
SOCIETY OF ACTUARIES
Individual Life & Annuities Canada – Company/Sponsor Perspective

Exam CSP-IC

MORNING SESSION

Date: Friday, May 11, 2007
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 7 questions numbered 1 through 7.
 - b) The afternoon session consists of 9 questions numbered 8 through 16.The points for each question are indicated at the beginning of the question.
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 CSP-IC.
6. Be sure your essay answer envelope is signed because if it is not, your examination will not be graded.

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****BEGINNING OF EXAMINATION****
INDIVIDUAL LIFE & ANNUITIES CANADA –
COMPANY SPONSOR PERSPECTIVE
Morning Session

- 1.** (4 points) Define the elements of insurance risk under each of the following Federal Reserve risk categories:
- (i) Credit risk
 - (ii) Market risk
 - (iii) Liquidity risk

2. (8 points) You are given the following for a block of permanent life insurance sold in 2006:

	Income Statement Year ending December 31 st , 2006
REVENUE	
First-year premium	20.50
Renewal premium	0.00
Net investment income	1.07
Total revenue	21.57
BENEFITS AND EXPENSES	
Claims and surrenders	1.40
Expenses and commission	4.70
Change in reserves	12.30
Total benefits and expenses	18.40
Net income	3.17

	Balance Sheet as at December 31 st , 2006
ASSETS	
Invested assets	15.47
Total assets	15.47
LIABILITIES AND CAPITAL	
Policy reserves	12.30
Surplus	3.17
Total liabilities and capital	15.47

Assume the following:

- Net investment rate is 8%
- Investment income is based on mid-year insurance cash flows and average reserves

Your company has secured a reinsurance proposal with the following details:

- Coinsurance with 75% quota share
- First year premium allowance equals 50% of premium
- Renewal premium allowance equals 15% of premium
- Reinsurance expense of 0.3% of premium

2. Continued

- (a) Outline the benefits and risks to your company of using the proposed reinsurance arrangement.
- (b) Construct the financial statements assuming the proposed reinsurance agreement was effective as of January 1, 2006. Show all work.
- (c) Describe advantages and disadvantages of funds withheld coinsurance.
- (d) Identify the changes to the income statement and balance sheet that would result from switching the proposal to funds withheld coinsurance.

- 3.** (9 points) ABC Insurance Company is evaluating a proposal to offer 1-year indemnity insurance coverage to manufacturers of a new flu vaccine.

You are given the following:

- If the vaccine is successful, ABC will receive 90 million at the end of the year
- If the vaccine is defective, ABC will pay 60 million at the end of the year
- The probability of each outcome is 0.5
- The risk-free rate is 8%

A security has been identified that correlates very highly with the net cash flows of the proposal. The security will pay 4.50 for a favourable outcome or cost 3.00 for an unfavourable outcome. The market price of the security is 0.625.

- (a) Identify the three primary variables in financial economics valuation models.
- (b) ABC has approached the government to request risk compensation in the event that the vaccine is defective. Determine the amount of compensation equivalent to applying a 30% risk-adjusted discount rate in calculating the expected value of the cash flows.
- (c) Identify and explain possible concerns that should be considered when using Monte Carlo simulation for evaluating capital budgeting proposals.

4. (12 points) ABC Insurance Company has issued the following variable annuity contract in the U.S.:

- Account value at valuation date: 900 (100% equities)
- Death benefit at valuation date: 1000
- Premium paid to date: 1000
- Net asset charges: 1%
- Valuation rate: 7%
- Attained age: 65
- Sex: Male
- Assumed first year drop: 14%
- Assumed fund recovery: 14%
- Death benefit guarantee: Maximum of an annual ratchet and 5% rollup
- Duration of contract: 5 years

Year	0	1	2	3	4	5
Surrender charges (% of premium paid)	4%	4%	3%	2%	1%	0%
Mortality rates per thousand	–	17	19	21	23	26
Survival function	1	0.983	0.964	0.944	0.922	0.898

- (a) Calculate the U.S. Statutory reserve for the guaranteed minimum death benefit based on Actuarial Guideline 34. Show all work.
- (b) Describe the theoretical and practical issues in valuing guaranteed benefits that need to be considered in setting valuation assumptions associated with policyholder behavior.
- (c) Propose contract features that could be introduced to limit the level of risk associated with the guaranteed minimum death benefit.

5. (9 points) You are given the following:

- A life insurance company, ABC, has issued GIC contracts with a face value of 400,000, a term of 1 year and payment rate of 8%. The customers expect to realize a yield-to-maturity of 9%.
- ABC has issued debt subordinate to the GICs with a face value of 200,000. The debt has a term of 1 year and pays 10% on its face value. The debt holders expect to realize a yield-to-maturity of 16%.
- ABC has purchased partial asset portfolio insurance with a premium of 25,000 from an unrelated insurance company.
- The risk-free rate is 7%.
- Complete portfolio insurance costs 60,000.

(a) Complete the following accounting and risk-capital balance sheets for ABC.

Accounting Balance Sheet			
Assets		Liabilities and Equity	
Investment portfolio	650,000	GICs	
Asset insurance	25,000	Debt	
		Equity	89,014
Total assets	675,000	Total liabilities and equity	675,000

Risk-capital Balance Sheet			
Assets		Capital	
Investment portfolio	650,000	Cash capital provided by:	
Asset insurance provided by:		Customers	
Equity holders		Debt holders	
Insurance company	25,000	Equity holders	40,654
Debt holders		Risk-capital provided by:	
Customers		Equity holders	
Total assets		Total capital	

Show all work.

(b) Identify the distinguishing features of principal financial firms.

6. (10 points) The U.K. life insurance subsidiary of Company ABC, XYZ Life, was put up for sale this year as part of Company ABC's strategy to exit the insurance business. Bank 123 was one of three bidders for the business. If Bank 123 wins the bidding battle, the group plans to use financial engineering to unlock value at XYZ Life. This could include securitizing some of the assets and using derivatives and guarantees to refinance the business.

(a) Describe the analysis behind the real-options classification scheme and categorize this investment opportunity.

(b) You are given the following:

- Required return on debt: 5.6%
- Expected rate of return for the market: 10.8%
- Risk-free rate of return: 2.8%
- Beta of Company ABC's stock: 0.87
- Market value of XYZ Life's debt: 1.8 billion
- Market value of XYZ Life's equity: 4.5 billion

Calculate the weighted average cost of capital for Company ABC using the CAPM approach.

(c) Describe other discount rates that are commonly used to price an acquisition.

(d) You are given the following:

- Solvency reserves to be transferred: 2.4 billion
- Tax reserves to be transferred: 2.2 billion
- Required capital for Bank 123: 118 million
- XYZ Life's embedded value: 420 million
- Pre-tax transaction costs associated with the acquisition: 10 million
- Tax rate: 40%

Calculate the maximum purchase value of XYZ Life.

Show all work.

7. (8 points) On July 1, 2005, ABC Life Company approved a new investment policy that permits the use of more investment classes and higher risk investments to increase asset yields. On the same day, the investment department sold all of the company's existing assets and bought new assets. No other assets were sold in 2005.

You are given the following information for the asset segment supporting ABC's universal life insurance products:

	December 31, 2004		December 31, 2005		2005 Investment Income
	Market Value	Book Value	Market Value	Book Value	
Government bonds	120	100	–	–	10
Corporate bonds	–	–	50	40	5
Commercial mortgages	–	–	30	40	1
Hockey team	–	–	5	10	–1

- (a) Determine the information that needs to be disclosed in the 2005 Appointed Actuary's report for the asset segment.
- (b) Explain the components of the source of earnings disclosure required by OSFI.
- (c) Propose commentary for each component of the source of earnings disclosure affected by the changes in the asset segment.

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

Exam CSP-IC

AFTERNOON SESSION

Date: Friday, May 11, 2007

Time: 1:30 p.m. – 4:45 p.m.

INSTRUCTIONS TO CANDIDATES

General Instructions

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COMPANY SPONSOR PERSPECTIVE
Afternoon Session

- 8.** (4 points)
- (a) (3 points) Describe the key areas of concern that a company should consider when implementing SOX 404.
 - (b) (1 point) Describe the valuation processes that fall under the COSO definition of control and indicate which of these steps are not covered by the SEC definition of control.

9. (5 points)

(a) Describe the probabilistic approach and the successive ratios approach for modeling interest rates stochastically.

(b) You are given the following:

Benchmark 90-day rate:	3%
Benchmark 10-year rate:	6%
Volatility factor:	10%
Coefficient of correlation of 90-day rate and 10-year rate:	0.8

The following random numbers form a binomial distribution with $n = 100$ and $p = 0.5$, for period 1:

90-day X_{100} : 35

10-year X_{100} : 80

Use the following approximation to the unit normal distribution:

$$Z_n = \frac{X_n - \frac{1}{2}(n)}{\frac{1}{2}(n)^{\frac{1}{2}}}$$

Calculate the next 90-day rate and 10-year rate using the successive ratios approach.

Show all work.

10. (12 points) ABC Life, a stock life insurance company, sells payout annuities. A third-party administrator provides minimal data on the block.

- (a) (3 points) Compare:
- (i) dedicated matching of asset and liability cash flows and
 - (ii) active asset-liability management.
- (b) (3 points) Explain the Appointed Actuary's responsibilities in working with the auditors and others in this circumstance under OSFI's Memorandum to the Appointed Actuary.
- (c) (6 points) A 3-year annuity certain has payments of 10,000 payable on December 31st of 2007 through 2009.

You are given the following:

- Shortfalls in cash flows are made up by divesting assets
- There are no transaction costs
- Any percentage of the asset may be sold
- Capital gain or loss accounting treatments are ignored
- Valuation of the annuity block on December 31st, 2006, uses Scenario X which is based on the following long-term rates that apply for durations greater than 1 year:

Year-end	2007	2008	2009
Rate	7%	6%	5%

- Short-term rates are 60% of long-term rates at all times

Calculate the policy liability for this annuity on December 31st, 2006, for each of the following:

- (i) The backing asset is an equity index fund based on the TSX 60. The expected return is 12% before provisions for adverse deviation. The book value is equal to the market value.
- (ii) The backing asset is a bond coupon maturing on December 31st, 2009, yielding 6% on the book value. Divestitures are subject to market value adjustment.

Show all work.

11. (10 points) You are an actuary working for ABC Life. Your company currently reports financial results on both U.S. Statutory and U.S. GAAP bases. You are preparing a presentation to the Board of Directors regarding financial reporting methods and investment opportunities.

- (a) (2 points) Describe the key elements of financial management systems.
- (b) (3 points) Describe the shortfalls of Statutory and U.S. GAAP accounting for internal reporting.
- (c) (5 points) The company has a choice of two investments.

Investment A is a pure insurance risk contract with the following cash flows:

Time	0	1	2
Premiums	90	60	0
Claims	0	40	90
Expenses	15	5	5
Risk capital	30	20	0

Risk-free rate: 4.5% for 1-year maturities
5.0% for 2-year maturities

Frictional capital costs: 2.0% for all years

Investment B generates an economic profit of 2 with the same risk capital investment structure as Investment A.

Recommend the best investment choice using the economic value of insurance liabilities methodology. Justify your recommendation.

Show all work.

12. (4 points)

- (a) (3 points) Describe each of the following:
 - (i) Statutory valuation
 - (ii) U.S. GAAP valuation
 - (iii) Tax reserve valuation
 - (iv) Gross premium valuation
 - (v) Embedded value

- (b) (1 point) Explain the objectives of the following:
 - (i) International Accounting Standards
 - (ii) Fair value accounting

13. (6 points) You are a pricing actuary at a large life insurance company. You have been asked to develop a mortality table that will be used to price a fully underwritten, renewable and convertible term product for the Canadian marketplace.

- (a) List potential sources of data you could use to construct your table.
- (b) You have decided to use the experience of a similar block of in-force business at your company.

Describe ways to validate the study results.

- (c) The midpoint of the study you are using is 5 years old.

Describe any adjustments that should be made in order to use the results in current product pricing and issues to be aware of with any such adjustments.

- (d) Your study does not contain enough data to be used in isolation.

Identify two major types of credibility theory you could use to blend your study with adjusted industry data.

- (e) Define selective lapsation and explain how selective lapsation can affect your final mortality assumption.

14. (10 points)

- (a) Describe the role and responsibilities of the Appointed Actuary in Canada.
- (b) Describe techniques that may be used to audit life insurance reserves.
- (c) Describe circumstances that would result in a mortality margin of at least the average of the high and low margins.
- (d) You are given:
 - Expected mortality is 80% of CIA8692
 - Mortality improvements are projected at 0.5% per year for 20 years
 - The margin for adverse deviation is 7 per thousand, divided by the best estimate curtate expectation of life

Assess the adequacy of the mortality margin for a block of preferred term that has been sold for one year

- (e) You are given:
 - The market has shown a significant reduction in long-term interest rates in the last year
 - Long-term yields on government bonds are currently 2.5% and are expected to remain level.

Describe the impact that this change in interest rates will have on the range of long-term Canadian risk-free rates used in the prescribed scenarios.

15. (5 points)

- (a) Describe the drivers of demand for securitization in the life insurance industry.
- (b) Describe the advantages and disadvantages of a risk warehousing model.
- (c) Determine the appropriate category of securitization for each of the following situations:
 - (i) A reinsurance company seeks to achieve continued high growth in its international life and accident reinsurance, but accounting rules require acquisition costs to be written off immediately.
 - (ii) A life insurer is concerned with its mortality exposure to pandemic flu.
 - (iii) A life insurer is domiciled in a country with very conservative statutory valuation assumptions on term life insurance.

Justify your answer.

16. (4 points) Describe the eligibility criteria and limits for inclusion in Tier 1 capital under MCCSR for life insurance companies in Canada for the following asset classes:

- (i) Preferred shares
- (ii) Innovative instruments

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