SOCIETY OF ACTUARIES
Life Finance & Valuation - Canada

Exam ILALFVC

AFTERNOON SESSION

Date: Thursday, October 29, 2015
Time: 1:30 p.m. – 3:45 p.m.

INSTRUCTIONS TO CANDIDATES

General Instructions

1. This afternoon session consists of 4 questions numbered 8 through 11 for a total of 40 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 because 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 ILALFVC.

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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****BEGINNING OF EXAMINATION****
Afternoon Session
Beginning with Question 8

8. (*9 points*) XYZ Life, a Canadian life insurer, has acquired a large block of unhedged segregated fund business offering Guaranteed Minimum Maturity Benefits (GMMB).

(a) (*2 points*) Explain the relationship between the CALM and Risk-Neutral Methods of valuing segregated fund guarantees as described by the Canadian Institute of Actuaries' Task Force on Segregated Fund Liability and Capital Methodologies.

(b) (*3 points*) XYZ will be using an approximation to CALM instead of computing reserves using a first-principles stochastic-on-stochastic (SOS) hedging model.

XYZ's valuation actuary sent a report to management regarding the valuation method to be used that included the following statements:

A. *The Hedge Cost Method should be our preferred approach. The CIA working group prefers this method and it has no significant drawbacks in setting a reserve.*

B. *Given the long term nature and complexity of the products, using a Proxy Function Method may be the simplest approach.*

C. *If we decide to hedge all of the liability greeks, an Adapted Risk Neutral method would give us a perfect approximation to stochastic-on-stochastic run.*

Critique each of the valuation actuary's statements.

8. **Continued**

(c) (*4 points*) XYZ wants to implement a hedging strategy for the GMMB block with the following values:

- Market value: 100,000
- Guarantee maturity value: 105,000

You are given:

- GMMB fee charged to policyholder is 5,000 at year start
- Risk free rate is 5%
- Segregated fund is 100% correlated to the TSX equity index
- Hedging uses futures contracts tied to the TSX with a cost of 0
- Market statistics:

	Current	**Path 1 (Up)**	**Path 2 (Down)**
TSX Index	1,000	1,200	800
Time		1 year	1 year
Probability		62.5%	37.5%

Calculate the total initial reserve under CALM if this hedging program is implemented. Show all work.

9. (*12 points*) DEF is a Canadian company that traditionally sells Term to 100 (T-100) insurance. DEF plans to launch its first universal life (UL) product in 2015 with the following features:

- Death benefit is face amount plus account value
- Guaranteed minimum credited interest rate
- Level cost of insurance (COI) charges
- Guaranteed bonus starting in year 5

(a) (*2 points*) Describe considerations in setting the base valuation assumptions under Canadian GAAP for the following policyholder options:

(i) Flexible premium payments and partial withdrawal privileges

(ii) Lapses

(b) (*4 points*) Recommend an appropriate margin for adverse deviation (MfAD) for the following valuation assumptions:

(i) Premium persistency and partial withdrawals

(ii) Expenses

(iii) Interest rate

Justify your recommendations.

DEF spent 10 million in 2015 upgrading the administrative system to handle the UL product. 8 million is capitalized and amortized over a 4-year period. A recent expense study revealed the following expenses for the product:

In Thousands	2015	2016	2017	2018	2019
Upgrading administrative system	10,000				
Capitalized portion of system upgrade	8,000	6,000	4,000	2,000	0
Financial reporting	500	450	450	450	450
IT personnel		750			
Marketing	400	350	300	300	300
Direct legal	1,000	1,000	1,000	1,000	1,000
Senior management – allocated to overhead	550	650	650	650	650
Policyholder statement mailing	10	20	36	44	50

9. Continued

(c) (*4 points*) Maintenance expenses on the UL product are expected to reach the long term best-estimates in year 2019, based on the following sales projection:

	2015	2016	2017	2018	2019
Number of policies	351	1,735	2,905	4,659	12,500

(i) Calculate the expense overrun in 2015 assuming an inflation rate of 2% per year. Show all work.

(ii) Explain why each expense from the expense study was included or excluded in the calculation in (i).

(d) (*2 points*) The administrative system upgrade is expected to reduce administrative expenses between 5 per policy and 10 per policy. 10 per policy reduction equates to a present value of 20 million. The best estimate is that a reduction of 7.5 per policy will be achieved. The portion of system upgrade expenses not capitalized caused an unusual increase in projected unit expenses of 2.5 per policy.

Calculate the impact on both the income statement and balance sheet of the system upgrade in 2015. Show all work.

10. (*11 points*) Blue Life is considering acquiring a block of fixed deferred annuities from Green Life on December 31, 2015. Both Blue Life and Green Life are U.S. companies.

Green provides the following assumptions:

Values (in millions)	December 31, 2015	December 31, 2016	December 31, 2017
Adjusted book value of block	65	N/A	N/A
Minimum required capital	40	45	49
Existing proxy DAC tax asset	70	60	50
Statutory reserve	200	250	270
Tax reserve	180	220	260
Increase in proxy DAC tax asset over prior year end	N/A	3	3

Cashflows occur at year end (in millions)	2016	2017
Premium and investment income	210	235
Benefits	17	18
Expenses	10	12
Unallocated expense	7.2	2.3

Risk free rate	2%
Expected market rate of return	10%
Beta	1.25
Tax rate	20%
Interest on capital	4%
Target capital ratio	300%

(a) (*7 points*) Calculate the actuarial appraisal value at December 31, 2015 using Green's assumptions, ignoring all cashflows after 2017. Show all work.

(b) (*3 points*) After reviewing Green's assumptions, Blue's actuary made the following observations:

- *Green is overly optimistic on the market return*
- *Green is holding excessive capital for this block*

Describe the possible impact on the actuarial appraisal value based on each of Blue's observations. Justify your answer.

(c) (*1 point*) Identify differences between actuarial appraisal value and embedded value calculations. No calculations are required.

11. (*8 points*)

(a) (*2 points*) Describe considerations in setting internal targets for Own Risk and Solvency Assessment (ORSA).

(b) (6 *points*) TKT Life, a Canadian insurer, is developing its ORSA. The following statements were made by TKT's Chief Risk Officer (CRO) in describing some of TKT's key decisions and principles:

A. "As our ORSA goal is to comply with OSFI's expectations, we shall include known and reasonably foreseeable risks from our MCCSR submissions, where those risks can be easily quantified."

B. "A number of non-material individual risks have been identified through sensitivity testing and discarded as they have little impact on the company's current operations. For these non-material risks, internal targets have been calculated with a floor of 125% of the relevant supervisory targets."

C. "We have also considered our likely potential entry into other markets. Since we plan to enter the segregated fund market in the next 12 months, we have reflected the risks associated with that market in developing our internal targets."

D. "Our bi-annual report to senior management and OSFI will demonstrate that the overall results confirm the position relative to supervisory targets."

E. "We want to avoid a supervisory review by OSFI as that leads to prescribed methods and uses of our ORSA."

F. "TKT's ORSA, including each ORSA report that goes to the Board will be reviewed by the Board's audit committee, which includes the CRO."

Critique the above statements.

****END OF EXAMINATION****

USE THIS PAGE FOR YOUR SCRATCH WORK