



**Practice Education Course – Individual Life and Annuities  
Exam – September 2008**

**THIS EXAM CONSISTS OF SIX (6) WRITTEN-ANSWER QUESTIONS WORTH 38 POINTS AND FOUR (4) MULTIPLE CHOICE QUESTIONS WORTH 2 POINTS FOR A TOTAL OF 40 POINTS.**

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**MULTIPLE CHOICE QUESTIONS**

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### Question 1 (5 points)

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The proposed expense assumptions used for reserving a closed block of whole life insurance policies sold prior to demutualization of company ABC are described as follows in the draft Appointed Actuary's Report:

	<b>Best Estimate Assumption</b>	<b>MfAD</b>	<b>Inflation Assumption</b>	<b>Notes</b>
<b>Claim Expense</b>	\$100.00 per claim	\$5.00 per claim	2.0%	1
<b>Renewal Commissions</b>	5% of premium	0.5% of premium	2.0%	2
<b>Maintenance Expense</b>	\$50.00 per policy	\$1.00 per policy	2.0% for 5 years, 0% thereafter	3
<b>Marketing Expense</b>	\$200.00 per policy at issue	\$5.00 per policy at issue	2.0%	
<b>Overhead Expense</b>	\$5.00 per policy	\$0.25 per policy	2.0%	4

Notes:

1. ABC Company has just transferred the claims processing function in house after several years of out-sourcing to an external third party vendor. The best estimate assumption has been based on the costs paid to the external vendor over the past several years.
2. The agent contract specifies an upfront commission of 40% paid at issue and a renewal commission of 5% paid each year thereafter.
3. The 2% inflation assumption for maintenance expense will drop to 0% after 5 years in anticipation that management will develop a plan in the next few years to reduce expenses.
4. These expenses include "investor relations" and OSC reporting requirement costs as well as pro-rata portion of senior management costs.

The Appointed Actuary of company ABC has asked for your help:

- a) **(4 points)** The Appointed Actuary would like you to review each assumption indicating any potential issues or concerns you may have.
- b) **(1 point)** The Appointed Actuary is also implementing a Canadian Asset Liability Method (CALM) valuation on this block. As per preliminary CALM testing, the block is exposed to decreasing interest rates. The Appointed Actuary would like to know what expense cash flows should be varied by CALM scenario including, but not limited to those listed above. The Appointed Actuary would also like to know what impact varying these assumptions will have on the block's exposure to interest rates.

## Question 2 (6 points)

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XYZ Life Insurance Company wants to capitalize on the growth in the Canadian Critical Illness (CI) market by introducing a new CI product targeted at the mid market. You are currently the Pricing Actuary for the Preferred Term Life line of business at XYZ Life Insurance Company and your role has recently expanded to include responsibility for CI pricing.

- a) **(2 points)** Discuss and explain three elements that need to be considered when developing the morbidity assumption for CI.
- b) **(3 points)** You are given a study related to Heart Disease to use in developing your CI morbidity assumption. What are some of the potential problems with this study and describe future medical issues that may occur that have implications in setting your CI incidence rates.
- c) **(1 point)** It was suggested that you set your morbidity assumption for CI using the same methodology as the mortality assumption for Preferred Term. Comment on this approach.

### Question 3 (7 points)

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UVW Life is a new Canadian Life Insurance company that has only a block of non-participating whole life insurance policies with fully guaranteed gross premiums, death benefits and cash values. All policies have been issued since 2000.

The following is at December 31, 2008

<b>Assets</b>	<b>Market Value</b>	<b>Book Value</b>
Bond 1 rated BBB – marked available for sale – backing surplus	4,000,000	4,500,000
Bond 2 rated BB – marked as hold to maturity – all backing policy liabilities	13,000,000	15,000,000
Stocks – backing surplus	2,000,000	N/A

<b>Other Assets</b>	
Goodwill	1,000,000

<b>Liabilities and Surplus</b>	
Policy Liabilities	15,000,000
Contributed Surplus	4,000,000
Retained Earnings	3,500,000
Shareholder Accumulated OCI (Loss)	(300,000)

<b>UVW Life – Other Financial Information</b>	
Total Sum Assured	200,000,000
Negative reserves on Seriatim Basis	5,000,000
Next year's expected death claims	300,000
Natural logarithm of Macaulay duration of death claims	3.5
Standard deviation of next year's death claims	245,000
Policy liabilities calculated with lapse MfAD increased by $\pm 15\%$ of expected	16,000,000
Tax Rate	40%

- a) **(5 points)** Calculate the Minimum Continuing Capital and Surplus Requirement (MCCSR) ratio at the balance sheet date.
- b) **(1 point)** Indicate any problems with the ratio or capital structure.
- c) **(1 point)** If UVW sold off 1/3 of Bond 2 on December 30, 2008 and purchased a Government of Canada bond with the proceeds, what would the new C-1 component be at December 31, 2008?

#### Question 4 (6 points)

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You are performing the December 31, 2007 CALM valuation for a block of Canadian non-participating life insurance liabilities. Your investment department has provided you with the investment information detailed on the following page. Please note that all interest rates shown on that page are annual effective interest rates.

The current reinvestment strategy for this block of business is to invest 50% of net positive cashflows into 5-year coupon bonds and 50% into 20-year coupon bonds. The distribution of these reinvestments by quality category is shown in the following table.

<b>Current Reinvestment Strategy</b>		
	<b>5-Year Bonds</b>	<b>20-Year Bonds</b>
<b>Government of Canada Bonds</b>	Nil	Nil
<b>Provincial "AA" Bonds</b>	66.7%	33.3%
<b>Corporate "A" Bonds</b>	33.3%	66.7%

- a) **(3 points)** Under the Base Scenario, calculate the weighted average yield rate in effect for reinvestments into 5-year bonds occurring at December 31, 2037 prior to making any deductions for investment expenses and default risk.
- b) **(3 points)** Under Prescribed Scenario 2, calculate the weighted average yield rate in effect for reinvestments into 20-year bonds occurring at December 31, 2021 prior to making any deductions for investment expenses and default risk.

<b>Risk-Free Forward Interest Rates - As at December 31, 2007 (%)</b>			
<b>Balance Sheet Date + t years</b>	<b>Term to Maturity</b>		
	<b>3 month</b>	<b>5 Year</b>	<b>20 Year</b>
0	2.63	3.45	4.09
1	3.27	3.58	4.15
2	3.57	3.73	4.22
3	3.51	3.82	4.26
4	3.59	3.95	4.31
5	3.85	4.10	4.35
6	4.00	4.17	4.38
7	4.05	4.22	4.40
8	4.17	4.29	4.41
9	4.31	4.34	4.42
10	4.19	4.39	4.41
11	4.28	4.49	4.42
12	4.37	4.58	4.41
13	4.47	4.69	4.40
14	4.56	4.79	4.39
15	4.67	4.90	4.36
16	4.77	4.80	4.33
17	4.88	4.68	4.28
18	5.00	4.51	4.23
19	5.12	4.32	4.17
20	5.21	4.25	4.12

<b>Moving Average of Canadian Risk-Free Yields - As at December 31, 2007 (%)</b>			
<b>Averaging Period</b>	<b>91-Day rates</b>	<b>5-Year Rates</b>	<b>Long-Term Rates</b>
	<b>V122531</b>	<b>V122540</b>	<b>V122544</b>
60 Month	3.67	4.44	4.86
120 Month	4.18	4.63	5.27
240 Month	4.66	5.10	5.85

<b>Investment Risk Premiums in Effect - As at December 31, 2007 (%)</b>			
<b>Asset Class</b>	<b>91-Day rates</b>	<b>5 Year</b>	<b>20 Year</b>
Provincial Bonds	0.15	0.40	0.70
Corporate "A" Bonds	0.25	0.70	1.40
Commercial Mortgages	N/A	1.20	1.90

### Question 5 (8 points)

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You are currently employed as the Corporate Actuary at Company A.

Over the past 10 years since you obtained your FCIA you have worked for at least 18 months in each of the following areas of Company A:

- Non-par individual life and health pricing,
- Group life and health valuation,
- Asset/liability management,
- Individual life and health marketing and sales support, and
- Corporate actuarial, working with the Appointed Actuary.

You have been offered the job as the Appointed Actuary at Company B, which is a stock company that has recently demutualized.

- a) **(2 points)** Describe the regulatory and professional steps you must complete if you are to accept the job as the Appointed Actuary of Company B.
- b) **(2 points)** Describe the qualifications required of you for this position.
- c) **(4 points)** Outline the professional and regulatory reports the Appointed Actuary of Company B must complete during the year.

### Question 6 (6 points)

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You are given the following information from a pricing model projection for a 3-year non-renewable term insurance product. Premiums, benefits, and expenses are the only cash flow items:

t	Premiums	Benefits and Expenses	Reserves
0	15,500	7,800	8,100
1	14,700	5,300	17,600
2	13,000	9,800	21,200
3	0	21,000	0

Required Capital = 50% of reserves

Statutory earnings = Net cash flow + Interest on reserves – Change in reserves

The interest rate earned on all items (cash flows, reserves, required capital) = 6%

Hurdle rate = 12%

Taxes are ignored

Calculate the following:

- (2 points)** New Business Strain
- (2 points)** Value of New Business (VNB)
- (2 points)** Profit Margin (does not include any required capital elements)

**Multiple Choice Question 1 (0.5 points)**

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This question consists of two lists. In the list at the left are two items, lettered X and Y. In the list at the right are three items, numbered I, II and III.

ONE of the lettered items is related in some way to EXACTLY TWO of the numbered items. Indicate the related items using the following answer code:

	Lettered Item	Is Related to Numbered Items
(A)	X	I and II only
(B)	X	II and III only
(C)	Y	I and II only
(D)	Y	I and III only
(E)	The correct answer is not given by (A), (B), (C) or (D).	

X	An agent contracts in their own name on behalf of a partially disclosed or undisclosed principal.	I	The third party can enforce the contract against the principal even if the agent had only apparent authority.
Y	An agent contracts on behalf of a disclosed principal.	II	The principal can enforce the contract against the third party only if the agent acted within the scope of their actual authority.
		III	The third party can enforce the contract against the agent.

**Multiple Choice Question 2 (0.5 points)**

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This question consists of two lists. In the list at the left are two items, lettered X and Y. In the list at the right are three items, numbered I, II and III.

ONE of the lettered items is related in some way to EXACTLY TWO of the numbered items. Indicate the related items using the following answer code:

	Lettered Item	Is Related to Numbered Items
(A)	X	I and II only
(B)	X	II and III only
(C)	Y	I and II only
(D)	Y	I and III only
(E)	The correct answer is not given by (A), (B), (C) or (D).	

X	Individual Life Insurance policy	I	Aleatory Contract
Y	Commutative Contract	II	Contract of Adhesion
		III	Bargaining Contract

**Multiple Choice Question 3 (0.5 points)**

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This question consists of two lists. In the list at the left are two items, lettered X and Y. In the list at the right are three items, numbered I, II and III.

ONE of the lettered items is related in some way to EXACTLY TWO of the numbered items. Indicate the related items using the following answer code:

	Lettered Item	Is Related to Numbered Items
(A)	X	I and II only
(B)	X	II and III only
(C)	Y	I and II only
(D)	Y	I and III only
(E)	The correct answer is not given by (A), (B), (C) or (D).	

X	Provincial Government	I	Have regulatory responsibility for securities firms and mutual funds.
Y	Federal Government	II	Has sole authority to regulate market conduct of insurance business within its jurisdiction.
		III	The majority of insurers have opted to be incorporated by this government.

#### Multiple Choice Question 4 (0.5 points)

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This question consists of two lists. In the list at the left are two items, lettered X and Y. In the list at the right are three items, numbered I, II and III.

ONE of the lettered items is related in some way to EXACTLY TWO of the numbered items. Indicate the related items using the following answer code:

	Lettered Item	Is Related to Numbered Items
(A)	X	I and II only
(B)	X	II and III only
(C)	Y	I and II only
(D)	Y	II and III only
(E)	The correct answer is not given by (A), (B), (C) or (D).	

Consider the following with respect to determining stochastic interest rate scenarios:

X	P Measure	I	Produces a distribution of outcomes based on a real world view of outcomes.
Y	Q Measure	II	Produces a distribution of outcomes based on risk neutral capital market outcomes.
		III	Consistent with the overall Canadian valuation approach and should be used.