ii) using the interest rate swap and the MTN.

(c) Outline the documentation and disclosure requirements that must be met in order to utilize the hedge accounting provisions provided under FAS 133.

8. *(10 points)* Beantown Life and Health Insurance Company issues universal life and major medical insurance. Liabilities are evenly distributed between the two products.

The company's investment manager has provided the following breakdown of Beantown's investment portfolio:

AA+ rated corporate bonds	35%
Unaffiliated common stock	23%
B- rated corporate bonds	18%
US government bonds	5%
Funds withheld in reinsurance arrangements	5%
Agency pass-through MBS	4%
CMO's - - Z tranches	4%
Canadian government bonds	3%
Russian government bonds	2%
Cash and other short term assets	1%

(a) Explain the elements Beantown should examine in assessing its liquidity risk.

(b) Detail the liquidity needs of Beantown's two main products.

(c) With respect to the investment portfolio, prioritize the assets that can be readily converted into cash. Defend your response.

(d) During a recent pandemic, Beantown saw its medical insurance claims rise by 40% and its life insurance claims rise by 20%. This experience is expected to continue or even worsen over the next 6 months.

(i) Propose actions that Beantown can take to meet the recent increase in cash demand.

(ii) Recommend a liquidity risk framework that Beantown could implement once the crisis is past to reduce its future exposure to liquidity risk.

9. *(5 points)*

(a) Two areas of concern for bondholders are the claims dilution problem and the asset substitution problem.

Explain these two concerns and describe how the use of hybrids can reduce these problems. Be specific as to the hybrids to be used.

(b) Provide three economic reasons why corporate management might consider issuing hybrids. For one of the three, explain specifically how a hybrid could be used to achieve management's objective.

(c) Explain what it means for a firm to have a "strategic exposure" to interest rates and describe methods for measuring the exposure.

(d) Give an example of how a firm could use financial instruments to minimize its exposure to rising interest rates.

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

****BEGINNING OF EXAMINATION****
FINANCE SEGMENT
AFTERNOON SESSION
Beginning With Question 10

Questions 10 - 12 pertain to the Case Study.
Each question should be answered independently.

10. *(4 points)*

(a) Referencing the determinants of organizational architecture, indicate how these have most likely shaped Zoolander's current corporate culture.

(b) The critical aspects of corporate organization have been identified as:

- the assignment of decision rights within the firm
- the structure of systems to evaluate performance
- the methods of rewarding individuals

Citing a specific situation at Zoolander, recommend changes to one or more of these aspects, indicating both the potential benefits and the risks of your recommendations.

Questions 10 - 12 pertain to the Case Study.
Each question should be answered independently.

11. *(11 points)* It is now January 2009, and you are still Zoolander's CFO. You are reviewing the GAAP accounting for Zoolander's GIC product that was introduced in 2006.

You are given the following information:

- The DAC amortization schedule has only been changed once (for year-end 2007)

Duration	DAC run off pattern - % of initial balance
Beginning of 1^{st} year	100%
Beginning of 2^{nd} year	75%
Beginning of 3^{rd} year	55%
Beginning of 4^{th} year	38%
Beginning of 5^{th} year	20%
End of 5^{th} year	0%

- The initial 2006 sales projections were realized in 2006 thru 2008

(a) *(2 points)* Explain how deferrable acquisition costs arise, and describe how they are treated under U.S. GAAP accounting.

(b) *(5 points)* Calculate the DAC balance as of December 31, 2008 for Zoolander's GIC business. Assume all GIC sales were made at the beginning of each year. Show your work.

(c) *(4 points)* Bonnie Hawke has suggested that Zoolander switch to fair value accounting for Zoolander's internal management reporting. Outline a report covering the following:

i. Describe differences between U.S. GAAP and fair value accounting.

ii. Outline advantages and disadvantages of using fair value accounting for Zoolander's management reports.

iii. Recommend whether to accept or reject Hawke's proposal. Support your recommendation.

Questions 10 - 12 pertain to the Case Study.
Each question should be answered independently.

12. *(15 points)*

You are proceeding with your analysis of Zoolander's proposed "Eagle" joint venture. You have calculated the following values:

Discount rate $(\boldsymbol{i})$	$\ddot{\boldsymbol{a}}_{\overline{5}\rceil} \times (1+i)^5$
10%	6.72
12%	7.12
14%	7.54
16%	7.98
18%	8.44
20%	8.93
22%	9.44
24%	9.98

(a) There are three options presented in the April memorandum from PTS regarding the structure of Zoolander's "Eagle" joint venture with Insuratron.

Compare the tax-efficiency of the three structures by calculating the expected after-tax return to be earned on invested capital for each of the three options. Show your work.

(b) Zoolander has decided to pursue the joint venture opportunity with Insuratron and structure the new entity so that it is a wholly owned subsidiary of Zoolander. The initial capital investment of $10 million has been set aside for this purpose, but there are legal and regulatory hurdles to overcome which may result in a 90 to 180 day delay in the capital actually being deployed.

The April memorandum from PTS gives Zoolander three possible options for investing these funds until Eagle is formed.

For each of these three options:

(i) Calculate the implicit and explicit tax rates, ignoring the riskiness of the three options. Show your work.

(ii) Calculate the implicit and explicit tax rates, taking account of the riskiness of the three options. Show your work.

(iii) Explain how the riskiness of an asset impacts implicit and explicit tax rates.

(iv) Recommend one of the three possible options for investing the funds. Support your answer.

12. Continued

(c) Zoolander's human resources (HR) department has asked you to evaluate the funding proposals for a new defined benefit pension plan for the employees of Eagle.

HR has received a recommendation for an aggressive equity portfolio with an expected annual pre-tax return of 15% (12% annual appreciation + 3% annual dividend), based on an expected low average age for Eagle employees.

Prepare a report to HR that covers the following:

(i) Describe how a Black Tepper arbitrage strategy could be utilized as an alternative to the funding recommendation received by HR. Assume an expected annual pre-tax return of 6% on the bond portfolio.

(ii) Calculate which alternative provides the higher expected return at the end of one year. Show your work.

(iii) Identify the non-tax costs associated with implementing the arbitrage strategy.

(iv) Outline the advantages and disadvantages of overfunding the defined benefit pension plan for Eagle.

13. *(9 points)* In order to grow profitably, your company's Board has set its sights on a potential acquisition target. The target is a block of term business that has had relatively stable claims and premiums over the past years and that appears to nicely complement your company's current product mix.

Following is key financial information for your company:

Current Debt Level	100 million
Current Equity Level	400 million
Corporate Tax Rate	35%
Current Debt Costs	6%
ROA	12%
Standard deviation of ROA	6%

ROA is assumed to be normally distributed.

The existing debt has restrictive covenants that are triggered if the company's ROE drops below 0% for a fiscal year. These covenants would severely hamper management's flexibility to run the business.

The cost of the acquisition is likely to be \$100 million. It has been estimated that the acquisition will cause the company's ROA to drop to 11% with the standard deviation of ROA dropping to 4%.

The Board is evaluating the following financing options to raise the necessary \$100 million for the acquisition:

1. Issue variable rate debt at LIBOR + 100bp. (LIBOR is currently at 3%.)
2. Issue fixed rate debt at 6%.
3. Issue convertible debt at 5%.
4. Issue common stock.

(a) *(7 points)* To assist the Board with its evaluation, for each of the financing options:

(i) Calculate the expected ROE and explain the implications of the ROE results. Show your work.

(ii) Demonstrate whether the company continues to meet existing debt covenant provisions with probability of 97.5%. $\left(\text{Prob}\left(Z < -1.96\right) = 0.025\right)$

(iii) Evaluate the potential impact on your company's share price.

13. Continued

(b) *(2 points)* A Board member recalls from his finance classes that the method of financing should not affect company value. You believe he is thinking of the Modigliani and Miller model.

Outline for the Board member the reasons why the assumptions used in the Modigliani and Miller model would not apply to this particular acquisition.

14. *(7 points)* Cambridge Life is a small life and annuity insurance company that is in the pre-marketing stage of selling the company. As an independent actuary, you have been brought in to perform an actuarial appraisal.

You are given the following assumptions:

- The risk free rate is 5%
- Beta of the company stock is 1.1
- The expected market return is 9%
- The cost of debt is 6%
- All cashflows occur at the end of the year
- CAPM is applied to calculate an appropriate discount rate, assuming a 25% debt/75% equity split.

You are given the following financial data with respect to Cambridge (in thousands):

Date	12/31/2005	12/31/2006	12/31/2007	12/31/2008	12/31/2009	12/31/2010
Required Capital	2,400	2,689	3,031	3,435	3,914	4,483
GAAP Reserve	39,200	43,928	49,508	56,111	63,936	73,225
Statutory Reserve	40,000	44,824	50,519	57,256	65,240	74,719
Tax Reserve	38,800	43,479	49,003	55,538	63,283	72,478

Year		2006	2007	2008	2009	2010
Salary Expense		425	446	469	492	517
Occupancy Expense		70	70	70	70	70
Other Expense		245	224	201	178	153
Premium		5,000	6,000	7,200	8,640	10,368
Investment Income		2,968	3,326	3,748	4,248	4,841
Taxes		500	500	500	500	500
Commissions		150	180	216	259	311
Benefits		400	448	505	573	652

14. Continued

(a) *(4 points)* Determine a fair value for the company based on the data provided. Show your work.

(b) *(2 points)* Explain several considerations involved in selecting an appropriate discount rate, including alternative methods other than CAPM.

(c) *(1 point)* Outline a report for the CFO of Cambridge detailing the steps of a typical M&A transaction as it relates to insurance companies.

15. *(8 points)* The President of MasterLife has been disappointed in the firm's financial performance since the company demutualized in 2002. He is concerned that the firm's current capital structure does not provide strong enough incentives for company management to maximize performance. As a result, he wants to pursue a financial restructuring of the organization.

(a) Explain how changes in debt/equity ratios can influence the financial performance of a company.

(b) The following five approaches have been recommended as alternatives for increasing leverage and/or concentrating ownership of the firm's equity:

(i) Share Repurchase Program
(ii) Leveraged Share Repurchase Program
(iii) Conversion of the Company to a Partnership
(iv) Program of Leveraged Acquisitions
(v) Commencement of Dividend Payments

Explain the advantages and disadvantages of each alternative.

(c) The President decides that an extreme change in the financial structure of the firm will be too disruptive. He concludes that the most appropriate way to improve financial performance is to gradually modify the incentive package for managers.

Suggest various compensation programs that could be implemented and explain how each would increase incentives for managers.

16. *(6 points)* Patriot Mutual Company is a US-based mutual company specializing in life and annuity products. Patriot recently launched a highly successful new term life product. The product is expected to be very profitable for Patriot. However, the large increase in sales and the front-loaded commissions on the product are straining the company's surplus.

Janet Olson, CFO, wants to maintain Patriot's good financial condition. She would like to implement a surplus enhancement within the next six months. She would also like to maintain the ability to manage the new term life product to maximize its profitability to Patriot.

Olson would like to explore the idea of securitizing commissions in a levelized commission financing transaction.

Margaret Ross, an actuary at Patriot, is concerned that securitization may not meet Olson's time line. She researches other surplus enhancement options that are available to mutual companies and finds the following alternatives:

- Surplus Notes
- Reinsurance
- Downstream Companies
- Demutualization

(a) *(4 points)* Compare the advantages and disadvantages of securitization versus the other available surplus enhancements.

(b) *(2 points)* Recommend a surplus enhancement option for Patriot and justify your answer.

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