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

Exam CSP-IC

AFTERNOON SESSION

Date: Friday, November 4, 2011
Time: 1:30 p.m. – 4:45 p.m.

INSTRUCTIONS TO CANDIDATES

General Instructions

1. This afternoon session consists of 9 questions numbered 9 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
Beginning with Question 9

9. (*5 points*) An intern at your company is creating a model to perform asset adequacy analysis on the company's life and annuity businesses.

You are given the following information about the model:

- Policies are grouped by issue age, gender, underwriting class, and smoker status.
- Model results at $t = 0$ are compared to the company's balance sheet.
- Initial assets equal the initial liabilities.

(a) (*2 points)* Explain the modeling approach with respect to:

- Model simplification
- Model validation

(b) (*1 point*) List challenges of cash flow matching as an Asset Liability Management technique.

(c) (*2 points*) Interest rates fall below those guaranteed in the company's life and annuity contracts.

Identify modeling assumptions that may need to change due to this interest rate change.

10. (*6 points*) You are a pricing actuary for a reinsurance company. A direct company for which your company has had a reinsurance treaty for a number of years wants to negotiate a new treaty for future Universal Life (UL) policy issues. The direct company is selling an innovative UL product that has increasing market share. It is seeking reinsurance for capital relief.

The following summary information is available for the direct company:

	2007	2008	2009	2010
Assets	125	150	175	200
Liabilities	80	120	160	195
Surplus	45	30	15	5

The direct company has requested a reinsurance quote with the following treaty parameters:

- Funds Withheld Coinsurance
- 99% Coinsurance limit
- Automatic basis of reinsurance
- Bulk-administration on an annual basis
- Reinsurance premiums are guaranteed for the life of the reinsured policies

(a) (*2 points*) Evaluate the proposed treaty parameters from the perspective of the reinsurer.

(b) (*4 points*) Propose changes and additions to the requested treaty parameters that reduce the risk to the reinsurer of entering into this reinsurance transaction.

11. (*7 points*)

(a) (*1 point*) Define the components of the base scenario used for interest rates under CALM.

(b) (*3 points*)

You are given:

12/31/2009	12/31/2010	
4.4%	1.5%	60 month moving average of 91 day Canadian risk free rates
4.8%	2.1%	120 month moving average of 91 day Canadian risk free rates
5.7%	3.7%	60 month moving average of long term Canadian risk free bond rates
7.9%	5.3%	120 month moving average of long term Canadian risk free bond rates

(i) (*1 point*) Determine the prescribed range for short term and long term Canadian risk free rates for the ultimate forecast period at 12/31/2009 and 12/31/2010. Show all work.

(ii) (*2 points*) Explain the implications for the prescribed interest rate scenarios when the prescribed ranges from 12/31/2009 are replaced with the prescribed ranges from 12/31/2010.

(c) (*3 points*) Compare the approach used to determine the discount rate under IFRS (*July 2010 Insurance Contracts Exposure Draft*) and CALM.

12. (*9 points*)

(a) (*3 points*) ABC Life has a block of renewable term policies with the following information:

Standard deviation of projected death claims	425,000
Macaulay duration of death claims	13.45
Total net amount at risk	200,000,000
Total net face amount	225,000,000
Projected net death claims	10,000,000

Calculate the Minimum Continuing Capital and Surplus Requirement (MCCSR) mortality risk component for this block of policies.

(b) (*6 points*) You are developing the economic capital model for mortality risk for ABC Life. The company sells universal life products in addition to its renewable term business. Economic capital is determined as follows:

- Modeling done stochastically
- One-year mark-to-market approach is used
- Risk tolerance level is determined at VaR(99.5)

(i) (*4 points*) Compare methodologies and models for economic capital and MCCSR.

(ii) (*2 points*) Assess whether the mortality risk component under the economic capital framework will be higher or lower than that of the MCCSR mortality component.

Justify your answers.

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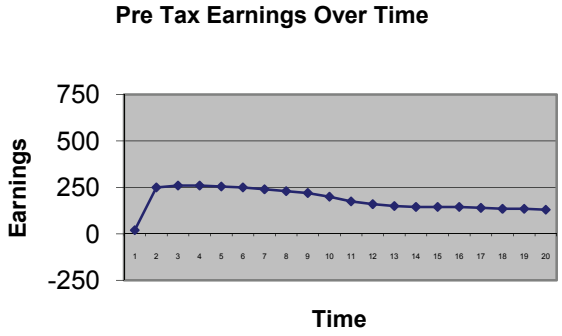
13. (*4 points*) The graphs below illustrate pre-tax earnings over time for a single issue year of non-par whole life business under various financial measurement bases.

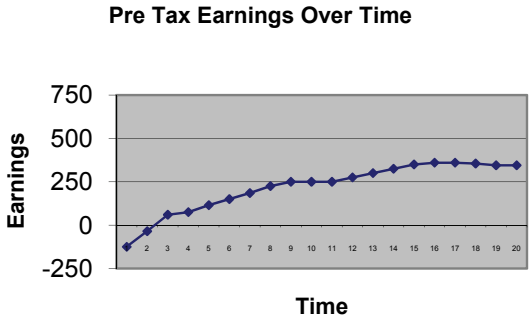
Assume:

- Actual experience is equal to expected experience in each graph.
- Graphs depict first 20 years of earnings only.

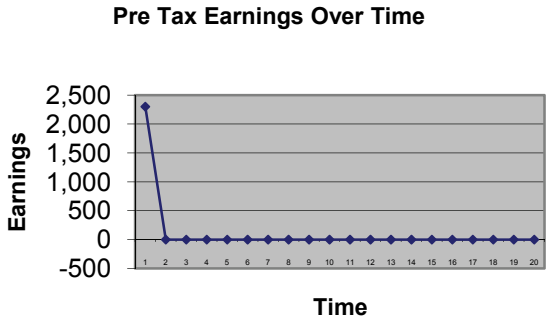
Measurement Basis A:



Measurement Basis B:



Measurement Basis C:



13. Continued

Based on the earnings patterns shown in each graph:

(a) (*1 point*) Determine the most likely financial measurement basis used for each of the three graphs.

(b) (*3 points*) Explain the aspects of the financial measurement bases that lead to the earnings patterns shown in each graph.

14. (*12 points*) You are an actuary at SSM Life, a Canadian life insurance company. You are updating the mortality assumption on its whole life product based on the mortality experience study results of both SSM Life and industry data.

(a) (*1 point*) List considerations in determining the mortality Margins for Adverse Deviation (MfAD) for this product.

(b) (*2 points*) Compare the following credibility methods:

(i) Limited Fluctuation Credibility Theory Normalized Method

(ii) Greatest Accuracy Credibility Theory

(c) (*4 points*) Another actuary prepared a memo recommending the mortality MfAD for the whole life product. The memo supports a MfAD of $3.75 / e_x$ for the following reasons:

- SSM Life decided to split the non-smoker class of the whole life product into two classes: preferred and non-preferred. The changes were introduced two years ago.
- Current policyholders under the old version of the whole life product have an option to convert to the new version with the preferred class rating, provided they meet the preferred underwriting criteria.
- Stricter underwriting procedures are being implemented. Impact on the mortality experience as a result of the revisions are still to be determined.
- Mortality improvements are expected in the future.

Assess whether the recommended MfAD is appropriate.

14. Continued

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

Mortality Ratios - Industry Data

	Total
Medical	70.10%
Non-Medical	84.70%
Total	75.25%

Mortality Ratios - SSM Life Data

	Total
Medical	55.40%
Non-Medical	89.30%
Total	70.00%

Number of Claims - SSM Life

	Total
Medical	79.20
Non-Medical	59.20
Total	138.40

Assume 3,007 is the factor from the Normal Distribution table corresponding to $p = 90\%$ and $r = 3\%$.

Calculate Actual to Expected ratios and expected number of claims for Medical and Non-Medical using Limited Fluctuation Credibility Theory Normalized Method. Show all work.

15. (*4 points*) You are given the following information for an insurance contract:

Time	**0**	**1**	**2**	**3**
Premiums	100	120	130	0
Claims	0	50	110	160
Expenses	10	2	2	2
Regulatory Reserves	100	70	50	0
Risk Capital	30	25	10	0

Assume:

- Risk-free rate is 3.5%.
- Risk capital cost is 1% of risk capital at the beginning of each year.
- Tax reserves are equal to the regulatory reserves.
- Tax rate is 30%.
- Total assets held to back the contract are equal to the regulatory reserves plus risk capital.
- Spread for the insurer's default option and liquidity value is 0 basis points.

Calculate economic profit at time zero. Show all work.

16. (*6 points*)

(a) (*2 points*) Summarize the process for classifying contracts under International Financial Reporting Standards (IFRS).

(b) (*4 points*) A life insurance company has the following products:

- Universal life insurance
- Payout Annuity
- Deferred Annuity
- Segregated Funds

Explain how each of the above products is classified under IFRS, including the product features that contribute to this classification. Justify your answer.

17. (*7 points*) LNZ Life, a U.S. company, introduced a variable annuity product in 2010 which provides minimum guaranteed death benefits and minimum guaranteed accumulation benefits. Currently, LNZ's reserves are calculated under IAS 39.

(a) (*5 points*) LNZ purchased derivatives in 2010 to hedge the risk of falling equity markets.

(i) Identify the criteria to have these derivatives qualify as hedges and outline the resulting accounting treatment under SFAS 133.

(ii) Distinguish the main differences in reporting for both guaranteed benefits and hedging derivatives under IAS 39 and SFAS 133.

(b) (*2 points*) The rating agencies have decided to upgrade LNZ's credit rating as part of an upgrade for the insurance sector as a whole.

Assess the impact on reserves. Justify your answer.

**** END OF EXAMINATION ****
Afternoon Session

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