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

Exam ILALFVU

MORNING SESSION

Date: Thursday, April 26, 2018
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 4 questions numbered 7 through 10.

   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.

BEGINNING OF EXAMINATION
Morning Session

1. (*12 points*) ABC Life uses Market Consistent Embedded Value (MCEV) as one of its management performance metrics.

     (a)   (*6 points*) You are given:

	Amount in millions
Opening MCEV	300
Closing MCEV	250
Opening adjustments	30
Closing adjustments	37
New business value	1
Operating variances	8
Economic variances	(5)
Expected existing business contribution using the reference rate	7
Expected existing business contribution using rate in excess of reference rate	2
Release of profits in the value of in-force business	3
Release of required capital	1

         (i)   Calculate the total return on MCEV. Show all work.

         (ii)   Calculate the operating return on MCEV. Show all work.

1. Continued

ABC Life is in the process of acquiring XYZ Life. XYZ performs Embedded Value (EV) calculations annually and does not calculate MCEV.

(b)   (*2 points*) Assess concerns with performing an actuarial appraisal of XYZ using its latest EV results.

(c)   (*4 points*) The following assumptions appear in XYZ's EV report:

    A.   *Persistency, mortality, and expense assumptions are best-estimate with provisions for adverse deviation.*

    B.   *Mortality improvement is included in the mortality assumptions. This is common industry practice.*

    C.   *Expenses consist of acquisition expenses (to the extent associated with existing business) and maintenance expenses. Overhead and one-time expenses are excluded.*

    D.   *Since non-economic assumptions used to calculate EV should be "entity-specific", the company's experience data was exclusively used to develop persistency, mortality, and expense assumptions. No industry data was used.*

Critique the appropriateness of each statement.

2. (*9 points*) LNT Life discontinued selling term life products several years ago. LNT has never used reinsurance on its term business, and it is now exploring the following options to cede 100% of the remaining inforce block at the end of 2018:

- Option 1: coinsurance with a 10% reinsurance allowance
- Option 2: modified coinsurance (mod-co) with a 10% reinsurance allowance and a 7% mod-co interest rate

Below are projected 2018 statutory financial statements for the block without reinsurance:

12/31/2018 Balance Sheet – Projected	
Assets	
Invested Assets	12,600
TOTAL ASSETS	12,600
Liabilities	
Policy Reserves	
Gross	9,500
Ceded	0
Net	9,500
TOTAL LIABILITIES	9,500
TOTAL SURPLUS AND CAPITAL	3,100

2018 Income Statement - Projected	
Revenue	
Premiums	
Gross	4,000
Ceded	0
Net	4,000
Investment Income	800
Reinsurance Allowance	0
Mod-co Adjustment	0
TOTAL REVENUE	4,800
Benefits	
Claims	
Gross	1,500
Ceded	0
Net	1,500
Reserve Increase	
Gross	1,000
Ceded	0
Net	1,000
TOTAL BENEFITS	2,500
TOTAL EXPENSES	300
NET INCOME	2,000

2. **Continued**

Assume:

- LNT earns investment income at a rate of 8%
- Cash flow during the year is not invested until the end of the year and therefore does not earn investment income during the year
- Income tax rate is 0%
- Any reinsurance arrangement would take effect at the end of 2018

(a) (*3 points*) Create LNT's projected 2018 term life income statements for each of the proposed reinsurance arrangements. Show all work.

(b) (*6 points*) You are given the following projected 2019 information for the term life block:

2019 Projected	
Premiums (gross)	3,500
Claims (gross)	500
Reserve Increase (gross)	1,000
Expenses	250

Calculate the projected 2019 net income for the block under each reinsurance arrangement. Show all work.

3. (*10 points*)

    (a)   (*3 points*) Describe how the following items are limited within each component of the AG 43 reserve calculation:

        (i)   Revenue sharing

        (ii)   Hedging

    (b)   (*2 points*) You have run 20 stochastic scenarios to approximate your company's AG 43 reserve for its block of variable annuities. You are given the following ranked scenarios in order of Greatest Present Value of Accumulated Deficiencies (GPVAD):

Scenario Rank	GPVAD
1	1050
2	1000
3	900
4	850
5	700
6	650
7	400
8	350
9	200
10	100
11	50
12	25
13+	0

Assume:
- Starting asset level is 3,100
- The standard scenario amount is 3,499

Calculate the AG 43 reserve. Show all work.

3.   Continued

(c)   (*3 points*) You are testing a spatial clustering algorithm to reduce the number of policies run through the company's stochastic models. You are given:

Segment A

	Policy 1	Policy 2
Variable 1 - Account Value in Equity Separate Account Funds	100	150
Variable 2 - Present Value of Living Benefits	20	50
Variable 3 - Account Value at the End of Year 10	50	200

Segment B

	Size	Distance from			
		Policy 3	Policy 4	Policy 5	Policy 6
Policy 3	40	--	120	190	260
Policy 4	50	120	--	155	100
Policy 5	35	190	155	--	200
Policy 6	70	260	100	200	--

(i)   Calculate the distance between the two policies in Segment A. Show all work.

(ii)   Determine which policies will be included in the first step of Segment B's clustering algorithm. Show all work.

(d)   (*2 points*) Critique the following statements:

A. *The largest policy in each cluster represents the entire cluster in the compressed in-force file.*
B. *After a clustered in-force file has been validated for AG 43 reserves, the same policy cluster mappings can be applied to the in-force files in any of the company's other Variable Annuity models. This is a good stress test because the CTE amount is based on the results of the worst economic scenarios.*
C. *Increasing the number of segments will increase the clustering algorithm runtime because each segment needs to be clustered separately from all of the others.*

4. (*14 points*) FRU Life produces US GAAP financials and is pricing a new Universal Life (UL) product with deferrable acquisition costs (DAC).

(a) (*4 points*) The following three COI patterns are being considered:

Pattern A	COI rates follow the curve of mortality with a provision for adverse deviation
Pattern B	COI rates are level for each issue age over the life of the product
Pattern C	COI rates are front loaded and decrease over the life of the product

For each pattern:

(i) Determine whether an SOP 03-1 reserve needs to be established. Justify your answer.

(ii) Determine whether an Unearned Revenue Liability (URL) needs to be established. Justify your answer.

(iii) Describe the interaction, if any, in the calculations of the URL, SOP 03-1, and DAC.

(b) (*3 points*) You are given the following FRU valuation assumption guidelines for this product:

A. *Where best-estimate assumptions will be used, we shall use conservative estimates to reflect the most likely outcome of events*
B. *For these best-estimate assumptions, we will consider the following in their creation:*
   - *characteristics and magnitude of the company's business*
   - *maturity of the company and the rate of growth*
   - *last 6 months of experience of the company*
   - *for future assumptions, ignore outside influences such as technological development that might affect future experience*
C. *Where data is not available or is not credible, the actuary should defer to the judgement of other actuaries at our company*

Critique each guideline with respect to ASOP 10, Methods and Assumptions for Use in Life Insurance Company Financial Statements Prepared in Accordance With GAAP.

4. Continued

(c) (*4 points*) You are given the following information at issue for this product:

Year	Deferrals	EGPs	Amortization Ratio (k)	DAC Balance – End of Period	DAC Amortization
1	35,000	14,882		28,885	7,865
2	0	13,972		22,945	7,384
3	0	13,069		17,185	6,907
4	0	12,348		11,518	6,526
5	0	11,830		5,842	6,252
6	0	11,606		0	6,134
Present value at issue	35,000	66,224	52.9%		

Assume:

- Crediting Rate: 5%
- Actual is the same as expected for the first two years
- Actual Gross Profits during year 3 is 25,000 due to favorable experience.

(i) Calculate the actual DAC Balance at end of year 3.

(ii) Calculate the impact of the retrospective unlocking.

Show all work.

(d) (*3 points*) If the block of business experiences significantly worse mortality than expected:

(i) Describe how the mortality assumtion should be changed as a result of this experience according to ASOP 10.

(ii) Explain how the change in mortality assumption would affect the amortization ratio, DAC balance, and future DAC amortization.

5. (*8 points*)

(a) (*2 points*) Critique the following statements related to investment accounting treatment for debt securities under US GAAP:

   A. *At acquisition, debt securities are recorded in the general ledger at the amount that will be repaid at maturity*
   B. *US GAAP requires that premiums and discounts be factored into the income recognition process while a security is held*
   C. *For securities classified as Trading and Available For Sale, the changes in the fair values are recognized in other comprehensive income*
   D. *If the security is impaired, a write-down of the security is required*

(b) (*2 points*) You are given for a collateralized mortgage obligation (CMO):
   - principal amount of 300,000
   - stated interest rate of 6%
   - purchased at a premium for 310,000

   The initial estimate of the principal pay-down schedule is:

Year	Principal Pay Down Schedule
1	150,000
2	150,000

   Calculate the projected amortized cost at the end of year 1. Show all work.

(c) (*4 points*) The actual prepayment is higher than expected at the end of year 1. The revised principal pay-down schedule is:

Year	Principal Pay Down Schedule
1	200,000
2	100,000

   Calculate the following:

   (i) True-up at the end of year 1 based on the requirement of SFAS 91.

   (ii) Revised amortized cost at the end of year 1.

   Show all work.

6. (*7 points*) You are preparing the 2016 Annual Statement and are given the following information on a whole life policy as of December 31, 2016:

Issue Date	July 1, 2010
Gross Annual Premium	1,400
Premium Payment Mode	Quarterly
Paid-to-Date as of December 31, 2015	January 1, 2016
Paid-to-Date as of December 31, 2016	October 1,2017
Terminal Statutory Reserve as of June 30, 2016	5,000
Terminal Statutory Reserve as of June 30, 2017	6,500
Constant Ratio of Statutory Net Premiums to Gross Premiums	80%

(a) (*2 points*) Calculate the direct premium on an accrual basis (earned premium) for 2016 by constructing Exhibit 1 in the Annual Statement, using the methodology that went into effect after codification. Show all work.

(b) (*2 points*) Calculate the statutory mean reserve and deferred premium asset as of December 31, 2016. Show all work.

(c) (*1 point*) Critique the following statements:

    A.   *The statutory mean reserve is reported in Exhibit 1 and also appears in the liabilities section of the balance sheet*

    B.   *The deferred premium asset is reported in Exhibit 5 and is not permitted to be recognized on the balance sheet*

(d) (*2 points*) Describe two techniques to confirm the reasonableness of the reserve calculations.

END OF EXAMINATION
Morning Session

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