SOCIETY OF ACTUARIES
Life Finance & Valuation – U.S.

Exam ILALFVU

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 ILALFVU.

6. Be sure your essay answer envelope is signed because if it is not, your examination will not be graded.

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Printed in the U.S.A.
Exam ILALFVU 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*)

(a) (*3 points*) List six of the items the IRS mentioned in Rev. Rul. 94-74 that constitute a change in basis under Section 807(f).

(b) (*7 points*) For a three-year non-life contingent single premium deferred annuity, you are given:

- Single premium is 100,000
- Applicable federal rate (AFR) is 2.50%
- Prevailing state assumed interest rate (PSAR) and the statutory valuation interest rate are 3.50%
- No withdrawals are allowed during the first policy year
- No free partial withdrawals
- For ease of calculation, no settlement options other than cash surrender

The company, a U.S. life insurer, is considering one of two guaranteed credited interest rate options that result in nearly the same ending cash value for the contract owner:

Option A (High First Year, Low Remaining Years):

	Account Value	Guaranteed Credited Interest Rate	Surrender Charge	Cash Value
At issue	100,000.00		3%	97,000.00
End of year 1	105,000.00	5.00%	2%	102,900.00
End of year 2	107,100.00	2.00%	1%	106,029.00
End of year 3	109,242.00	2.00%	0%	109,242.00

Option B (Level All Years):

	Account Value	Guaranteed Credited Interest Rate	Surrender Charge	Cash Value
At issue	100,000.00		3%	97,000.00
End of year 1	102,990.00	2.99%	2%	100,930.20
End of year 2	106,069.40	2.99%	1%	105,008.71
End of year 3	109,240.88	2.99%	0%	109,240.88

4. Continued

(i) (*4 points*) Calculate the tax reserve at issue for each option. Show all work.

(ii) (*3 points*) Recommend which credited interest rate option is preferable for each of the following company objectives:

1) To minimize the difference between the statutory reserve and the tax reserve at issue.
2) To minimize the tax reserve at issue.

Justify your recommendation.

5. (*9 points*) A life insurer has a universal life product that falls under the scope of SFAS 97. Best estimates of projected estimated gross profits (EGPs) and deferrals at issue are shown below:

	Original expected projection amounts		
Year	EGPs	Deferred acquisition expenses	Deferred premium loads
1	25	100	50
2	40	25	20
3	50	0	10
4	55	0	0

You are given the following:

	Actual amounts		
Year	EGPs	Deferred acquisition expenses	Deferred premium loads
1	25	100	50
2	40	35	20

Assume:

- Credited rate is 4.0%
- EGPs are as of the end of the year
- Expenses and premiums occur at the beginning of the year

(a) (*5 points*) Calculate any effect of retrospective unlocking on the FAS 97 balances at the end of year 2. Show all work.

5. Continued

(b) (*4 points*) Explain how a profit-neutral unrealized capital gain would affect each of the following items when calculating a shadow DAC adjustment:

(i) Current and historical gross profits

(ii) Future gross profits

(iii) Amortization factor

(iv) Shadow DAC asset.

6. (*10 points*) TWY Company has a block of 5-year level death benefit term policies sold only to 45-year-olds. Assume all premiums are paid annually at the beginning of the year and all benefits are paid at the end of the year.

You are given:

Policy Year	Premium per 1000	Cash value per 1000
1	45	0
2	45	10
3	45	28
4	45	24
5	45	0

(a) (*3 points*) You are given:

Policy Year (t)	Statutory mortality rate per 1000	$1000A^{1}_{45+t-1:\overline{5-(t-1)}\rceil}$	$\ddot{a}_{45+t-1:\overline{5-(t-1)}\rceil}$
1	20	163.1700	4.3818
2	28	152.7518	3.5888
3	38	134.6316	2.7700
4	50	106.0466	1.9135
5	66	63.4615	1.0000

$1000A_{46}$	665.1353
$\ddot{a}_{46:\overline{19}\rceil}$	8.4954
Statutory interest rate	4%

Calculate the statutory reserve at the end of year 3 for a policy with 100,000 face amount using the Commissioners Reserve Valuation Method (CRVM). Show all work.

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

Policy Year (t)	p_{45+t-1}	Commission rate % of premium	$1000A^{1}_{45+t-1:\overline{5-(t-1)}\rceil}$	Present value of surrender benefit per 1000 at beginning of year	$\ddot{a}_{45+t-1:\overline{5-(t-1)}\rceil}$
1	0.9220	100	123.2433	2.6309	3.8656
2	0.9148	5	120.8303	2.9962	3.2635
3	0.9058	5	111.1410	2.7831	2.5980
4	0.8950	5	91.0776	1.3714	1.8524
5	0.8806	5	56.5714	0.0000	1.0000

6. Continued

GAAP mortality rates	90% of statutory valuation mortality rates from part (a)
GAAP interest rate	Level 5%
GAAP lapse rate	Level 6%
DAC Deferral	Excess first-year commission

Assume no other expenses or deferrals.

Calculate the GAAP benefit reserve and DAC balance at the end of year 3. Show all work.

(c) (*3 points*) You are given:

Inforce face amount at end of year 3	850,000
Actual death claim in year 4	40,800
Actual surrender benefit in year 4	0
Statutory reserve at end of year 4	16,900
GAAP benefit reserve at end of year 4	19,400

Calculate the statutory and GAAP differences between actual and expected mortality experience in year 4. The expected mortality rates are given in parts (a) and (b). Show all work.

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

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