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

Exam CSP-IC

AFTERNOON SESSION

Date: Friday, May 1, 2009
Time: 1:30 p.m. – 4:45 p.m.

INSTRUCTIONS TO CANDIDATES

General Instructions

1. This afternoon session consists of 8 questions numbered 10 through 17 for a total of 60 points. 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.

Tournez le cahier d'examen pour la version française.

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Exam CSP-IC Front Cover

****BEGINNING OF EXAMINATION****
AFTERNOON SESSION

10. (*4 points*) Your company is concerned about its segregated fund reserves.

(a)

(i) Outline criteria for making reasonable changes to the Conditional Tail Expectation (CTE) level over time for a segregated fund block.

(ii) Evaluate management's suggestion to decrease the CTE level when guarantees are more "in the money."

(b) Explain the importance of the risk margin and considerations in its determination according to International Accounting Standards.

11. (*8 points*) ABC Insurance is a stock company.

You are given:

- Tier 1 capital: High-risk capital, Value-at-Risk
- Tier 2 capital: Low-risk capital, needed to maintain the ratings
- Tier 3 capital: Excess or Shortage capital, not allocated by business unit

Business Unit	**After-tax Net Income**	**Tier 1 Capital**	**Tier 2 Capital**	**Tier 3 Capital**
Life	14	93	50	0
Annuities	5	25	20	0
Investment Management	2	7	5	0

ROE requirement (business unit and total company level)	15% after-tax
Tier 2 Capital Charge	2%
Interest on Tier 2 Capital	5%
After-tax cost of Debt	8%

(a) Explain the consequences of using debt, equity or reinsurance to raise capital.

(b) ABC has decided to raise capital and is considering two capital structures:

- 20% debt, 80% equity
- 50% debt, 50% equity

Recommend the preferred level of debt capital. Show all work.

(c) ABC uses the Value-at-Risk method to allocate capital to each business line.

Evaluate the current allocation among these three business units.

12. (*8 points*) ABC Life, a Canadian company, has a reinsurance agreement with company XYZ Re.

You are given the following information:

Valuation Date:	December 31, 2008
Policy Type:	Term
Policy Expiry Date:	December 31, 2009
Policy Size:	100,000
Policy Premium:	450

Valuation Information

Margins for Adverse Deviations	Maximum utilized
Expected Mortality	0.005
Curtate Life Expectancy	25.0 years
Expected Lapse rate	0%
Expected per Policy Expenses	75
One year interest rate	5%
Short Term rate	4%
Bond maturity	December 31, 2009
Bond yield	7%

Assume:

- Liabilities are backed by Government of Canada Zero Coupon Bonds designated as Held to Maturity.
- Excess cash flows are invested at the short term rate.
- Cash flow deficiencies are covered by divesting a portion of the assets.
- No other expenses, C-1 deductions or tax reserve implications.
- Any asset divestiture is considered immaterial.
- Claims occur at the end of the year.
- Premiums, expenses and allowances occur at the beginning of the year.

Reinsurance Information

Percentage Reinsured	90%
Reinsurance Premium	3.00 per 1,000
Reinsurance Allowance	0.50 per 1,000

(a) (*6 points*) Calculate the gross and net reserves for ABC as of the valuation date.

(b) (*2 points*) Identify reasons why XYZ's reserve would not equal the reduction in reserve for reinsurance at ABC.

13. (*10 points*) You are given the following CALM (Canadian Asset & Liability Method) scenario results:

Supporting Asset Amounts (millions)

	Segment 1 ***Non Par Individual Life***		**Segment 2** ***Annuity***		**Segment 3** ***Par Life***
Scenario	**Product 1**	**Product 2**	**Product 3**	**Product 4**	**Product 5**
Base	50	100	75	110	80
Scenario a	45	110	90	100	75
Scenario b	60	135	70	120	85
Scenario c	65	120	65	140	82
Scenario d	55	105	73	115	74
Scenario e	57	117	80	105	77

(a) (*6 points*) With respect to CALM,

(i) Outline the method.

(ii) Outline considerations for determining the appropriate level of aggregation.

(iii) Determine the reported policy liabilities and interest rate provision for adverse deviation. Justify your answer.

(b) (*2 points*) Explain considerations in determining the types and number of additional interest rate scenarios to be run under CALM.

(c) (*2 points*)

(i) Explain the difficulty in incorporating income and capital taxes in CALM.

(ii) Define the two acceptable approximation techniques to incorporate taxes.

14. (*8 points*) You are given the following projected product cash flows:

Year	Premium	Maintenance Expenses	Benefits
2009	6,000	400	4,000
2010	6,000	400	4,500
2011	6,000	400	5,000
2012	6,000	400	5,500
2013	6,000	400	6,000

Present value of the projected cash flows discounted at the valuation rate of 5% are:

End of Year	Premium	Maintenance Expenses	Benefits
2008	27,276	1,732	21,436
2009	22,339	1,418	18,508
2010	17,156	1,089	14,934
2011	11,714	744	10,680
2012	6,000	381	5,714

Assume:

- A margin for adverse deviation of 20% is applied to benefits and maintenance expenses.
- Premiums are paid at the beginning of the year.
- Benefits and maintenance expenses are paid at the end of the year.
- 2009 actual experience is:

Maintenance expenses	250
Benefits paid	4,300
Interest earned	5.25%

(a) Identify the benefits of a source of earnings (SOE), and explain the challenges of presenting a SOE to an external audience.

(b) Construct a pre-tax income statement for 2009 and a projected income statement for 2010. Show all work.

(c) Construct a pre-tax SOE for 2009 and a projected SOE for 2010. Show all work.

15. (*10 points*) Executive Life selected a one-year mark-to-market approach at 1% Value at Risk (VaR) to calculate Economic Capital.

(a) (*3 points*) Compare the risks covered by statutory capital and Economic Capital for the following categories:

- Underwriting Risk
- Credit Risk
- Market Risk
- Operational Risk

(b) (*5 points*) You are given:

- Non-adjustable, non-par, individual life insurance. There are no reinsurance arrangements for these products.

(millions)

Total face amount	800
Total reserve	450
Projected total death claims	45
Standard deviation projected death claims	12
Macaulay duration of projected death claims	8.5

- Economic capital distribution for mortality can be approximated by a Normal distribution with a mean of 11 and a standard deviation of 6.5.

- Standard Normal (z) table:

P	Z
0.950	1.645
0.975	1.960
0.990	2.326
0.999	3.090

Calculate the capital requirement related to mortality risk under:

(i) MCCSR basis;
(ii) Economic Capital.

(c) (*1 point*) Recommend targets other than the one-year mark-to-market at 1% VaR approach.

(d) (*1 point*) Outline the modeling issues you may encounter in calculating Economic Capital.

16. (*6 points*) True North Life (TNL) has calculated the reserves for two blocks of non-participating whole life policies with adjustable premiums.

Reserves at December 31, 2007 (in thousands):

Block	Issue Year	Canadian Asset Liability Method	Policy Premium Method	1.5 Year Preliminary Term Method	Cash Surrender Value	Incurred But Not Reported
A	1985	4,500	4,400	6,300	4,550	120
B	2000	8,700	8,300	9,700	9,000	150

Reserves at December 31, 2008 (in thousands):

Block	Issue Year	Canadian Asset Liability Method	Policy Premium Method	1.5 Year Preliminary Term Method	Cash Surrender Value	Incurred But Not Reported
A	1985	5,000	4,900	6,500	5,100	90
B	2000	9,000	8,500	10,000	9,200	80

	Block A	Block B
Rate used by TNL in the calculation of guaranteed benefits	5.0%	3.5%
Taxable amounts reported to policyholders	125	75

60 month moving average rate for Government of Canada bonds: 7.5%
Life investment loss carry forward: 100

(a) Calculate the difference between statutory and taxable income due to reserves for 2008.

(b) Calculate the Investment Income Tax for TNL for 2008.

(c) Assess each of the following statements:

(i) "TNL determines premium tax rates based on where its head office is domiciled."

(ii) "TNL owns some vacant land which we don't have to worry about for tax purposes."

(iii) "Policy loans are a matter between TNL and the policyholder – there are no tax consequences for TNL."

(iv) "Premiums received by TNL with respect to reinsurance ceded to us by other insurers is not subject to premium tax."

17. (*6 points*) You are given the following mortality data for an existing term product:

	Mortality Ratios					
	Company Experience			Industry Experience		
	Male	**Female**	**Total**	**Male**	**Female**	**Total**
Medical	62.0%	50.0%	59.2%	74.0%	78.0%	74.9%
Non-medical	85.9%	90.1%	86.9%	84.0%	83.0%	83.8%
Paramedical	75.0%	101.2%	77.8%	73.0%	85.0%	74.3%
Total	69.9%	67.1%	72.3%	77.5%	81.7%	78.3%

Underwriting Category	**Credibility Factors with $p = 90\%$ and $r = 3\%$**		
	Male	**Female**	**Total**
Medical	18.0%	10.0%	
Non-medical			
Paramedical			
Total			27.6%

Assume:

- A 100% credibility factor requires 3,007 claims.

(a) Calculate, for the Medical Underwriting category:

(i) The actual number of claims by gender,

(ii) The blended expected mortality ratios by gender,

(iii) The total mortality ratio.

Show all work.

(b) ABC is developing a new term insurance product to enter a new market. ABC will modify its underwriting practices.

(i) Identify the general principles to consider in setting margins for adverse deviation.

(ii) Determine an appropriate margin for adverse deviation for mortality of ABC's new term insurance product. Justify your answer.

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