ILA LFVC Model Solutions
Fall 2016

1. **Learning Objectives:**
4. The candidate will understand basic financial management, capital management and value creation principles and methods in a life insurance company context.

Learning Outcomes:
(4a) Assess financial performance, including analyzing and interpreting the financial performance of a product line or company.

Sources:
LFV-106-07: Mergers and Acquisitions, Chapter 4 (Sections 4.1-4.6)

Embedded Value: Practice and Theory, SOA, Actuarial Practice Forum, March 2009

Strategic Management of Life Insurance Company Surplus, TSA XXXVIII (pages 105-116)

Commentary on Question:
This question tested the candidates' understanding of the fundamental principles of capital management and allocation. Candidates were expected to know how to measure the cost of capital and to utilize the cost information to assess the value creation potential of various competing projects.

Candidates generally did well. A few candidates did not state the formula for WACC or make the correct adjustment for the capital allocation. Some candidates failed to convert the equity growth rate result into a 1 year result for use in comparisons with yearly costs of capital and ROE.

Solution:
(a) Calculate ABC's weighted average cost of capital. Show all work.

WACC = e * E/(D+E) + d * D/(D+E) where

  e is the cost of equity
  d is the cost of Debt
  E is the amount of Equity capital and
  D is the amount of Debt

WACC = 15%*(300/(300+100)) + 5%*(100/(300+100)) = 12.50%

1.   Continued

(b)   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.

Unit A

The equity growth rate is greater than the ROE (13.19% > 10%);
 Free cash flow is not being generated.
ROE is less than the WACC (10% < 12.50%);
Economic value is not being created.
The company should reduce the growth of this unit (Decrease allocation)

Unit B
The equity growth rate is greater than the ROE (21.64% > 15%)
 Free cash flow is not being generated.
ROE is greater than the WACC (15% > 12.50%)
Economic value is being created.
The company should continue its current course with this unit (No Change)

Unit C
 The equity growth rate is less than the ROE (18.56% < 20%)
 Free cash flow is being generated
 ROE is greater than the WACC (20% > 12.50%)
 Economic value is being created.
The company should allocate more capital to this unit (Increase allocation)

2.   **Learning Objectives:**
   4.   The candidate will understand basic financial management, capital management and value creation principles and methods in a life insurance company context.

Learning Outcomes:
(4b)   Apply methods and principles of embedded value.

(4c)   Explain and apply methods in determining risk based capital and economic capital.

(4d)   Explain and evaluate the respective perspectives of regulators, investors, policyholders and insurance company management regarding the role and determination of capital.

Sources:
LFV-106-07: Chapter 4 of Insurance Industry Mergers & Acquisitions (Sections 4.1-4.6)

LFV-131-14: Economic Capital Overview: Chad Runchey, August, 2012

Economic Capital for Life Insurance Companies, SOA Research Paper, Feb 2008,

Commentary on Question:
This question tested the candidates' understanding of actuarial appraisal value (AAV) components and their calculation. The candidates were expected to demonstrate their knowledge by evaluating statements.

Solution:
(a)
   (i)   Describe the main components of an actuarial appraisal.

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

   Commentary on Question:
   Candidates generally understood the main components of AAV. Some candidates confused AAV with economic value terms and assumptions and received partial credit as a result. Full credit was given for stating the term correctly and explaining it or defining how it was calculated.
   Most candidates calculated ROE and WACC correctly. Some candidates did not calculate the WACC and used ROE as the discount rate for AAV and received partial credit as a result.
   In calculating AAV, candidates often included the interest on required capital or cost of capital. They were not needed given the information provided.

2.   **Continued**

       (i)   Adjusted Book Value - The ABV is equal to the net worth of the insurance company on a statutory basis (i.e. the excess of statutory assets over statutory liabilities).
Value of Inforce Business - The present value of future statutory profits arising from the business that is on the books as of the valuation date. Use best estimate assumptions and discount at WACC.
Value of Future Business Capacity - The present value of future profits arising from the business that is expected to be written subsequent to the valuation date.

      (ii)   CAPM Formula: Return on Equity = rfr + beta * (market rate - rfr)
= 2% + 1.2 * (8% - 2%)
= 9.2%

WACC = Required return of Debt * (D / (D + E)) + Return on Equity * (E / (D + E)) where D = MV of debt; E = MV of equity
= 5% * (30/(30+90)) + 9.2% * (90/(30+90))
= 5% * 0.25 + 9.2% * 0.75
= 8.15%

AAV = NPV(DE) = Excess Capital(t=0) + NPV(AT Earnings - Inc in RC)
= ABV + (DCF in 2017 + future NPV(DE)) / (1 + WACC)

DCF in 2017 = AT Earnings - increase in RC for 2017 = 10 - (9 - 6) = 7
AAV = 100 + (7 + 200)/1.0815 = 291.4M

(b)   Critique the consultant's statements.

Commentary on Question:
Most candidates did well on this part of the question. Candidates were expected to relate each statement to the stated objectives of the company. Full credit was received if the candidates stated whether each statement was appropriate, explained why or why not, and provided alternative approaches if necessary.

    A. Liability approach is not appropriate. One-year time horizon approach would be more appropriate since the owner is more interested in the outcome within the next year.
    B. The Stochastic approach is not appropriate for all assumptions. The Stochastic approach is resource intensive and is more appropriate for economic assumptions. For assumptions like mortality and lapse rates, Stress Test may be a better method.
    C. Consultant's recommendation is not appropriate of using CTE(99.5) because the CTE is the average of the tail and therefore is more conservative than a "1-in-200-year event. VaR(99.5) would appropriate.

2. **Continued**

    D. It is inappropriate to do a simple sum because diversification is ignored. An aggregation method that includes correlation such as a correlation matrix will be appropriate.

    E. The consultant's statement is not appropriate because holding excess capital will create additional frictional cost, reduction in shareholder value. Consideration for multi-stakeholder view need to be considered when determining capital level.

3. **Learning Objectives:**
5. The candidate will understand the nature and uses of basic reinsurance arrangements used by life insurance companies.

Learning Outcomes:
(5a) The candidate will understand the various forms of reinsurance, and be able to, with respect to both the ceding and assuming parties, analyze and evaluate:
- (i) Risk transfer considerations
- (ii) Cash flow mechanics
- (iii) Accounting and financial statement impacts
- (iv) Reserve credit considerations

Sources:
Life, Health and Annuity Reinsurance by Tiller, 3rd Edition, Chapters 4

Commentary on Question:
This question tested the candidates' understanding of reinsurance.

Solution:
(a) Describe the primary advantages and disadvantages of the following methods of reinsurance:

- (i) yearly renewable term (YRT)

- (ii) coinsurance

- (iii) modified coinsurance (mod-co)

Commentary on Question:
This part of the question tested the candidates' knowledge of the advantages and disadvantages of each reinsurance type. Candidates that did well commented on risk transfer, capital and surplus relief, cost and level of administrative difficulty. Some criteria could be considered both an advantage or a disadvantage. Candidates who did not do well failed to explain the reasoning behind their choices.

YRT
Advantages
- Low cost
- Easy to administer
Disadvantages
- Can only be used to transfer mortality and morbidity risks
- Limited or no capital/surplus relief

3. Continued

Coinsurance
Advantages
- Can be applied to any type of insurance
- Transfers proportion of all risks to reinsurer
- Provides surplus/capital relief

Disadvantages
- If reinsurer is unauthorized, may not be able to obtain reserve credit
- More complex to administer than YRT

Modified Coinsurance
Advantages
- Same benefits as coinsurance
- Able to obtain reserve credit regardless of reinsurer authorization since assets stay with ceding company

Disadvantages
- Very complex administration

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

Commentary on Question:
This part of the question tested the candidates' understanding of the financial impacts of each type of reinsurance agreement on a company's statutory income statement. Candidates who did well were able to identify each piece that goes into the income statement and how it would be affected by the different agreements. Common mistakes were failure to recognize the coinsurance percentage based on the company's retention limit, and not understanding that the policy fee is paid by the policyholder to the insurer and not from the insurer to the reinsurer.

3. **Continued**

		YRT		Coinsurance
Gross Premium	a	8020	a	8020
Ceded Premium	b	550	c	7218
Investment Income	d	50	d	50
Reinsurance Allowance	e	11	f	7362.36
Total Revenue	g	7531	g	8214.36
Gross Reserve Increase	h	900	h	900
Ceded Reserve Increase	i	675	j	810
Commissions	k	7218	k	7218
Expenses		430		430
Premium Tax	l	160.40	l	160.40
Total Expenses	m	8033.40	m	7898.40
Net Income	n	-502.40	n	315.96

Ceded percentage = (Face Amount – Retention Limit)/Face Amount = 90%

(a) Prem rate per 1000 * face/1000 + policy fee = 8 * 1000 + 20 = 8020
(b) FY YRT prem per 1000 * ceded face/1000 + cession fee = .6 * 9000 + 10 = 550
(c) Ceded percentage * Gross Premium = 90% * 8020 = 7218
(d) Initial Surplus * Investment rate of return = 1000 * 5% = 50
(e) Premium Tax % * Ceded Premium = .02 * 550 = 11
(f) (FY Expense Allowance + Premium Tax %) * Ceded Premium = (100% + 2%) * 7218 = 7362.36
(g) Gross Premium – Ceded Premium + Investment Income + Expense Allowance
(h) FY Mean Reserve per 1000 * Face/1000 = .9 * 1000 = 900
(i) FY YRT Mean Reserve per 1000 * Ceded Face/1000 = .75 * 9000 = 675
(j) Reinsurance Percentage * Gross Reserve = 90% * 900 = 810
(k) Gross Premium * FY Commission % = 8020 * 90% = 7218
(l) Gross Premium * Premium Tax % = 8020 * 2% = 160.40
(m) Gross Reserve – Ceded Reserve + Commissions + Expenses + Premium Tax
(n) Total Revenue – Total Expenses

Due to the fact that the Mod-co interest rate equals TNY's investment rate of return, Mod-co and Coinsurance will have the same statutory income.

Both Coinsurance and Mod-co maximize TNY's 2017 statutory income.

3. **Continued**

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

Commentary on Question:

This part of the question tested the candidates' understanding of reinsurance by defending which reinsurance type is most appropriate given a specific situation. There is no right or wrong answer to this question. Candidates who did well were able to recommend one form of reinsurance and relate it to TNY and its new product release. However, many candidates failed to relate their recommendation to TNY's current situation and instead simply restated their answer to part (a).

I recommend TNY use coinsurance for their new whole life product. TNY only has a surplus of $1,000, so the surplus relief given by coinsurance would be important to avoid capital strain. TNY has only sold term insurance in the past and is a young company, therefore they might not have the expertise to handle all of the risks involved with selling a whole life product (e.g., investment, persistency, etc.). Coinsurance would transfer a proportion of all risks associated with the product, not just the mortality risk. While Mod-co reinsurance will also transfer the risks, TNY may not want to deal with its additional complexity and may not have the asset management experience needed for such a long duration product. YRT would allow transferring the mortality risk, but would not offer the surplus relief that TNY should be looking for.

4. **Learning Objectives:**
2. The candidate will be able to understand and apply valuation principles of individual life insurance and annuity products issued by Canadian life insurance companies.

Learning Outcomes:
(2c) Calculate liabilities for life and annuity products and their associated riders.

Sources:
CIA Educational Note: CALM Implication of AcSB Section 3855 Financial Instruments – Recognition and Measurement

LFV 634 CIA SOP Practice Specific Standards for Insurers

Commentary on Question:
This questioned tested the candidates' understanding of section 3855 on an insurer's financial statements, and of CALM principles.

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

Commentary on Question:
This part of the question tested the candidates' understanding of the asset designation choices. Most candidates were able to identify at least three of the four designations and assess why each one was appropriate or not. Partial credit was received for a well-explained answer even if the option was not the most appropriate.

Loans and Receivables (including real-estate) – Not an option for zero coupon bonds (ZCBs)
Held-to-Maturity – Is an option for ZCBs. However, this is not appropriate for an insurance company due to unknown timing of the liability cash flows. A sale of a single asset taints the entire portfolio.
Available for Sale – Is an option. However, unrealized gains go through equity resulting in an income statement mismatch. Not ideal for backing liabilities.
Fair Value option (including Held for Trading) – Most ideal for backing liabilities, as changes in the asset values will be matched by changes in the liability.

4. Continued

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

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

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

Show all work.

Commentary on Question:
This part of the question tested the candidates' ability to construct financial statements for a life insurance company. Most candidates did not do well. To receive full credit candidates had to demonstrate understanding of how to correctly calculate the market value of the asset at each point in time, which required applying the yield curve appropriately. Candidates had to demonstrate an understanding of the linkage between the statement values of assets and liabilities under CALM. Finally, candidates had to correctly identify differences between investment income and OCI income, and calculate these amounts in a reasonable manner.

Step 1: determine the best estimate cash flows as of Dec 2016, 2017 and 2018:

YE 2016 cash flow = q75*face = 1/1000 * 500,000 = 5,000
YE 2017 cash flow = p75*q76*face = (1-10/1000)*15/1000*500,000 = 7,425
YE 2018 cash flow = p75*p76*(q77+p77)*face = p75*p76*face = (1-10/1000)*(1-15/1000)*500,000 = 487,575

Step 2: calculate the value of the asset as of Dec 31, 2015, 2016 and 2017. This required correctly applying the yield curve. The curve was given in spot rates as being 1% for 1 year, 2% for 2 years and 3% for 3 years

4.   **Continued**

Dec 31, 2015 Value of asset =
Cashflow1 * discount rate1^1 + cashflow2* discount rate2^2 + cashflow3 *
discount rate3^3
= 5,000* (1.01)^-1 + 7,425*(1.02)^-2 + 487,575*(1.03)^-3 = 458,287
Dec 31, 2016 – Value calculated in a similar, but one year later.
= 7,425*(1.01)^-1 + 487,575*(1.02)^-2 = 475,993.
Value of asset Dec 31, 2017 = 487,575 * 1.01^-1 = 482,748

Commentary on Question:
*Few candidates got full credit for this part of the question. Common errors
included recording the liability as 500,000 and using a 2-year forward rate to
discount the cash flow. Partial credit was given where appropriate.*

Step 3: Populate balance sheet.

	Year End		
Balance Sheet	Dec.31, 2015	Dec. 31, 2016	Dec. 31, 2017
Assets	458,287	475,993	482,748
Policy Liabilities	458,287	475,993	482,748

Step 4: calculate the change in liabilities and investment income by year. As the
question assumes the assets designated AFS, this requires projecting the book and
market values for each asset. The book value is projected using the initial spot
curve (i.e. 3 year rate for the 3 year bond), whereas the market value is projected
using the current spot curve.

4. **Continued**

	Dec 31, 2015	Dec 31, 2016	Dec 31, 2017	Investment income 2016	2017	OCI 2016	2017
Bond 3							
Book value	446,200.19	459,586.20	473,373.79	13,386.01	13,787.59		
Market Value	446,200.19	468,641.87	482,747.52			9,055.67	318.07
Unrealized G/(L) - Cumulative		9,055.67	9,373.74				
Bond 2							
Book value	7,136.68	7,279.41	7,425.00	142.73	145.59	72.07	(72.07)
Market Value	7,136.68	7,351.49	7,425.00				
Unrealized G/(L)		72.07					
Bond 1							
Book value	4,950.50	5,000.00		49.50		-	-
Market Value	4,950.50	5,000.00					
				13,578.24	13,933.17	9,127.74	246

For example, the maturity value for bond 2 = 7,425. The book value one year earlier = 7,425 / 1.02 = 7,279.41 and the market value = 7,425 / 1.01 = 7,351.49. The book and market value two years earlier = $7,425/1.02^2$ = 7,136.68.

The investment income is the change in book value, and the cumulative OCI = the difference between the market value and the book value. The OCI amount is the year-over-year change in OCI.

Income Statement	Dec.31, 2015	Dec. 31, 2016	Dec. 31, 2017
Change in Policy Liabilities	0	-17,706	-6,754
Investment Income	0	13,578	13,933
Other Comprehensive Income	0	9,128	246

Commentary on Question:
Some candidates showed the change in reserve for 2015 equal to the opening reserve and no credit was lost this alternative approach. Some candidates adjusted for survivorship in the step 1 to determine best estimate cash flows and no credit was lost for this alternative approach. Note that the sum of the change in policy liabilities, investment income and OCI equals 5,000 in 2016 and 7,245 in 2017, which are equal to the expected cash flows.

4. Continued

(c)   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.

Commentary on Question:
This part of the question tested candidates' understanding of the challenges associated with each statement as a result of section 3855 asset choices. Candidates were not expected to provide the complete solution below to receive full credit. A well-explained answer received full credit. Further commentary is provided with each statement.

Statement A:
The best choice to maintain stable financial statements is to designate all assets backing liabilities under the Fair Value Option. This will create volatility in investment income, but it should be more-or-less offset by the change in liabilities. Examples of the challenges that the Company would face include:
•Effective true-up process: If CALM is run off valuation dates (e.g. a quarter in arrears), the Company would need a process for truing up the asset values to the balance sheet date.
•Yield and Duration analysis: Under section 3855, yield analysis would have to be at market yields, not book yields.
•Reporting and disclosure: The actuary would need to explain the change in liabilities in relation to the investment income.

Commentary on Question:
Most candidates understood there would be some volatility due to section 3855, but few seemed to identify the associated challenges. Many candidates identified the issues with using the AFS designation, which was not required.

4. **Continued**

Statement B:
YVR can report in both basis, but this may require designating assets differently for Canadian and US GAAP. This will create administrative complexity in that the same asset has to be reported upon in to different ways. The actuary will need to explain material differences.

Commentary on Question:
Common mistakes include stating that US GAAP was incompatible with 3855 and that the Company did not need to report in US GAAP.

Statement C:
If a PPM approximation is used with an off balance sheet date CALM run, an effective true-up process will be required. This will require monitoring asset changes from the run date to the valuation date, as well as developing control processes to estimate the impact on policy liabilities of fair value movements.

Commentary on Question:
Many candidates did well, identifying the need for a true-up process to adjust for changes in fair value movements.

Statement D:
Policy liabilities that are held at cost with no discounting will create an accounting mismatch. The actuary could consider using shorter term instruments which would be less volatile.

5. **Learning Objectives:**
3. The candidate will be able to understand and analyze the implications of emerging financial and valuation standards.

Learning Outcomes:
(3a) Describe emerging developments impacting Canadian valuation and International Financial Reporting frameworks, and assess their impact on the valuation of reserves and financial statements.

Sources:
LFV-642-16: OSFI: Life Insurance Framework Standard Approach – Jan 2015

Commentary on Question:
This question tested candidates' understanding of OSFI's Life Insurance Capital Framework Standard Approach. Candidates who demonstrated understanding of the key concepts received full credit.

Solution:
(a) 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

Commentary on Question:
Some candidates were able to identify that the discount rates are based on risk-free rates plus an illiquidity premium for part (i). Few candidates were able to explain the differences for cash flows with different durations (e.g., 0-20; 20-30 and 30+). Many candidates did not demonstrate understanding of the discount rate calculation concept, confusing this with other methods.

(i) Discount rate components in the Best Estimate Liability (BEL) calculation
- The discount rates are based on risk -free rates plus an illiquidity premium proxy set at the Corp A spread
- Current risk free rates plus the spread for cashflows from years 0 to 20
- Linearly interpolated based on forward reinvestment rates between the 20 year discount rate and the ultimate forward rate (UFR) and converted to spot rates for cashflows from year 20 to 30
- UFR plus 80% of the long term corporate spread and converted to spot rates for cashflows beyond 30 years.

5. **Continued**

(ii) Reinsurance
- Reinsurance contracts reduce the QIS solvency buffer for insurance risk.
- Reinsurance operational risk and credit risk solvency buffers are treated differently in QIS6 than in the current MCCSR.
- The solvency buffer for reinsurance counterparty credit risk is obtained by a factor based on an average of reinsurer credit ratings.
- The credit for reinsurance is calculated implicitly, using net cash flows in the solvency buffer calculations

(b)

(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.

Mortality risk on life insurance
- the risk associated with the increase in liability cash flows due to the incidence of death.
- Applies to 3-year term as the key risk is mortality

5. Continued

Longevity risk on annuities and death supported life insurance
- The risk associated with the increase in liability cash flows, due to people living longer.
- Not applicable to 3-year term as it is a term product, not a death-supported product.

Morbidity risk on disability, critical illness, long term care and accident & sickness
- The risk associated with the increase in liability cash flows, due to the increased incidence of policyholder disability or health claims (including critical illness), as well as reduced recovery or termination rates.
- Does not apply to 3-year term as product is payable on death.

Lapse / policyholder behaviour risk
- The risk associated with the increase in liability cash flows due to the incidence of (or lack of) policyholder lapses.
- Policyholder lapsation includes options to fully or partially terminate an insurance contract, or decrease or suspend/resume insurance coverage.
- Does not apply to this 3-year term product with no assumed lapses (would apply if we had an assumed lapse rate).

Expense risk (excludes operational and strategic risk)
- The risk associated with the increase in expense liability cash flows due to the variation of the in-force policies, excess claims, lapses and surrenders, new business decrease or other circumstances that could have an impact on unit expenses.
- Does not apply to this three-year term product as we do not have any assumed expenses (would apply if we had assumed expenses)

Asset CF 300m is at end of year 1. Under Base scenario, PV asset = 300/(1.02) = 294.12

Padded Liability CF is 88, 99, 110,

PV(liability cash flow) = 88/1.02+99/(1.02)^2+110/(1.02)^3 = 285.09

Base Scenario NPV of cash flows =294.12 -285.09 = 9.03

Under shocked down scenario, PV asset = 300/1.01 = 297.03

Under shocked down scenario, PV(liability cash flow) = 88/1.01+99/(1.01)^2+110/(1.01)^3 = 290.94

Shocked down scenario NPV of cashflows = 297.03-290.94 = 6.09

Under shocked up scenario, PV(asset) = 300/1.03 = 291.26

5. **Continued**

Under shocked up scenario, PV(liability cash flow) =
$88/1.03+99/(1.03)^2+110/(1.03)^3 = 279.42$

Shocked up scenario NPV of cashflows = 291.26-279.42 = 11.84

Lowest NPV is under shocked down scenario.

Interest rate Buffer = 9.03 - 6.09 = 2.94

6. **Learning Objectives:**
2.   The candidate will be able to understand and apply valuation principles of individual life insurance and annuity products issued by Canadian life insurance companies.

Learning Outcomes:
(2a)   Describe valuation methods.

(2b)   Recommend appropriate valuation assumptions.

Sources:
LFV-634-16: CIA Standards of Practice: Insurance Sections 2100, 2300, 2500, March 2015

Final Communication of Promulgations of the Maximum Net Credit Spread, Ultimate Reinvestment Rates and Calibration Criteria for Stochastic Risk-Free Interest Rates in the Standards of Practice, May 2014

Commentary on Question:
This question tested candidates' knowledge on Canadian standards of practice, in particular the application of the net credit spread in CALM.

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

Commentary on Question:
Few candidates received full credit for this part of the question. Many candidates did not know the correct methodology to calculate the corporate-A bond and the risk free rate under prescribed scenario 1. Some candidates incorrectly used the year 5 rate to calculate the best estimate and P1 liabilities. Most candidates had the correct calculation of PfAD

Given the risk free rate, The best estimate of credit spreads would be the credit spreads available in the market at the balance sheet date, at and after the 5th anniversary from the balance sheet date, would be based on long-term historical average credit spreads corresponding to assets by type, credit rating, and term, and between the balance sheet date and the 5th anniversary, would be determined using a uniform transition.

Therefore, the Corporate A Bond rate at time 0 is
Risk Free Rate(0) + Corp A Spread = 0.5% + 0.5% = 1.0%
For time 1 – time 5
Corporate A Bond Rate (t) = Risk Free Rate (t) + 0.5%+ (1.5%-0.5%)*t/5

6.   **Continued**

t	0	1	2	3	4	5
risk free rate	0.50%	0.55%	0.60%	0.70%	0.70%	0.80%
Corp A Bond Rate	1.00%	1.25%	1.50%	1.80%	2.00%	2.30%
BE spread	0.50%	0.70%	0.90%	1.10%	1.30%	1.50%

Best estimate spread is the difference of Corporate A Bond and Best estimate risk free rate

And the best estimate liability is
1000/[(1+1%)(1+1.25%)(1+1.5%)(1+1.8%)(1+2%)] = 927.83

For prescribed scenario 1, the risk-free interest rates are determined using a uniform transition, between each of the balance sheet date and the 1st, 20th, and 40th anniversaries, while the 20th anniversary of the balance sheet date, the risk-free interest rates are equal to 10% of the risk-free interest rates at the balance sheet date plus 90% of ultimate risk-free reinvestment rate-low.

Therefore, P1 Risk Free Rate (20) = 0.1* 0.5% + 0.9* 1.4% = 1.31%

And P1 Risk Free Rate for time 1 is 90% of time 0 = 0.5% * 90% = 0.45%
For time 2 – time 5
P1 Risk Free Rate (t) = P1 Risk Free Rate (t-1) + (1.31%-0.45%)/19

And the margin for adverse deviations (MfAD) in credit spreads would be zero at the balance sheet date, an addition or subtraction, as appropriate in aggregate, of 10% of the best estimate assumptions at and after the 5th anniversary from the balance sheet date, and between the balance sheet date and the 5th anniversary, the margin for adverse deviations as percentage of the best estimate would be determined using a uniform transition.

Time	0	1	2	3	4	5
(1) P1 RFR	0.50%	0.45%	0.50%	0.54%	0.59%	0.63%
(2) Best Estimate Spread	0.50%	0.70%	0.90%	1.10%	1.30%	1.50%
(3) MfAD	0%	2%	4%	6%	8%	10%
(4) Spread incl. MfAD = (2) X [1-(3)]	0.50%	0.69%	0.86%	1.03%	1.20%	1.35%
Corp A Bond Rate = (1)+(4)	1.00%	1.14%	1.36%	1.57%	1.78%	1.98%

And the best estimate liability is
1000/[(1+1.00%)(1+1.14%)(1+1.36%)(1+1.57%)(1+1.78%)] = 934.23

And the provision for adverse deviation (PfAD) is 934.23 – 927.83 = 6.40

6. **Continued**

(b) 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.

Commentary on Question:
Most candidates recognized the implication of the asset depreciating in this scenario, but few offered enough details to demonstrate a good understanding of the material.

Most candidates were able to point out the risk from foreign exchange rates and provide some explanation. Few candidates were able to provide sufficient details, including the margins for adverse deviation for the scenario and the use of currency forwards.

The considerations should include
- Fixed Income Asset Depreciation
- The actuary's best estimate of asset depreciation would depend on asset type, credit rating, liquidity, term, and duration since issue, subordination to other debt of borrower or issuer, the insurer's credit underwriting standards, diversification within a particular type of investments, to the extent that it is indicative of the future, the insurer's own experience, the insurance industry's experience, guarantees that offset depreciation, such as that in an insured mortgage, and potential for anti-selection by borrowers and issuers.
- Asset depreciation comprises that of both assets that are impaired at the balance sheet date and assets that become impaired after the balance sheet date, and includes loss of interest, loss of principal, and expense of managing default.
- The low and high margins for adverse deviations for a scenario would be respectively 25% and 100% of the best estimate for that scenario
- The needed assumptions would include foreign exchange rates when insurance contract liabilities and their supporting assets are denominated in different currencies.
- The base scenario used to develop the assumption for foreign exchange rates would be based on currency forwards. If currency forwards are not available, the forward exchange rates would be derived based on risk-free interest rate differentials where available. If neither is available, the actuary would use his or her best judgment to develop an appropriate approach.
- A provision for adverse deviations would be developed from a scenario using adverse movements in the exchange rate. Such movements would reflect the historical volatility in the exchange rate over the applicable period. The provision for adverse deviations would be the excess of the insurance contract liabilities based on this adverse scenario over the insurance contract liabilities calculated using the base scenario.

6. **Continued**

- A minimum provision for adverse deviations would apply. This would be the excess of the insurance contract liabilities resulting from the application of an adverse 5% margin to the projected exchange rates underlying the base scenario over the insurance contract liabilities calculated using the base scenario.

7.   **Learning Objectives:**
2.   The candidate will be able to understand and apply valuation principles of individual life insurance and annuity products issued by Canadian life insurance companies.

Learning Outcomes:
(2a)   Describe valuation methods.

(2b)   Recommend appropriate valuation assumptions.

Sources:
LFV-133-16: Cluster Analysis: A Spatial Approach to Actuarial Modeling, Milliman, 2008

CIA Educational Note: Reflection of Hedging in Segregated Fund Valuation

Commentary on Question:
This question tested the candidates' knowledge of segregated fund risks and modelling techniques.

Solution:
(a)   Describe the following:

    (i)   The classic cell reduction approach to modeling.

    (ii)   The primary steps of the cluster modeling process.

    Commentary on Question:
    Candidates did generally well on this part of the question. Most candidates were able to describe the relevant steps of the cluster modelling process to receive full credit. Most candidates provided less information on the classic cell reduction approach.

    (i)   Of classic approaches to modelling, cell reduction has the most potential impact. Classic cell reduction techniques include:
    - Combining policies issued in the same month, in same plan code, to policyholders of similar characteristics
    - Modelling quinquennial or decennial issue ages, or combining cells across issue months or premium modes
    - Other modelling techniques, such as combining risk classes or mapping minor plans into major plans.

7. Continued

(ii)   Cluster modelling automatically assigns all policies from a seriatim inforce file to one of a small number of user selected number of representative model points. The primary steps of the cluster modelling process are:
- Define an arbitrary number of location variables for each policy. A location variable is a variable that the compressed model should closely reproduce
- Define a size variable to represent the importance of a given policy. This ensures large policies are not mapped away as easily as small policies, all else being equal
- Divide the business into segments. The program does not map policies across segments
- Specify the number of cells the compressed model should contain.
- Define and scale the location variables
- Define and calculate the importance of each policy as the policy size multiplied by the distance to the nearest policy
- The process finds the policy with the lowest importance and maps it to its nearest neighbor (the destination policy). The process is repeated until the target cell count is reached

(b)   Recommend a modeling option for BIT's segregated fund portfolio. Justify your answer.

Commentary on Question:
Most candidates did not sufficiently justify their recommendation for this part of the question. Stating clustering would reduce run time is not sufficient as classical techniques offer the same benefit. The benefits of cluster modelling in and above classical techniques were required to receive credit.

A number of candidates discussed approaches to approximate a full stochastic-on-stochastic liability (Adapted Risk Neutral, Hedge-Cost Method, etc.) As these are reserving methodologies, and not modelling options, they received no credit.

Candidates could have recommended using classical techniques and still received credit providing their recommendation was adequately justified.

Using a cluster modelling approach is recommended for BIT's Segregated Fund Portfolio as it offers superior benefits in comparison to classical techniques. These benefits include:
- Cluster modelling can be applied to any product type and can be extended to include assets as well as liabilities
- Cluster modelling is easily automated

7. **Continued**

- Cluster modelling can be maintained and applied in similar ways at later valuation dates
- Cluster modelling allows customization to place different priorities on different measures of model fit
- Cluster modelling allows for easy adjustment to the number of model points to produce more or less granularity, depending on the application
- Cluster modelling allows for easy on-the-fly analysis for model fit for differing levels of model granularity, without rerunning the model
- Cluster modelling is better suited for emerging nested stochastic on stochastic or nested stochastic on deterministic modelling than classical cell reduction techniques
- Can achieve higher compression ratios with cluster modelling (around 840-1) than with classical techniques (10- or 20-1)
- Traditional mapping techniques are challenging as otherwise similar policies may have decidedly different in-the-moneyness ratios
- Traditional mapping techniques are challenging as policyholder investment allocations that drive future performance are infinitely granular and flexible

(c) For each of the above statements:

(i) Describe the underlying risk.

(ii) Critique the valuation methodology recommendations.

(iii) Propose changes to the valuation methodology where appropriate.

Commentary on Question:
This part of the question was not answered well by candidates. Few candidates were able to accurately identify and describe the underlying risks in each statement. Many candidates provided critiques which were not relevant and recommendations which did not address the situation described in the question.

Scenario A

(i) The underlying risk is Basis Risk
- Basis risk is the imperfect alignment between returns on managed funds and those on hedge instruments
- When hedging, the hedge instruments may be able to significantly offset the effect of changes in market indices on the liabilities, but the hedge generally cannot offset the effect of the actively managed fund's performance versus the mapped market indices
- The hedge vehicle slippage versus the market indices also contributes to gains or losses

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7. **Continued**

    (ii)   Valuation Methodology
- The most explicit and intuitive way to include basis risk in the model is to add a noise (random) term
- The noise term can be added either to the individual segregated fund asset returns (such that they are not perfect linear combinations of the market index returns) or to the hedge instrument returns (such that they are not perfectly aligned with market indices)
- The magnitude of the noise term can be derived from regression analysis performed between return on hedge assets and underlying segregated fund investments

    (iii)   Recommendation
- Basis risk is primarily a volatility item to earnings and should not be reduced for positive gains, only a reduction in volatility. Ie, high volatility basis risk gains should warrant a higher basis risk assumption, not lower as the volatility is the driving component in valuation
- A bulk manual is not an appropriate assumption; a noise term should be added to valuation. This noise term should not be reduced due to basis risk gains, on a reduction in volatility supported by regression analysis

Scenario B
(i)   The underlying risk is Unhedged Risk
- A hedging strategy may intentionally not hedge some risk types, certain elements of the liability cash flows such as fee revenue based on account value
- There may be risks that are not explicitly captured in the modeling. These can exist because they are intentionally not modeled or because approximations have been used to simplify the modeling or the valuation method itself cannot capture the risks.

(ii)   Valuation Methodology
- A bifurcation of the liability may be an appropriate option; bifurcating the fees between unhedged fees and hedged fees and calculating the unhedged portions using a first-principles CALM approach that does not reflect hedging may be appropriate. Avoid disconnecting insurance contract feature interactions
- These risks would still need to be included in the valuation in some fashion

7. **Continued**

    (iii)   Recommendation
- A natural offset should not be used to decrease the PfAD. A more appropriate option is to bifurcate the fees or model the product separately
- Given the product is not hedged, it should be modeled separately as other risks (basis risk, counterparty risk, etc) are not applicable

Scenario C

    (i)   There are multiple risk underlying the trading of options
- Liquidity Risk - Hedging programs can create significant liquidity risk whether using put options, rolling futures positions or transacting in swaps
- Liquidity - Liquidity risk is caused by a widening of the spreads on derivatives that increases the transaction costs required to re-balance the hedge portfolio
- Transaction Costs - Hedging programs can have significant amounts of trading which will generate transaction costs, which would be included in the CALM valuation
- Volatility Risk - If the dynamic hedging strategy utilizes material amounts of options or instruments with embedded options, then future market-implied volatility becomes an important assumption that will affect the cost of hedging

    (ii)   Valuation Methodology
- Liquidity - The actuary would monitor the liquidity of hedge instruments as part of the hedge program measurement. This may be more appropriately covered by capital requirements than by liabilities
- Transaction/Counterparty Risk - Should both be modeled or accounted for
- Volatility Risk - consider the important relationship between time-zero volatility and simulated forward volatility to assess properly the material effect that volatility modeling choices can make on expected results and risk profiles

    (iii)   Recommendation
- Liquidity - Should be monitored by the actuary. Extreme scenarios are covered by capital requirements but concern could lead to a higher CTE level
- Transaction/Counterparty Risk - increased levels could result in increase in CTE level or explicit modeling of a cash flow
- Volatility - should be modeled throughout the projection at different levels to proxy the hedge cost. Could also lead to an increase in CTE level

8. **Learning Objectives:**
1. The candidate will understand financial statements and reports of Canada life insurance companies as well as the professional standards addressing financial reporting and valuation.

3. The candidate will be able to understand and analyze the implications of emerging financial and valuation standards.

4. The candidate will be able to explain and apply the methods, approaches and tools of financial management and value creation in a life insurance company context. In addition the candidate will understand the Risk Based Capital (RBC) regulatory framework and the principles underlying the determination of Regulatory RBC and Economic Capital.

Learning Outcomes:
(1e) Explain the role and responsibilities of the appointed/valuation actuary.

(3a) Describe emerging developments impacting Canadian valuation and International Financial Reporting frameworks, and assess their impact on the valuation of reserves and financial statements.

(4g) Describe the MCCSR/RBC regulatory framework and the principles underlying the determination of Regulatory RBC.

(4h) Compute the MCCSR for a life insurance company:
- Identification of significant risk component.
- Identification of Specialized product MCCSR requirements.
- Interpreting results from a regulatory perspective.

Sources:
LFV-606-16: OSFI Guideline – MCCSR for life insurance companies Sections 1 – 5, 8-9, Jan 1, 2015

LFV-642-16: OSFI: Life Insurance capital Framework Standard Approach – Jan 2015

Commentary on Question:
This question tested candidates' knowledge of MCCSR, and in particular the mortality component and its calculation. Candidates that demonstrated the adjustment for unregistered reinsurance did well. Most candidates were able to describe the base mortality component and understand how the formula is applied. The unregistered reinsurance presented challenges to the candidates and thus part (b) was not answered as well as part (a).

8. Continued

Solution:

(a)   Calculate the MCCSR mortality component. Show all work.

Commentary on Question:
Candidates generally did well on this part of the question. Most candidates demonstrated that the MCCSR requirement for mortality was the volatility component plus the catastrophe component and knew the correct formula for each as well as the factors. (i.e.. Vol = 2.5×A×B×C/D and Cat = 0.1×C×E/F.) Many candidates received full credit. A few candidates used the base mortality instead of the padded mortality and credit was adjusted accordingly.

Volatility
A=Standard Deviation
=(sum q*(1-q)*b^2)^.5
=(10000^2*.005*.995+6000^2*.005*.995+3000^2*.007*.993)^.5 = 860
D = Macauly Duration of projected claims = 1 for 1 year term
B= 1 since it is one-year term; B =max (lnD,1)
E=NAR= (10000-100)+(6000-60)+(3000-50)=18790
F=Face Amount = 10000+6000+3000=19000
Volatility = 2.5*860*1*18790/19000=2125.6 which rounds to 2126

Catastrophe:
C=Projected death claims = 10000*.005+6000*.005+3000*.007=101
E=18790,F=19000
Catastrophe=0.1*101*18790/19000=9.99 which rounds to 10

Mort MCCSR
Mortality risk capital = 2126+10 = 2136

(b)

(i)   Calculate the total company MCCSR mortality component. Show all work.

(ii)   The unregistered reinsurer of the 20-year renewable term product provides a 1,500 deposit to Atlantic Life for the remainder of the policy term. Assume there is no other required capital requirement under MCCSR.

Recalculate the total company MCCSR mortality component. Show all work.

8. Continued

Commentary on Question:
Few candidates received full credit for this part of the question. Most candidates knew that an adjustment was required for an unregistered reinsurer, but demonstrating that in the formula was challenging. Many candidates were able to solve for the capital net of registered reinsurance M_0. The 1,500 reduction to the capital requirement was often applied incorrectly: some candidates stated that a change to capital was not required and others deducted the 1,500 from the mortality component of M_0. Most candidates did not complete the M_1 calculation. Few candidates knew to take the minimum reduction to the original M_0

Volatility = (2000^2+8000^2+5000^2)^.5= 9644
Catastrophe = 500+2400+2000=4900
Mortality risk capital net of registered reinsurance (M0)= 9644+4900 =14544

Mortality risk capital net of registered and unregistered reinsurance:
Volatility = (2000^2+8000^2+1500^2)^.5= 8382
Catastrophe = 500+2400+600=3500
M1 = 8382+3500 = 11882

Reduction of mortality capital = 14544-11882 = 2662
Maximum reduction = minimum (2662, 1500) = 1500
Mortality component = 14544 - 1500=13044

9.   **Learning Objectives:**
1.   The candidate will understand financial statements and reports of Canada life insurance companies as well as the professional standards addressing financial reporting and valuation.

Learning Outcomes:
(1c)   Describe how to compute the taxable income of a life insurance company.

Sources:
Future Income and Alternative Taxes, CIA Educational Note, December 2012

Commentary on Question:
This question tested the candidates' knowledge of tax regulations and the fundamental differences between GAAP and Tax accounting.

Solution:
(a)   Explain why future tax provisions are necessary.

   Commentary on Question:
   Most candidates were able to explain the differences between tax rules and GAAP principles, which are the drivers for establishing future tax provisions.

   GAAP contract liabilities assume that experience emerges as expected basis with margins producing zero income in each period. As such there would be no income tax.
   In reality, certain differences exist between income tax rules and GAAP principles give rise to a projection of tax cash flows. Future tax provisions reflect the value of these future tax cash flows that are not included in the GAAP insurance contract liability.

(b)   Calculate the following as at the end of 2016:

   (i)   Discounted future tax provision

   (ii)   Future tax carve-out

   Show all work.

   Commentary on Question:
   Although candidates were able to identify the correct formula for taxable income for insurance related contracts, few candidates were able to apply the formula correctly. To receive full credit candidates had to demonstrate correct calculation of different components. A common error was including the full reserve and investment income amounts instead of the change in those values.

9. Continued

Step 1 Calculate the PolTaxProfit

PolTaxProfit = (GAAP_Exp - Tx_Exp) + (Tx_InvInc_ICLIFT-GAAP_InvInc_ICLIFT)+ (Δ in ICLIFT - Δ in MTAR)

1.1 Calculate Δ **in ICLIFT and** Δ **in MTAR and GAAP less Tax Change in reserve**

Calendar Year	2016	2017	2018	2019
Change in ICLIFT		-200	-200	-200
Change in MTAR		-225	-210	-215
GAAP less Tax Change in reseve		25	10	15

1.2 Calculate (GAAP_Exp - Tx_Exp)

Calendar Year	2016	2017	2018	2019
GAAP less Tax Expenses		20	20	20

1.3 Calculate (Tx_InvInc_ICLIFT- GAAP_InvInc_ICLIFT)

Calendar Year	2016	2017	2018	2019
GAAP Basis Investment Income		600*0.06=36	24	12
Tax Basis Investment Income		590*0.04=23.6	14.4	6.2
Tax less GAAP Investment Income		-12.4	-9.6	-5.8

1.4 Calculate PolTaxProfit = sum of 1.1 to 1.3

Calendar Year	2016	2017	2018	2019
PolTaxProfit(t)		32.6 = 25 + 20 – 12.4	20.4	29.2

Step 2 Calculate DFTP
Commentary on the Question: *Candidates are not required to calculate DFTP for 2017 and 2018. The values are shown for illustrative purposes only.*

DFTPk = $\sum_{t>k}$ Vt-k * Tt
26.71 = 11.41*0.962+ 7.14*0.926+10.22*0.892

Calendar Year	2016	2017	2018	2019
V @ 6%*(1 - Tax Rate)	1.00	0.962	0.926	0.892
Future Tax cash flows		=32.6*0.35=11.41	7.14	10.22
DFTP	26.71	16.34	9.84	

Step 3 Calculate ICLBCO
Commentary on the Question: *Candidates are not required to calculate ICLBCO for 2017 and 2018. The values are shown for illustrative purposes only.*

9. **Continued**

ICLBCO = ICLIFT + DFTP

	2016	2017	2018
ICLBCO	626.71 = 600 + 26.71	416.34	209.84

Step 4 Calculate FTCO

FTCO = tx *[(MTAR - ICLBCO)+(GAAP_A - Tx_A)]/(1-tx)

$$=0.35*[(650-626.71)+(600-590)]/(1-0.35)$$
$$= 17.93$$

(c) There is a loss carry forward of 24 at the end of 2016 that is deemed not policy related. The company has other future taxable income such that the tax benefits can be realized equally over the next two years.

Calculate the revised net balance sheet position to reflect the loss carry forward. Show all work.

Commentary on Question:
Few candidates received full credit for this question. Most candidates did not spread the LCF out for two years. Few candidates correctly calculated FTA with the LCF by not discounting.

Step 1: Spread the LCF out for two years -- 12 in 2017 and 12 in 2018
Step 2: Calculate future tax benefits 12*0.35 = 4.2 in 2017 and 2018
Step 3: FTA re LCF at 2016: 4.2+ 4.2 = 8.4 (FTA is undiscounted since not policy related)
Step 4: Total Revised NBSP:

ICLACO = 626.71 - 8.4
= 618.31

	2016	2017	
Spread the LCF out for two years -- 12 in 2017 and 12 in 2018		12	12
Future Tax Benefit		4.2	4.2
FTA re LCF	8.4	4.2	

10.

Learning Objectives:

2. The candidate will be able to understand and apply valuation principles of individual life insurance and annuity products issued by Canadian life insurance companies.

3. The candidate will be able to understand and analyze the implications of emerging financial and valuation standards.

Learning Outcomes:

(2a) Describe valuation methods.

(3a) Describe emerging developments impacting Canadian valuation and International Financial Reporting frameworks, and assess their impact on the valuation of reserves and financial statements.

Sources:

LFV-132-14: Practical Guide to IFRS, PwC, (July 2013)

LFV-135-16 – How We Responded to Feedback on the 2013 Exposure Draft, IASB

CIA Educational Note: Margins for Adverse Deviations (MfAD) – November 2006

LFV-634-16: CIA Standards of Practice: Insurance Sections 2100, 2300, 2500, March 2015

Commentary on Question:

This question tested candidates' understanding of the IFRS 4 Phase II standards.

Solution:

(a) The following statements have been made regarding the changes IFRS 4 Phase II will have on reserves and net income recognition:

A. *Changes in the present value of expected cash flows related to future service should be recognized in earnings when the change becomes known.*

B. *Insurance contract revenue and expense should be presented in the statement of comprehensive income with revenue recognized as earned including investment components.*

C. *An entity should choose to present the effect of changes in discount rates in profit and loss or in Other Comprehensive Income (OCI) as its accounting policy. The same accounting policy should be applied to all similar insurance contracts that are backed with similar investments.*

10. Continued

D. *A contract which is deemed to be onerous at time of issuance will be deemed to be onerous throughout the term of the contract.*

Critique each of the above statements and recommend changes where appropriate.

Commentary on Question:
This part of the question tested candidates' understanding of the underlying concepts of IFRS and required candidates to demonstrate their comprehension by identifying errors in the statements.

Many candidates were able to critique the statements appropriately. For statement A, many students were able to identify that the statement was incorrect, but could not describe how earnings would be recognized.

To receive full credit, candidates needed to identify if the statement was true or false. In addition, false statements required identification of what was incorrect and an appropriate change recommendation.

A. This statement is false. The statement should be revised as follows: Changes to the present value of expected cash flows related to future earnings must be recognized in earnings **over the period** during which the service is provided and not all in the period when the change becomes known.
B. This statement is false. The statement should be revised as follows: Insurance contract revenue and expense should be presented in the statement of comprehensive income with revenue recognized as earned that **excludes** investment components.
C. This statement is true. No additional changes are required to this interpretation.
D. This statement is false. A contractual service margin (CSM) can be reinstated if a contract becomes profitable again after being onerous. Therefore, tracking of negative contractual service margin will be required.

(b) Identify which product graph and earnings emergence bar series corresponds to each of the following:

(i)   10-year term life under IFRS

(ii)   10-year term life under CALM

(iii)   Deferred annuity under IFRS

(iv)   Deferred annuity under CALM

Justify your answers.
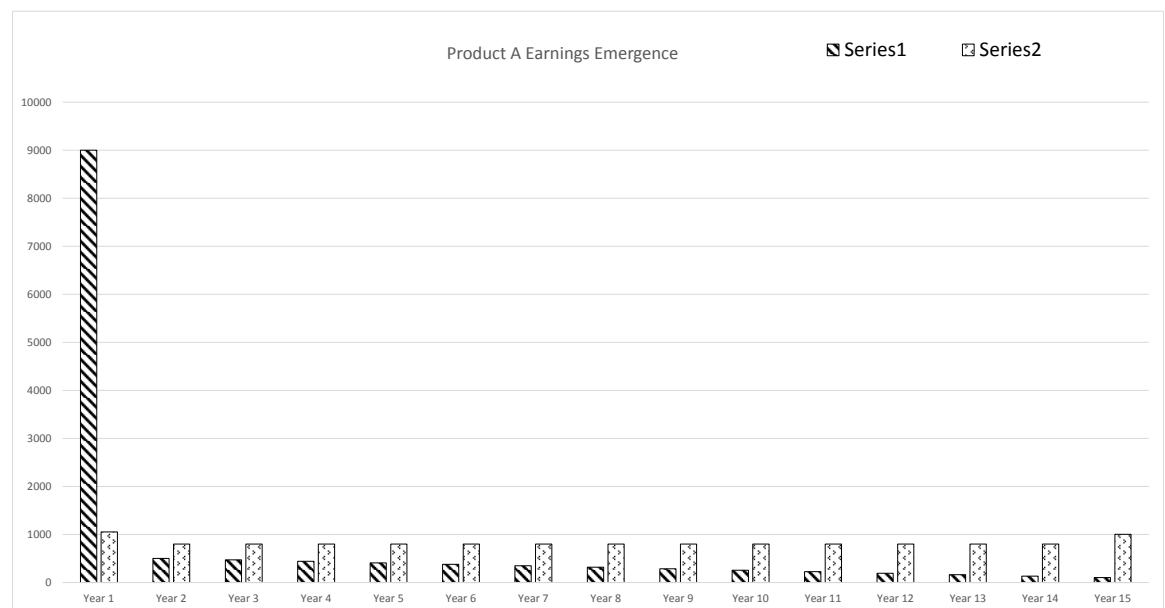
10. Continued

Commentary on Question:
This part of the question tested the candidates' knowledge of CALM and IFRS, and the impact of assumptions/product features on earnings. However, the graphs provided for this question were defective, as they should have gone to 15 years in order to illustrate the shock lapse. Since partial information was missing, full credit for identifying the products was given to candidates who showed appropriate effort to identify the products. The correct graphs have been provided below.

To receive full credit, the candidate needed to properly identify the reporting standard, and clearly justify how the graphs aligned with each standard.

Most candidates were able to properly match up the graphs, and many were able to articulate the differences in upfront gain between the two standards. Few were able to articulate the difference between income emergence in future years.

10. Continued

Product B Earnings Emergence — Series1, Series2
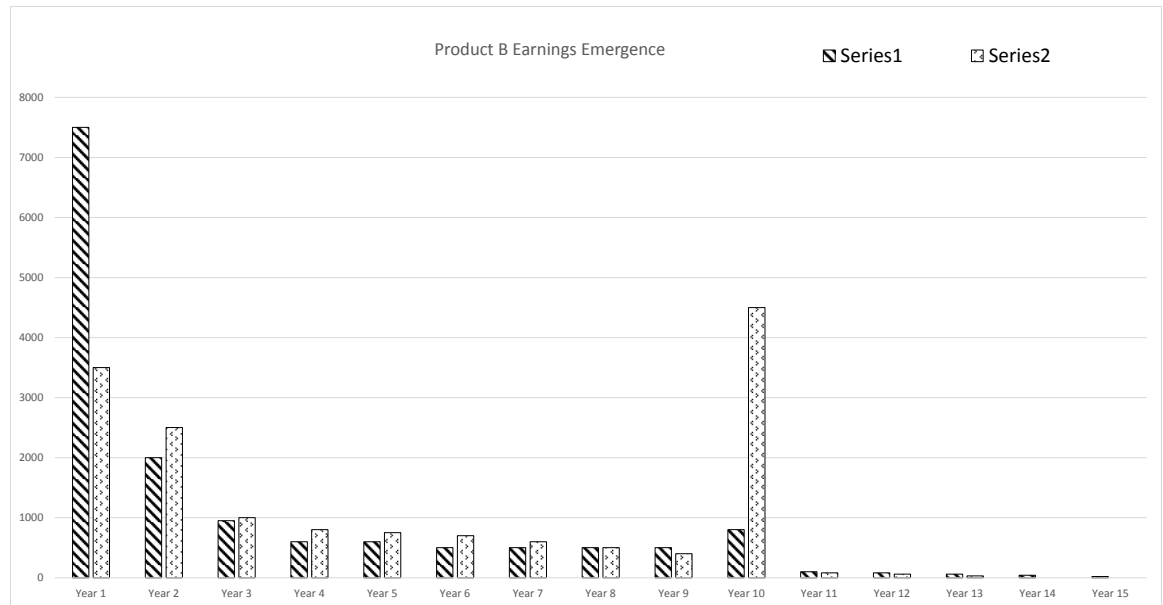
(i)   10-year term life under IFRS – Product B Series 2

(ii)   10-year term life under CALM – Product B Series 1

(iii)   Deferred annuity under IFRS – Product A Series 2

(iv)   Deferred annuity under CALM – Product A Series 1

In both graphs, CALM is represented by series 1 as the profit, excluding the margin for adverse deviation, is booked at time of sale. Future profits are recognized into income in subsequent years through the release of margins of adverse deviations as actual versus expected experience unfolds.

In both graphs, IFRS is represented by Series 2 as future profits are only recognized into income through the Contractual Service Margin (CSM) which is amortized over the coverage period of the product in a systematic way that best reflects the remaining services provided under the contract.

Product B is more likely to be the 10 year term product, as the profit grades downwards, aligning with the declining lapse rates and associated PfAD, as well as the shock lapse in year 10.

11.

Learning Objectives:

2.   The candidate will be able to understand and apply valuation principles of individual life insurance and annuity products issued by Canadian life insurance companies.

Learning Outcomes:

(2b)   Recommend appropriate valuation assumptions.

Sources:

CIA Research Paper: Mortality Improvement Research Paper (September 2010)

CIA Educational Note: Margins for Adverse Deviations (MfAD) – November 2006

LFV-634-16: CIA Standards of Practice: Insurance Sections 2100, 2300, 2500, March 2015

CIA Educational Note: Expected Mortality: Fully Underwritten Canadian Individual Life Insurance Policies: July 2002 (excl. appendices)

Commentary on Question:

This question tested the candidates' understanding of how mortality improvements are applied in CALM.

Candidates generally did well on this question. However, few candidates were able to identify all the deficiencies required to receive full credit. Most candidates struggled in their critique of the MfAD, failing to justify why the test was inappropriate with applicable examples.

A number of candidates included the promulgated mortality improvement rates in their response. As this did not contribute to the critique of the assumption, no credit was received.

Solution:

The recommendation is to set the CALM reserve based on Test # 4 and to include the annuitant mortality to reduce conservatism.

Critique the recommendation.

Commentary on Question:

For illustration purposes only, Test #7 is the correct test for setting the CALM reserve. As the question asked for a "critique" and not a "recommendation", stating this was not required to achieve full credit.

11. Continued

Test #4 is not appropriate for establishing the CALM Reserve for the following reasons:

- Mortality Improvement should only be modeled for 25 years from the valuation date with no improvements thereafter
- Select & Ultimate period does not apply to Mortality Improvements, only to the expected mortality (for the years immediately after a policy has been underwritten)
- Mortality Improvement should vary by Attained Age, not Issue Age
- Utilization of Smoker vs Non-Smoker Mortality Improvement rates is not applicable due to the lack of credible data
- With no clear pattern in Sex distinct Mortality Improvement rates, Unisex rates should be used
- An MfAD at the high margin of $15/e_x$ is too conservative. An MfAD at the low margin of $3.75/e_x$ is more appropriate because:
  - XYZ has credible mortality experience (N > 3,007)
  - The data is homogeneous
- Annuity and Life mortality may not be combined even if deemed to be conservative