SOCIETY OF ACTUARIES

Life Financial Management – U.S.

Exam ILALFMU

MORNING SESSION

Date: Wednesday, April 29, 2020
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 5 questions numbered 1 through 5.

   b) The afternoon session consists of 4 questions numbered 6 through 9.

   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 ILALFMU.

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

Canadian version of this exam is recognized by the Canadian Institute of Actuaries.

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Exam ILALFMU Front Cover

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

1. (*9 points*) ABC Insurance Group is a US-based corporation that sells only nonparticipating whole life and accident policies. ABC reports GAAP financials based on FAS 60. ABC is being acquired by an insurance group based in the European Union and will report financials on both an IFRS and US GAAP basis.

(a) (*2 points*) Compare the methodology and assumptions used to calculate ABC's liabilities under IFRS 17 and ASU 2018-12.

You are given:

Present value of cash flows	1,000
Risk Adjustment	250
Contractual Service Margin	100
Liability for Incurred Claims	475
Incurred But Not Reported (IBNR)	500
Other Assets	2,000
Liability for future policyholder benefits	1,280
GAAP - DAC	100

(b) (*3 points*) Calculate ABC's equity under both ASU 2018-12 and IFRS 17. Assume that the basis of Other Assets is the same under both regimes. Show all work.

(c) (*4 points*) Critique the following statements regarding the Insurance Capital Standard (ICS) guided by International Association of Insurance Supervisors (IAIS).

A. The main objectives of the ICS are protection of shareholders and to contribute to financial growth.

B. The ICS reflects only insurance and investment risks to which an International Active Insurance Group (IAIG) is exposed.

C. The capital requirement in the ICS is intended to represent a three-year 95 percentile Conditional Tail Expectation (CTE) level of risk.

D. Currently, the only approach being considered to estimate margin over current estimates (MOCE) is the Cost of Capital MOCE approach, which is based on an assumed cost of holding ICS required capital.

2. (*12 points*) Assume VM-21 as written in the 2018 Valuation Manual.

(a) (*4 points*) You are given the following information from a VM-21 model for a variable deferred annuity:

Year	Premium Deposits	Partial Withdrawals	Account Balance
1	100,000	0	90,000
2	0	0	110,000
3	0	2,000	150,000
4	0	2,000	140,000
5	0	2,000	170,000

Assume:

- Premium deposits and partial withdrawals occur at beginning of year
- Account balance is end of year
- Guaranteed minimum death benefit: annual 5% roll up
- Guaranteed minimum withdrawal benefit: one-year ratchet with a 5% withdrawal rate and a two-year waiting period

(i) Calculate the death benefit at the end of each year. Show all work.

(ii) Calculate the guaranteed minimum withdrawal benefit available each year. Show all work.

(iii) Assess whether the Alternative Methodology can be used for the valuation of this product.

(b) (*2 points*) You are given the following output from a VM-21 model:

Stochastic Output	
Scenario Rank	**Largest Discounted Accumulated Deficiency**
1	2,000,000
2	1,000,000
3	750,000
4	500,000
5	250,000
6+	0

- Starting asset level is 300,000
- Number of stochastic scenarios is 100
- Standard scenario amount is 400,000

Calculate the VM-21 reserve. Show all work.

2. Continued

(c) (*5 points*) You are given the following results from a VM-21 model with three subgroupings:

Results for each subgroup			
	Subgroup A	**Subgroup B**	**Subgroup C**
Conditional Tail Expectation Amount	120,000,000	79,000,000	160,000,000
Standard Scenario Amount	110,000,000	85,000,000	155,000,000
Cash Surrender Value	90,000,000	70,000,000	145,000,000

Results for two policies in Subgroup A		
	Policy 1	**Policy 2**
Basic Adjusted Reserve	198,000	159,100
Cash Surrender Value	200,000	160,000
Greatest Present Value of Negative Accumulated Net Revenue	2,400	800

Assume:

- Both policies have a GMDB and a GMWB
- No reinsurance or hedging

Calculate the VM-21 reserve for Policy 1 and Policy 2. Show all work.

(d) (*1 point*) You are given the following results from a VM-21 model for Policy 3.

Policy 3	**General Account**	**Separate Account**	**Total**
Account Value (AV)	1,000	199,000	200,000
Cash Surrender Value (CSV)	920	183,080	184,000
Basic Reserve (GA/SA proportional to AV)	950	189,050	190,000
VM-21 Reserve	3,950	189,050	193,000

Calculate the tax reserves for Policy 3 according to the 2017 Tax Cuts and Jobs Act (TCJA).

3. (*13 points*)

(a) (*4 points*) Given the following for a newly issued UL policy:

- Face amount = 100,000
- Issue age = 60
- Premium load = 7%
- Expense charge = 0
- Death Benefit Option = 1 (level)
- Guaranteed interest rate = 3%
- Statutory minimum interest rate = 3%

Interest rate	A_{60}	$\ddot{a}_{60}$	$\ddot{a}_{60:\overline{7}\rceil}$
4%	0.4458	13.7940	5.2310
6%	0.3419	11.4830	4.5380

Calculate the following:

(i) Guideline Level Premium

(ii) Guideline Single Premium

(iii) 7-pay Premium

(iv) CVAT maximum cash surrender value at issue

Show all work.

3. Continued

DBM Life is developing a new flexible premium UL product with a secondary guarantee which will follow VM-20 for reserves. DBM Life's inforce block currently consists of term life, variable UL and indexed UL products, some of which are reserved for under VM-20 and backed by separate investment strategies and portfolios.

(b) (*1 point*) Describe how interest rates should be determined for this new product for each of the following:

(i) Net premium reserve

(ii) Deterministic reserve

(iii) Stochastic reserve

(c) (*4 points*) Critique the following statements regarding the cash flow model that will be used to determine the stochastic and deterministic reserves for this new product:

A. When setting anticipated experience assumptions, DBM should consider ASOP 2 (Nonguaranteed Charges or Benefits for Life Insurance Policies and Annuity Contracts) and use professional judgment in setting reasonable assumptions.

B. The new product should be combined with all of DBM's other VM-20 products in a single segment to help offset risk.

C. If the new product includes a bonus for higher premiums, then DBM can assume a higher level of future premiums for this product.

D. DBM has done well at keeping expenses level over the past five years, so it should be able to set the expense inflation assumption at or near zero.

E. DBM should not project any mortality trends beyond the date of valuation.

Question 3 continued on the next page.

3. Continued

(d) (*4 points*) When establishing the anticipated experience mortality assumption for the deterministic and stochastic reserves, DBM currently uses the Buhlmann Empirical Bayesian method to assess credibility. DBM is thinking about switching to the Limited Fluctuation method.

(i) Describe the process that DBM would need to follow to change credibility methods.

(ii) You are given the following:

- Using company experience mortality data, DBM has estimated its A/E ratio to be 80%
- The relative error in the estimate is no more than 5% with a probability of at least 95%
- The standard deviation of the estimate is σ

Determine the values of σ where it is not possible for the Buhlmann Empirical Bayesian credibility factor to equal or exceed the Limited Fluctuation credibility factor. Show all work.

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4. (*13 points*)

(a) (*4 points*) With respect to the impact of ASU 2018-12 on long duration nonparticipating traditional insurance contracts:

(i) Explain the impact on the DAC asset and benefit reserve liability of each of the following product costs:

- Commissions in excess of the ultimate level
- Claims expenses
- Salary and benefit costs of the Chief Actuary

(ii) List three ways that the DAC asset calculation has changed.

(iii) Describe the considerations for setting the liability discount rate and how changes in the rate are reflected in the financial statements.

(b) (*6 points*) You are given the following information at the end of year 3 for an issue year cohort of nonrenewable five-year term policies:

	ASU 2018-12 Original Assumptions				
Year	**Projected Face Amount**	**Projected Premiums**	**Present Value of Premiums**	**Projected Benefits**	**Present Value of Benefits**
1	10,000,000	200,000	726,874	100,000	523,023
2	9,000,000	180,000	553,218	112,500	449,174
3	7,920,000	158,400	391,878	123,750	359,133
4	6,810,000	136,200	245,152	133,008	253,339
5	5,720,000	114,400	114,400	139,648	132,998

	ASU 2018-12 Revised Assumptions				
Year	**Projected Face Amount**	**Projected Premiums**	**Present Value of Premiums**	**Projected Benefits**	**Present Value of Benefits**
1	10,000,000	200,000	707,787	100,000	536,886
2	9,000,000	180,000	533,177	112,500	463,730
3	7,920,000	158,400	370,835	123,750	374,417
4	6,810,000	136,200	223,057	140,000	269,388
5	4,560,000	91,200	91,200	150,000	142,857

Non-commission costs	0
Commission rate (% of premiums)	
First year	100%
Renewal years	10%

4. Continued

Assume:

- All policies in the cohort were issued at the beginning of the year
- Premiums and commissions are paid at the beginning of the year
- Benefits are paid at the end of the year
- All projected face amounts and present values in the tables are beginning of year
- Actual experience through year 3 equals expected experience using original assumptions
- Mortality assumptions were revised at the end of year 3, but there have been no other revisions to assumptions including the discount rate

Calculate the following under ASU 2018-12:

(i) Liability remeasurement gain/loss at the end of year 3

(ii) Expected amount of DAC amortization during year 4

Show all work.

(c) (*3 points*) You are given the following information for a noncallable bond accounted for under U.S. GAAP:

- Purchase price: 1,046.11
- Par value: 1,000
- Term: 5 years
- Bond equivalent yield to maturity: 3%
- Nominal coupon rate: 4%, paid semi-annually
- SFAS 115 classification: available for sale
- Fair value at end of year 1: 950

(i) Calculate the amount of accumulated other comprehensive income (AOCI) at the end of year 1. Show all work.

(ii) Provide an argument for why this bond should not be written down at the end of year 1.

5. (*13 points*)

(a) (*2 points*) Your company currently performs attribution analysis under both Market Consistent Embedded Value (MCEV) and AG 43. You are tasked with performing a reserve attribution analysis based on VM-20.

(i) Propose which current attribution analysis structure to use as an initial template for the VM-20 attribution analysis. Justify your answer.

(ii) Identify changes necessary, if any, to the proposed attribution analysis structure for VM-20.

You are given the following VM-20 reserve attribution results and additional background information for a Universal Life Product with Secondary Guarantees (ULSG):

Step	Movement	Reserve	Anticipated Reserve Change	Reserve Volatility
0	PBR Time 0	100	-	-
1	Time Passage	110	10	-
2	Inforce Terminations	103	-6	-1
3	New Business	105	-2	4
4	Mortality Experience	109	2	2
5	Mortality Credibility	110	-	1
6	Yield Curve	100	-	-10
7	Investment Strategy	69	-1	-30
8	PBR Time 1	72	-	3

- Deterministic reserves are anticipated as the dominating reserves in all steps
- The attribution was performed for a ULSG product which was first issued two years ago
- Terminations were slightly higher than expected
- Sales were higher than expected
- An experience study was performed this year showing a 5% increase in mortality
- Credibility is increasing on the block
- Treasury rates decreased
- The reinvestment strategy was revised to target lower duration and lower quality bonds
- All non-zero attribution steps are provided

5. Continued

(b) (*7 points*)

(i) (*5 points*) Analyze the reasonableness of each attribution step's result.

(ii) (*2 points*) List one additional potential cause of unexpected change in reserve for the following attribution categories:

1. Demographic changes
2. Economic assumptions
3. Non-economic assumptions
4. Risk management

You are given the following VM-20 reserves for a closed Term insurance product. You have confirmed that it passes the stochastic exclusion test.

Reserve	Anticipated		Actual	
	DR	NPR	DR	NPR
Reserve at 12/31/2018	200	190	200	190
Roll-forward to 12/31/2019	210	205	210	205
Policy inventory update	208	204	205	203
Updated experience assumptions	208	204	200	203
Updated yield curve	205	204	195	203
Final reserve at 12/31/2019	205	204	195	203

(c) (*4 points*) Construct an attribution analysis using the similar structure as the ULSG product for the 2019 reporting period.

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

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