****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****
ENTERPRISE RISK MANAGEMENT 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 1st year	100%
Beginning of 2nd year	75%
Beginning of 3rd year	55%
Beginning of 4th year	38%
Beginning of 5th year	20%
End of 5th 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. *(11 points)*

(a) Based on Moody's observations about corporate governance, identify key governance concerns at Zoolander and recommend how they could be remedied.

(b) Using the 'lessons learned' from recent risk management failures, cite specific weaknesses that exist at Zoolander.

(c) Identify five major areas of operating risk at Zoolander. Assess the potential impact to the company of each and recommend immediate steps that should be taken to mitigate the risk.

13. *(12 points)* Concord Life is launching a new Variable Annuity product that offers a Return of Premium Guaranteed Minimum Death Benefit (GMDB) and a Guaranteed Minimum Maturity Benefit (GMMB) equal to the full premium. Premiums are to be invested in an Equity Index fund, with a total monthly management charge of 0.20%, of which 0.04% is the margin offset to cover the GMDB and GMMB.

In beginning your risk analysis of the new product, you have simulated monthly Equity Index returns using a lognormal process with constant variance of 0.0025. You have focused in on one simulation for one cell of a 3-month maturity bucket as follows:

Month t	Simulated Equity Index S_t	${}_t p_x^T$	${}_{t\|1}q_x^d$	F_{t^-}
0	1.00	1.000	0.0003	100.00
1	0.96	0.995	0.0003	
2	1.02	0.988	0.0003	
3	1.01	0.980	0.0003	

You have gathered the following information:

- The monthly risk-free rate is 0.40%.
- Black-Scholes put option price formula, with payoff $\left(K - S_T\right)^+$:

$$BSP_t = Ke^{-r(T-t)}\,\Phi\left(-d_2\right) - S_t\,\Phi\left(-d_1\right)$$

Where $$d_1 = \frac{\ln\left(S_t / K\right) + \left(T-t\right)\left(r + \sigma^2/2\right)}{\left(T-t\right)^{0.5}\,\sigma}$$

and $$d_2 = d_1 - \sigma\left(T-t\right)^{0.5}$$

- Selected $\Phi\left(x\right)$ values:

x	$\Phi\left(x\right)$
-0.0	0.5000
-0.1	0.4602
-0.2	0.4207
-0.3	0.3821
-0.4	0.3446
-0.5	0.3085

13. Continued

(a) *(2 points)* Contrast the actuarial approach with dynamic hedging in the risk management of equity-linked liabilities.

(b) *(4 points)* Determine whether the margin offset of 0.04% monthly would be sufficient to cover the cost of the given 3-month guarantee cell under the actuarial approach. Show your work.

(c) *(6 points)* Estimate the cost of the 3-month GMMB under the dynamic hedging approach. Show your work.

14. *(10 points)* Romney Life, an AA-rated company has been steadily improving its risk management practices. Romney believes that if S&P were to apply its Financial Product Company (FPC) model of capital adequacy to Romney's non-insurance business, Romney would have a better capital profile than that demonstrated by S&P's traditional risk-based capital model.

Romney has gathered the following data from S&P and internally with respect to its benefit-responsive GIC block:

Applied Interest Rate Volatilities for 'AA' Rated Company (bps)		
1 - 12 months	**24 months**	**36 - 60 months**
220	200	190

Applied Correlation Coefficients Between Risk Buckets			
Risk Bucket	**1 - 12 months**	**24 months**	**36 - 60 months**
1 - 12 months	1.00	0.90	0.80
24 months	0.90	1.00	0.95
36 - 60 months	0.80	0.95	1.00

GIC Book Risk Point Summary	
Risk Point	**DV01s ($)**
1 - 12 months	1,600
24 months	(7,900)
36 - 60 months	8,100

Rating	**Default Factor (%)**
AAA	0.10
AA	0.60
A	1.00
BBB	2.00

(a) *(3 points)* Describe the principles and uses of the FPC model as S&P has applied it to the non-insurance business of life insurance companies.

(b) *(5 points)* Calculate the incremental capital adequacy charge relating to Interest Rate Delta Risk under the FPC model for Romney's GIC Book using a 50% factor for covariance effects. Show your work.

(c) *(2 points)* Romney has purchased a $20 million, 3-year Credit-Default Swap from an A-rated counterparty to offset its $20 million exposure to an underlying 3-year BBB-rated bond. Romney has also written a 3-year Credit-Default Swap on an A-rated corporate security for $10 million.

Calculate the CR-1 Incremental Charge Relating to Credit Derivatives under the FPC model. Show your work.

15. *(12 points)* You are investigating the interest rate risk exposures embedded in an interest-sensitive liability segment backed by fixed income assets with some interest rate optionality.

(a) *(4 points)* Identify the stochastic interest rate model you feel is most appropriate for your analysis of interest rate risk. Describe the features of your model and justify your choice of that model.

(b) *(3 points)* Using your stochastic interest rate model, you have run 500 simulations of L_0, the random variable of losses on this interest-sensitive segment. The simulation produced the following ordered data:

Number	L_0 **($000s)**
500	1200
499	920
498	890
497	860
496	850
495	810
494	740
493	650
492	600
491	590
490	590
489	570

Determine the quantile risk at the 99% confidence level and develop 95% confidence intervals of your initial ordered simulated losses. Show your work.

(c) *(3 points)* You are given the following selected values from the Normal table:

$\Phi^{-1}(x)$	x
1.960	0.9750
2.240	0.9875
2.575	0.9950

Determine the Conditional Tail Expectation (CTE) at the 99% confidence level for your initial simulation and develop a rough estimate of the sample error for your CTE measure. Show your work.

(d) *(2 points*) Assess the coherence properties of the quantile risk measure and the CTE.