SOCIETY OF ACTUARIES
Life Finance & Valuation - Canada

Exam ILALFVC

MORNING SESSION

Date: Thursday, November 3, 2016
Time: 8:30 a.m. – 11:45 a.m.

INSTRUCTIONS TO CANDIDATES

General Instructions

1. This examination has a total of 100 points. It consists of a morning session (worth 60 points) and an afternoon session (worth 40 points).

   a) The morning session consists of 6 questions numbered 1 through 6.

   b) The afternoon session consists of 5 questions numbered 7 through 11.

   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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Printed in the U.S.A.
Exam ILALFVC Front Cover

****BEGINNING OF EXAMINATION****
Morning Session

1. (*8 points*)

(a) (*2 points*) You are given the following for ABC Life:

- The only two sources of capital available are debt and equity
- The value of debt is 100 million
- The value of equity is 300 million
- The cost of debt is 5%
- The cost of equity is 15%

Calculate ABC's weighted average cost of capital. Show all work.

(b) (*6 points*) You are given the following 3-year financial plan for ABC's business units:

Business Unit	GAAP ROE	Beginning Equity	Ending Equity
A	10%	200	290
B	15%	100	180
C	20%	75	125

Determine the direction of adjustment (if any) of the capital allocation to each business unit to increase the economic value of ABC using the weighted average cost of capital calculated in part (a). Justify your answer.

2. (*12 points*) JFK and LAX are U.S. life insurance companies. You are the chief actuary for JFK, and your company is currently evaluating whether or not to acquire LAX at the end of 2016.

(a) (*7 points*)

(i) (*2 points*) Describe the main components of an actuarial appraisal.

(ii) (*5 points*) You are preparing an actuarial appraisal for LAX as of 12/31/2016. You are given the following information from your model:

Values as of 12/31/2016	
Adjusted statutory book value	100 million
Required capital	6 million
Required return on debt	5%
Stock beta	1.2
Market value of debt	30 million
Market value of equity	90 million
Risk-free rate of return	2%
Expected rate of return for the market as a whole	8%

Projected values as of 12/31/2017	
Required capital	9 million
Present value of future distributable earnings	200 million

Your model produces after-tax statutory earnings for 2017 of 10 million.

Determine the actuarial appraisal value as of 12/31/2016, using the CAPM method to determine the discount rate. Show all work.

2. Continued

(b) (*5 points*) JFK has hired a consultant to develop a model for determining how its economic capital position would be impacted by the acquisition of LAX, with the stated objective of being able to absorb a 1-in-200-year event within the next year. After identifying the major risks faced by the two companies, the consultant develops a proposal including the following:

A. Calculate economic capital using the liability runoff approach.

B. Model each risk stochastically.

C. For each risk, determine economic capital at the CTE (99.5) level.

D. Determine aggregate economic capital by summing the economic capital amounts for each risk.

E. The amount of capital produced by this approach might be conservative, but it is never a bad thing to have too much capital since it helps to reduce the risk of bankruptcy or a ratings downgrade.

Critique the consultant's statements.

3. (*11 points*)

(a) (*3 points*) Describe the primary advantages and disadvantages of the following methods of reinsurance:

(i) yearly renewable term (YRT)

(ii) coinsurance

(iii) modified coinsurance (mod-co)

TNY is a small life insurance company. The company is less than five years old and sells a variety of low face amount term life products. The company is planning to introduce a high face amount whole life product, and they are evaluating three reinsurance options for this product: coinsurance, YRT and mod-co.

You are given the following information:

Single Whole Life Policy Assumptions	
Insured	Lemon Doe
Issue age	35
Underwriting class	Standard smoker
Issue date	July 1, 2017
Face amount	1,000,000
Premium rate per 1,000	8
Annual policy fee	20
First year mean reserves per 1,000	0.90
First year commissions (% of premium)	90%
Premium tax (% of premium)	2%
First year expenses	430

Ceding Company and Reinsurer Assumptions		
	TNY	Reinsurer
Initial surplus (January 1, 2017)	1,000	1,000
Investment rate of return	5%	5%
Retention limit	100,000	5,000,000
Income tax rate	0%	0%
First year reinsurance expenses	(included in policy expenses)	70

3. Continued

YRT Assumptions	
First year premium rate per 1,000	0.60
Annual cession fee	10
First year mean reserves per 1,000	0.75

Coinsurance and Mod-co Assumptions	
First year expense allowance	100%
Mod-co interest rate	5%

Assume:

- The policy is still inforce at the end of 2017
- Investment income is earned only on assets present at the beginning of 2017
- Premiums are paid and expenses are incurred at the beginning of the policy year

(b) (*6 points*) Determine which of the three reinsurance options will maximize TNY's 2017 statutory income for this policy. Show all work.

(c) (*2 points*) Recommend one reinsurance option for TNY's new whole life product. Justify your recommendation.

4. (*10 points*) CNW Life is a Canadian domiciled life insurance company that sells a single premium, 3-year endowment life insurance product. The product's investment strategy is to purchase zero-coupon bonds at issue that match valuation expected cash flows.

(a) (*2 points*) Assess the appropriateness of each asset designation under Accounting Standards Board (AcSB) Section 3855 for CNW's zero-coupon bond portfolio. Justify your answer.

(b) (*4 points*) You are given:

- A 500,000 face amount policy was issued to a 75-year-old on December 31, 2015
- Expected mortality rates per 1000, with deaths occurring at the end of the policy year:

x	q_x / 1000
75	10
76	15
77	20

- Yield curve at December 31, 2015:

Term to Maturity	Spot Rate
1 Year	1%
2 Years	2%
3 Years	3%

- The yield curve does not change during the projection period.
- There are no lapses, expenses, commissions, or taxes.
- There are no margins for adverse deviations.
- The single premium is received moments before the Dec. 31, 2015 valuation date.
- CNW Life calculates policy liabilities using the Canadian Asset Liability Method (CALM) with no margins for adverse deviation.

4. Continued

Calculate the financial statement values, based on an AFS asset designation, assuming the policy stays inforce for all 3 years:

	Year End		
Balance Sheet	Dec. 31, 2015	Dec. 31, 2016	Dec. 31, 2017
Assets			
Policy Liabilities			

	Year End		
Income Statement	Dec. 31, 2015	Dec. 31, 2016	Dec. 31, 2017
Change in Policy Liabilities			
Investment Income			
Other Comprehensive Income			

Show all work.

(c) (*4 points*) You are given the following statements for YVR Life, another Canadian based life insurance company:

A. *YVR would like to maintain stable financial statements in order to appease shareholders and investment analysts.*

B. *YVR must also report US GAAP results to its shareholders.*

C. *YVR wishes to use a PPM approximation to calculate its CALM reserve.*

D. *The reserve on Cost of Living Adjustment (COLA) riders is set equal to 50% of accumulated premiums.*

Explain the challenges YVR may face as a result of Section 3855 asset designations for each of the above statements.

5. (*9 points*)

(a) (*2 points*) Describe OSFI's Life Insurance Capital Framework Standard Approach for the following:

(i) Discount rate components in the Best Estimate Liability (BEL) calculation

(ii) Reinsurance

(b) (*7 points*) You are provided with the following information for a single premium 3-year term life insurance product:

	(in Millions)	Discount Rates		
Projection Year	Best Estimate Death Benefits	Base Scenario	Upward Shock Scenario	Downward Shock Scenario
1	80	2%	3%	1%
2	90	2%	3%	1%
3	100	2%	3%	1%

Assume:

- At issue, the company purchases a one-year zero-coupon Government of Canada bond with a 300 million maturity value.
- Upon maturity, the 300 million maturity value is held as cash earning 0%.
- Deaths occur at the end of each projection year.
- The mortality PfAD is 10% of the best estimate death benefit cash flow each year.
- No MfAD on assets.
- No lapses or expenses.

(i) Describe the insurance risk categories as defined by OSFI's Life Insurance Capital Framework Standard Approach.

(ii) Identify which insurance risk categories apply and do not apply to this term product. Justify your answer.

(iii) Calculate the Interest Rate Risk Solvency Buffer immediately after issue under the Life Insurance Capital Framework Standard Approach for the product. Show all work.

6. (*10 points*) YTZ Life is a Canadian life insurance company with one liability cashflow of 1,000 denominated in Canadian dollars, payable at time 5. This liability is backed by Canadian AA Corporate Bonds.

You are given:

Forward Curve for 1-year Canadian Zero Coupon Bonds

t	**0**	**1**	**2**	**3**	**4**	**5**
Risk Free Rate	0.50%	0.55%	0.60%	0.70%	0.70%	0.80%

Canadian AA Corporate spreads for 1-year zero coupon bonds.

Current	0.5%
Historical	1.5%

The Actuarial Standards Board (ASB) has promulgated the following:

The short-term ultimate risk-free reinvestment rate - high	10.0%
The long-term ultimate risk-free reinvestment rate - high	10.4%
The short-term ultimate risk-free reinvestment rate - median	4.0%
The long-term ultimate risk-free reinvestment rate - median	5.3%
The short-term ultimate risk-free reinvestment rate - low	1.4%
The long-term ultimate risk-free reinvestment rate - low	3.3%

(a) (*7 points*) Calculate the economic provision for adverse deviation (PfAD) held under prescribed scenario 1. Show all work.

(b) (*3 points)* After 1 year, a 4-year US dollar zero-coupon bond rated B+ is purchased.

Describe additional assumptions and margins for adverse deviation (MfADs) required in the valuation.

****END OF EXAMINATION****
Morning Session

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