ILA 101 Model Solutions
November 2025

1. Learning Objectives:

1. The candidate will understand the designs of the common Life and Annuity products and their associated features and inherent risks, and the methods to design and price these products.

Learning Outcomes:

(1b) Evaluate and apply pricing practices for life and annuity products.

(1c) Describe and apply the common profit metrics (IRR, Value of New Business, Embedded Value, ROE) used in pricing insurance products.

Sources:

ILA101-100-25: Life Products and Features, ILA Committee, 2019

ILA101-104-25: Profit Measures and Analysis, Atkinson and Dallas, Ch. 11, pp. 499-502

ILA101-102-25: Understanding Profitability in Life Insurance

Commentary on Question:

Commentary listed underneath question component.

Solution:

(a) Critique the following statements:

(i) *The projected ROE for joint products will be equivalent in all future durations when priced using either the joint equal age method or the equivalent same age method.*

(ii) *Substandard policies will have lower profitability than standard lives due to increased mortality costs.*

(iii) *Each component of Market Consistent Embedded Value is significantly impacted by an update to the conversion option assumptions.*

1. Continued

Commentary on Question:
Candidates generally did poorly on part i but performed well on parts ii and iii. For full credit, candidates were expected to assess whether the statement was true or false and provide appropriate justification. For part i, several candidates described the joint equal age and equivalent same age methods but failed to explain how they would impact the mortality curve or impact ROE.

(i) This statement is false. ROE can change if your underlying reserves change. Reserves would be different if mortality assumptions are different at any point in the future.
Mortality rates are different for ESA vs JEA.
- ESA mortality: joint mortality matched to a single life
- JEA mortality: true joint but assuming both insureds are the same age and not their actual ages.

Mortality rate patterns are different, therefore reserves would be different, therefore ROE would not be the same in all future durations.

(ii) This statement is false. Substandard policies have higher mortality rates than standard cases, so for a life insurance product, their mortality costs would be higher. This part of the statement is true. However, higher mortality costs do not necessarily mean profitability would be worse. Products can be priced to overcome these mortality differences, which could result in worse, equal, or better profitability than other business, depending on the methods employed.

(iii) This statement is false. Market Consistent Embedded Value = Value of Inforce + Required Capital + Free Surplus
VIF is sensitive to assumption updates since it includes the Present Value of Profits as a component in its formula, and profits in general can vary significantly with assumption changes.
Required capital = MV of capital allocated to the business. Some second order impacts would be expected from assumption updates, but the materiality is unknown.
Free Surplus = MV of capital allocated to the business but not required. Similar commentary as Required Capital.
Therefore, the statement is false as not all components necessarily have materiality.

(b) Calculate the total expected cost of the conversion option through policy year 10.

Commentary on Question:
Candidates performed fair on this part of the question. Candidates received partial credit for approaching steps of the calculation correctly even if the final result was incorrect. Candidates commonly did not decrement for conversions.

1. Continued

	(1)	(2)	(3)	(4)		
Year	BOY	Decrement	Conversion	Conversions	Option Cost	
1	1000	0.05	0	-		
2	950	0.05	0	-		
3	902.5	0.05	0	-		
4	857.375	0.05	0	-		
5	814.5063	0.05	0.07	= (1) x (1 - (2)) x (3) = 54.16	= (4) x 40 = 2166.59	
6	719.6163	0.05	0.07	47.85	1,914.18	
7	635.781	0.05	0.06	36.24	1,449.58	
8	567.7524	0.05	0.06	32.36	1,294.48	
9	507.0029	0.05	0.05	24.08	963.31	
10	457.5701	0.05	0.05	21.73	869.38	
	Reduce pool by prior year				**8,657.51**	= sum of the above
	decrements and conversions				**8.66**	per thousand

(c) You are concerned about the high costs to the company of term conversion elections.

(i) Describe three philosophical approaches to charging for this conversion option.

(ii) Recommend one of the approaches to decrease the likelihood of future term conversions. Justify your answer.

(iii) Describe how a term conversion option would impact the product's IRR if it was priced competitively.

Commentary on Question:
Most candidates were able to describe the three philosophical approaches for part i. For part ii, candidates who received full credit for recommending and approach with appropriate justification. In part iii, many candidates did not make the connection that IRR depends on the profit in the pricing which could increase or decrease the margin in the conversion option. However, many were able to define IRR and generally describe impact on profitability which led to partial credit.

(i) There are three ways to pass option costs to policyholders:
- Option 1 - Those who exercise the option pay
- Option 2 - All pay if they have the option available
- Option 3 - All pay if they have the option available or not

(ii) Under option 1, costs to the policyholder are highest because all option costs are more concentrated in a smaller number of policyholders. Option 3 is the lowest cost. All else being equal, you would expect that the higher the cost, the less likely people would be to exercise the option.

1. Continued

Decreasing the likelihood depends on what methodology is currently used in the product. If option 3 is used today, option 1 and 2 would increase costs and would be expected to decrease elections (1 would decrease the most). If option 1 is already used today, then the cost of the option would need to increase to compensate. Therefore, I recommend pricing with the first option above into the product, but if that option is already in use, I recommend increasing the cost charged.

(iii) The impact on profitability depends on how the option is priced and what profitability criteria is used. IRR solves for the interest rate at which the present value of profits and losses equal zero. The impact on IRR would depend on if the option is priced to be profitable or not; if it's priced to be profitable, IRR would increase as PV(profits) > PV(losses) from the option. Otherwise, IRR would decrease. The question states it's priced competitively, but that could still increase the IRR from not having the option.

2. Learning Objectives:

2. The candidate will understand different types of actuarial assumptions and how experience studies are designed and used for evaluating past experience and for setting assumptions.

Learning Outcomes:

(2b) Describe and evaluate mortality, lapse, premium persistency, term conversions and utilization assumptions used for various purposes, and apply methods and techniques for their development.

Sources:

ILA101-101-25: Annuity Products and Features, ILA Committee, 2019

Commentary on Question:

The question was intended to test the candidate's knowledge of actuarial assumptions and their application to annuity products. Overall, candidates did well on part a and c but performed poorly on part b.

Solution:

(a) Explain how each of the product changes below would impact the withdrawal assumptions.

(i) Flexible premium payments are allowed for the first 2 years only.

(ii) The surrender charge period is extended from 5 years to 10 years.

(iii) The minimum interest rate guarantee is reduced to 2% per year.

(iv) A penalty-free withdrawal provision is introduced.

Commentary on Question:

Candidates generally did poorly on subpart (i) but did well on subparts (ii) through (iv). Candidates that demonstrated a clear understanding of the product changes and how it could affect withdrawals received full credit. Many candidates incorrectly believed that flexible premium payments being allowed for the first 2 years meant that the policy would switch to fixed premiums for the remaining 8 years.

(i) In this design change, premiums can only be paid within the first 2 years as opposed to the first 10. This would result in reduced account values for policyholders, which can impact the withdrawal assumption.

(ii) Surrender charges reduce the amount the policyholder receives upon a withdrawal. If the surrender charge period is extended to 10 years, withdrawals become more costly for longer than they are today. It can be inferred that if it's more costly to withdraw funds, withdrawals would decrease, all else being equal.

2. Continued

(iii) The minimum interest rate guarantees a crediting rate. If this guarantee decreases, policyholders would be more sensitive to alternative investments. A lower guarantee makes it more likely that better alternatives present themselves in the external market, therefore increasing withdrawal activity.

(iv) This provision allows a policyholder to withdraw a certain amount of funds without incurring a surrender charge. If more money can be withdrawn without costing the policyholder anything, it is reasonable to conclude that withdrawals would increase, at least up until the limit.

(b) Recommend two product feature changes that could improve the product's premium persistency. Justify your answer.

Commentary on Question:
Most candidates did poorly on part b. Candidates were expected to recommend two product feature changes that would improve premium persistency, i.e., encourage additional premiums, to receive full credit. Many candidates confused premium persistency with policy persistency and provided product features to improve persistency, i.e., to keep policies in force.

I recommend a large account value bonus, as the benefit is directly tied to the size of the account value to encourage more premiums deposit and therefore improve premium persistency.

I also recommend an annuitization bonus, a bonus that provides an additional 10% of the account value upon annuitization. This improves premium persistency since the benefit is greater the more premium that is deposited.

(c) For each of the three assumptions:

(i) Describe potential reasons you would approve the proposed pricing assumptions.

(ii) Describe potential reasons you would reject the proposed pricing assumptions.

Commentary on Question:

Candidates generally did well on part c. Candidates that provided reasons to approve or not approve each of the three assumptions received full credit. Candidates also needed to state that VA is not mortality sensitive to receive full credit. Candidates that provided reasons for some of the assumptions received partial credit. Simply stating whether an assumption is reasonable or unreasonable without justification did not receive credit.

2. Continued

(i)

Maintenance: Administration of policies is outsourced to a third-party company that charges a fixed per policy rate regardless of the contract.

Marketing: Higher marketing budget for a new product to promote sales.

Mortality: No experience on VA-specific mortality is available, and current assumption is fully credible for DA product. VA is also not expected to be mortality-sensitive, so if immaterial to profitability, it could be okay.

(ii)

Maintenance: VAs are usually more administratively complex than DA. If this is true with the new VA product, I would expect the assumption to be higher.

Marketing: If truly a one-time expense, we don't want to allocate a higher 1-year cost that would be incurred for all future premiums beyond that year.

Mortality: More appropriate non-insured mortality table, possibly on VA annuitants specifically, is available. Different underwriting is conducted between the products.

3. Learning Objectives:

1. The candidate will understand the designs of the common Life and Annuity products and their associated features and inherent risks, and the methods to design and price these products.

Learning Outcomes:

(1a) Describe and compare various life insurance and annuity product designs.

Sources:

ILA101-101-25: Annuity Products and Features, ILA Committee, 2019

Registered Index-Linked Annuities, SOA Research Institute, Carbo, Elliot, and McGarr, 2022

ILA101-102-25: Understanding Profitability in Life Insurance

Commentary on Question:

Commentary listed underneath question component.

Solution:

(a) Calculate the fund values at the end of the fifth year for the following designs given the information in Excel.

(i) 5% cap, 0% floor

(ii) 75% participation rate, 0% floor

Commentary on Question:

The majority of candidates were able to correctly calculate in excel the fund values for an indexed annuity at the end of the fifth year for both designs where the annual index returns were either: above the cap; below the floor; or in between the floor and cap. For part ii) candidates had to apply the 75% participation against the annual index returns produced whilst ensuring that the adjusted returns did not fall below the floor of 0%. Some candidates mistakenly used the index value in place of the fund value to determine the final fund values at the end of the fifth year.

See Excel Solution for solution.

3. Continued

(b) Critique the following statements:

(i) *Option-based static hedging is a logical choice for hedging a variety of fixed indexed annuity designs due to its cost-effectiveness and simplicity.*

(ii) *Fixed indexed annuities and registered index-linked annuities are nearly identical from both the contract holder perspective and the insurance company perspective.*

(iii) *The primary source of earnings for fixed annuities, fixed indexed annuities, and variable annuities is investment income.*

Commentary on Question:
The majority of candidates performed poorly on part i) as they were unable to explain why static based hedging was both cost-effective and simplistic. Many candidates only answered why it was either cost-effective or simplistic but not both, while other candidates disagreed with the statement and discussed other hedging choices using bonds, reinsurance or dynamic hedging.

Although the majority of candidates marginally passed ii), they struggled articulating the key product features for FIA's and RILAs including what made them similar and different. The question also asked candidates to discuss this from both the contract holder and insurance company perspectives. Many only discussed the answer from either the contract holder or the insurance company and not both which was required to obtain a passing grade.

Part iii) was the best answered of all these sub-parts. Most candidates understood that FA & FIA's utilize the insurance company's general account whilst RILA's utilizes a separate account which generates fee income instead of investment income. Candidates who performed poorly on this question either agreed with the statement which is incorrect or failed to provide an explanation of their false or partially false statements.

(i) It is true that static hedging is a good choice for fixed indexed annuity designs, but may not be the "logical" choice for all companies

- Option based static hedging *is* more simple than an alternative method, such as Dynamic hedging which requires active portfolio management to rebalance the portfolio often
- Although option costs can be sensitive to volatility and market movements, dynamic hedging is as well; but dynamic hedging does not offer the downside protection that option based static hedging does

3. Continued

- Option based static hedging can be especially cost effective if large restrictions to policy purchases are restricted to a few times a month to that option purchases can be made in bulk

(ii) With Registered index-linked annuities (RILAs), the policyholder bears more risk and the company bears less risk. There is typically less downside protection for the policyholder because unlike a FIA with a typical 0% floor, RILAs allow the fund to decrease, and in the case of a buffer design, the fund value may decrease significantly in poor market conditions. Also, the company holds assets in the separate account and general account for RILAs, but just the general account for FIAs.

(iii) This statement is partially true. Since fixed annuities and FIA products are fully invested in general account assets, the primary source of earnings would be investment income. However, variable annuity assets are held in the separate account, meaning the insurer doesn't directly earn investment income on it. Instead, the insurer charges management fees and charges to the policyholder, and this is the primary source of earnings for a VA.

(c) Recommend a form of hedging for the fixed indexed annuity that aligns with management's interests.

Commentary on Question:
The majority of candidates performed poorly on part c) as they stated that dynamic hedging instead of static hedging was the recommended form of hedging. The stem for part c) stated that Management wanted to minimize earnings volatility stemming from equity market volatility while maintaining competitive product. Many candidates' answers did not indicate how the form of hedging that they recommended would minimize earnings volatility and maintain a competitive product which was required to obtain a passing grade.

Recommend using static hedging with over-the-counter call options

- Buy an ATM call struck at the current index
- Sell an OTM call struck at the cap for the FIA product

This will ensure that the options will be able to fund the index crediting for an increase in the equity index. When using a call spread, the premium from the sold OTM call does offset (some) of the cost of buying the ATM call.

3. Continued

This method is more suitable than using dynamic hedging (or replicating portfolio), which is subject to downside risk in the face of equity volatility and can be costly to manage. A more expensive hedging strategy reduces spread earnings on this product, which would make it less competitive.

4. Learning Objectives:

3. The candidate will understand common issues and practices related to Product Management.

Learning Outcomes:

(3b) Describe and apply the significant US tax regulations relating to the taxation of individual life and annuity insurance products.

Sources:

ILA101-108-25: Chapters 1 and 2 of Life Insurance and Modified Endowments Under IRC §7702 and §7702A, Desrochers, 2nd Edition

Commentary on Question:

The question tests candidates' knowledge/understanding of how insurance contracts are classified – life insurance contract or not, MEC or non-MEC under Internal Revenue Code and the corresponding tax implication.

Solution:

(a) Evaluate the tax status of distributions from the contract in each of the following situations. Assume that each policy complies with the requirements of Internal Revenue Code §7702 – Definition of Life Insurance.

(i) A whole life policy has a guaranteed fixed premium structure. The policy's annual premium is equal to the 7-pay annual premium. The payer decides to pay monthly premiums and the total of the monthly premiums over the year is 2% higher than the annual premium.

(ii) A whole life policy has a level death benefit of 100,000. The annual premium paid is 800 and the 7-pay annual premium is 1,100. The death benefit was decreased at the end of the 3rd policy year, which reduces the 7-pay annual premium to 550.

(iii) A small final expense whole life policy has a level death benefit of 5,000 and an annual level premium of 400 payable for 10 years. The 7-pay annual premium was computed as 350 based on the prevailing commissioner's mortality and interest rate. The policy owner does not have any other life insurance policies.

4. Continued

Commentary on Question:
Part a of the question focusses on the classification of a life insurance contract as MEC or non-MEC using 7-Pay test under 3 scenarios: monthly premium mode, benefit reduction (material change), and small face amount contracts. Candidates are expected to determine whether the policy is considered MEC, provide explanation, and elaborate consequent tax treatment on distributions. In addition, to achieve a full mark of 4, at least one action item, for example: notifying policyholder regarding the MEC status is required.

A (i) The policy would be classified as MEC (Modified Endowment Contract) under IRC 7702 as it fails the 7-pay test which requires the premium paid is less than or equal to the 7-pay premium. Due to monthly mode, the policyholder pays 2% higher than 7-pay premium. As such, partial withdrawals, full surrenders, policy loans, assignments or pledges to secure borrowing, and dividends received by the policyholder (e.g., paid in cash or applied to pay off a loan)—are includible in gross income to the extent of gain in the contract, and may be subjected to a 10 percent penalty tax. Company should notify the policyholder about the MEC status and refund the extra 2% premium as appropriate.

A (ii) The decrease in death benefit in year 3 would trigger the "reduction-in-benefit rule" which requires the MEC status be reevaluated retroactively at policy issue against the new 7-pay premium with the reduced death benefit using all the premiums since issue. Since the annual premium of 800 is more than the new 7-pay annual premium of 550, this policy is a MEC. It is therefore subject to the taxation rules described in a (i). The company should notify the policy owner of the excess premium paid and that the excess would cause the policy to become a MEC. Signed consent of the MEC status from the policy owner is necessary.

A (iii) The policy is a non-MEC because it passes the 7-Pay test. For a small face amount contract (DB <= 10,000) in aggregate of all coverages, $75 per policy and modal premium expense allowances can be added to the 7-Pay premium - $75 + $350 = $425, which is higher than the annual level premium of $400. As an non-MEC, lifetime distributions generally are subject to more favorable income tax regime, e.g., a partial withdrawal generally is includible in gross income only to the extent it exceeds the investment in the contract; policy loans, assignments and pledges generally are not treated as distributions; and no 10 percent penalty tax applies.

(b) For substandard lives on a universal life product, the pricing mortality is 200% of the prevailing industry select table. The guaranteed mortality charges are 400% of the prevailing commissioner's ultimate mortality table. The company uses the guaranteed mortality charges when computing guideline and 7-pay annual premiums.

4. Continued

Evaluate this product with respect to compliance with Internal Revenue Code §7702 – Definition of Life Insurance.

Commentary on Question:
Part b focuses on the appropriate assumptions to be used when applying 7702 to determine whether an insurance policy is considered a life insurance contract. Candidates are expected know mortality assumptions should follow "reasonable mortality charges" rule. Out of the 3 sub parts, candidates responded worst to part b.

As required by IRC 7702 and 7702A, one of the two safe harbors should be followed, e.g., the mortality charge should be calculated with 100% prevailing CSO tables at issue. In addition, for substandard risks, a contract will be deemed to satisfy the reasonable mortality charge requirement of section 7702 if the mortality charges assumed in the calculations "do not differ materially from the charges actually expected to be imposed by the company". Given the pricing morality is 200% of prevailing industry select table, using 400% of the ultimate mortality does not satisfy the reasonable mortality guidance. Suggest calculating the policyholder tax premiums using the pricing mortality.

(c) Information for a whole life policy with a face amount of 50,000 is provided below.

Attained Age	CVAT Net Single Premiums for a 1,000 Whole Life Policy	Cash Value Per 1,000 of Death Benefit	Guaranteed Surrender Charge per 1,000 of Death Benefit	Present value of the expected premiums for Rider 1	Present value of the expected premiums for Rider 2	Present value of the expected premiums for Rider 3
68	513	510	20	55	13	70
69	528	536	15	25	7	45
70	544	540	10	0	0	25

The policy and any applicable riders are intended to qualify as life insurance using the cash value accumulation test (CVAT). The deemed maturity age for cash value accumulation net single premiums is 121. You are evaluating the following riders:

- Rider 1: Hospital indemnity benefit rider that pays 500 per day for qualifying confinements in a hospital or care facility that terminates at age 70
- Rider 2: 50,000 accidental death benefit rider that terminates at age 70
- Rider 3: 50,000 spouse term life insurance rider that terminates at spouse's age 100

4. Continued

The riders do not change the cash surrender value of the whole life policy.

Assess whether each of the following passes the cash value accumulation test. Show your work.

(i) Whole life policy with rider 1

(ii) Whole life policy with rider 2

(iii) Whole life policy with rider 3

Commentary on Question:
Part c focuses on testing candidates' knowledge on how to apply CVAT test. Candidates are expected to clearly identify CVAT, cash surrender value (w/o surrender charge), and how does qualified additional benefit (QAB) affect CVAT. Common errors include: subtracting surrender charges from CSV before comparing with NSP; rider 1 is considered QAB, QAB is included in CSV calculation, and only one of the ages out of 68-70 is tested

Model Solution: CVAT test checks whether the contract's CSV will never exceed the PV of future benefits. Where CSV should be gross of surrender charge, and future benefits include death benefits, endowment benefits, and charges for QAB but not QAB benefits. For this whole life policy, there are no endowment benefits. PV of future benefits is essentially the CVAT net single premium (NSP). As such comparing NSP + QAB charge with CV at each age would be sufficient to determine the test results.

Rider 1 – hospital indemnity benefit is not QAB, CSV at age 69 is 536 > NSP of 528, so fail the CVAT test.

Rider 2 – accidental death benefit rider is QAB, its charge (premium) needs to be added to NSP when comparing with CSV. Again, at age 69, CSV of 536 is > NSP + QAB = 528 + 7 = 535, fail the test.

Rider 3 – spouse term life insurance rider is QAB, its charge (premium) needs to be included to NSP when comparing with CSV. And for all ages, CSV < NSP+QAB (age 68: 510 < 513+70; age 69: 536 < 528+45; age 70: 540<544+25), so pass the test.

5. Learning Objectives:

4. The candidate will understand common valuation and capital techniques used in US, Canadian, and international regulatory frameworks.

5. The candidate will understand various techniques for addressing the mitigation of risk within a life insurance and annuity context.

Learning Outcomes:

(4a) Describe the US statutory actuarial framework, including the principles-based reserves and calculate basic life insurance reserves.

(5e) Describe basic terms, concepts, and types of life insurance reinsurance arrangements.

Sources:

Tiller, 4th edition, Chapter 4: Basic Methods of Reinsurance

ILA101-110-25: Fundamentals of the Principle – Based Approach to Statutory reserves for Life Insurance, July 2019

Commentary on Question:

The question was trying to test coinsurance and mod-co reinsurance arrangements. To receive maximum points, the candidate must comprehend the differences under both arrangements, understand gross and ceded cashflows well, and the advantages of using each reinsurance arrangement.

Solution:

(a) Calculate the second-year gain from operations under a 75% quota share coinsurance agreement.

Commentary on Question:

For many candidates, calculation was mostly correct, conceptually understanding what to do but making various errors. Most candidates knew how to calculate ceded premiums but failed to include policy fee in the gross premium. Some candidates struggled with the "per1000" use in calculating premiums. Few candidates got investment income correct – it should be based on the sum of EOY 1 or BOY 2 reserve and EOY 1 surplus, with the reserve ceded out and the surplus retained with the ceding company. Most candidates did not pay attention to the "Assumptions" section in the given EXCEL workbook. Some candidates struggled with calculating net cashflows for the ceding company.

5. Continued

Total Revenue (thousands):	
Gross Premium	(7 x 600,000+35,000)/1000 = 4,235
Ceded Premium	75% x (4,235-35,000/1000) = 3,150
Net Premium	4,235-3,150 = 1,085
Investment Income	[(1-75%) x 2,000+150] x 5% = 32.5
Expense Allowances	5% x 3,150 =157.5
Total Revenue	**1,085+32.5+157.5 = 1,275**
Total Benefit and Expense (thousands):	
Gross Claims	250+150=400
Ceded Claims	75% x 400=300
Net Claims	400-300=100
Gross Reserve Increase	7,000-2,000=5,000
Ceded Reserve Increase	75% x 5,000=3,750
Net Reserve Increase	5,000-3,750=1,250
Commissions	10% x 7 x 600,000/1000=420
Maintenance Expenses	25
Premium Tax	2.5% x 4,235=105.875≈106
Total Benefit and Expense	**100+1,250+420+25+106=1,901**
Gain from operation	**1,275-1,901=-626**

Commissions based on gross premium including policy fee is also acceptable.

(b) Calculate the second-year gain from operations under a mod-co agreement using a mod-co interest rate of 4%.

Commentary on Question:
Seldom candidates got investment income correct. Most candidates understood the reserve increase should be the gross reserve increase, and the ceded reserve is used to calculate mod-co adjustments. Some candidates struggled with mod-co adjustment.

Total Revenue (thousands):	
Gross Premium	(7 x 600,000+35,000)/1000 = 4,235
Ceded Premium	75% x (4,235-35,000/1000) = 3,150
Net Premium	4,235-3,150 = 1,085
Investment Income	(2,000+150) x 5% = 107.5
Expense Allowances	5% x 3,150 =157.5
Mod-co Adjustment	3,750-75% x 2,000 x 4%=3,690
Total Revenue	**1,085+107.5+157.5+3,690 = 5,040**

Total Benefit and Expense (thousands):	
Gross Claims	250+150=400
Ceded Claims	75% x 400=300
Net Claims	400-300=100
Gross Reserve Increase	7,000-2,000=5,000
Ceded Reserve Increase (for mod-co adj)	75% x 5000=3,750
Commissions	10% x 7 x 600,000/1000=420
Maintenance Expenses	25
Premium Tax	2.5% x 4,235=106
Total Benefit and Expense	**100+5,000+420+25+106=5,651**
Gain from operation	**5,040-5,651=-611**

Commissions based on gross premium including policy fee is also acceptable.

(c) Recommend whether the company should use coinsurance or mod-co for reinsuring the whole life block. Justify your response.

Commentary on Question:
Most candidates identified mod-co as preferred. Some candidates could justify the arrangement for policies with cash values and policy loans.

The company should use mod-co. Mod-co is often used for products that develop cash values in order for the ceding company to retain the assets for investment purposes while still obtaining the surplus relief aspects of coinsurance. Mod-co also eliminates the problem of participating in policy loans by the reinsurer as the ceding company holds all the assets.

6. Learning Objectives:

4. The candidate will understand common valuation and capital techniques used in US, Canadian, and international regulatory frameworks.

5. The candidate will understand various techniques for addressing the mitigation of risk within a life insurance and annuity context.

Sources:
ILA101-117-25: The Handbook of Fixed Income Securities, Fabozzi, 9th Ed. , Ch. 10: Corporate Bonds (pp. 235-262, excluding exhibits 10-1 & 10-2)

ILA101-113-25: Derivatives Markets, McDonald, 3rd ed., Ch. 7 - Interest Rate Forwards and Futures, Sections 7.2 - 7.7LO1 - Understanding Profitability in Life Insurance

ILA101-112-25: Revisiting the Role of Insurance Company ALM within a Risk Management Framework, Goldman Sachs, 2010

ILA101-114-25: Understanding Options Embedded in Insurer's Balance Sheets, Rubin, Ch. 16 of ALM Management of Financial Institutions, Tilman, 2003

Regulatory Capital Adequacy for Life Insurance Companies: A Comparison of Four Jurisdictions (including spreadsheet)

Commentary on Question:
Commentary listed underneath question component.

Solution:
(a) Describe two types of credit risk related to corporate bonds.

Commentary on Question:
*Overall, candidates did well on part (a). Candidates who tied their definitions closely to the wording in the source material scored higher than candidates who were generic or invented risks. Full credit was given for answers that correctly identified and clearly described **two** related risks (for example, default risk and downgrade risk).*

Candidates generally did a very good job of identifying and describing default risk. Fewer identified and described credit-spread risk and downgrade risk.

6. Continued

1. Credit **default risk**
   This is the risk that the bond issuer will **fail to make timely payments of interest and repayment of the amount borrowed.**

2. Credit-**spread risk**
   Credit-spread risk is the risk of financial loss or **underperformance of a bond or portfolio due to changes in this spread.** If spreads widen (for example, due to worsening perceived credit quality or adverse macro conditions), the price of the corporate bond falls relative to Treasuries.

3. (Additional) Downgrade **risk**
   The risk that a bond is downgraded to a lower rating, reflecting deterioration in credit quality and increasing the probability of default. Downgrades are modeled using credit transition matrices.

(b) Construct a duration matched bond portfolio.

Commentary on Question:

- *Many candidates did quite well and correctly identified that both the present value and **duration** needed to be matched. However, very few candidates used the correct discount rate for the duration calculation.*
- *Some candidates did not clearly indicate whether their final portfolio matched the liability duration, making it hard to determine if they understood the objective of the exercise.*
- *Many candidates also relied on excel functions without showing the accompanying formula and work not fully demonstrating their understanding of the calculations.*

Model solution for this question is attached in the excel spreadsheet.

(c) Describe how the changes would impact the SAA.

Commentary on Question:
*Candidates performed generally well on this part of the question. To receive full credit, candidates needed to address **both** changes (duration tolerance and BBB bonds), not just one.*

Many candidates earned partial credit by noting "more flexibility" or "higher yield" but:

- *Only discussed one of the changes in real detail, or*
- *Stayed at a generic risk level without tying it to SAA trade-offs*

Candidates generally did a better job of identifying the impact of including BBB rated bonds than the duration mismatch.

6. Continued

1. Duration tolerance: Increasing the tolerance to ±0.3 years allows greater flexibility in asset allocation, enabling the company to focus on achieving its target yield of 4.5% rather than strictly matching durations.

   Portfolios can tilt slightly shorter or longer in duration relative to liabilities without violating ALM constraints which reduces the need to overweight long-duration assets (which may be low-yielding or expensive).

2. Inclusion of BBB bonds: Adding BBB-rated corporate bonds increases credit default risk due to their higher probability of default, but it also provides the potential for higher investment returns compared to the existing A- and AA-rated portfolio but requires monitoring of the SAA and awareness of the risk.

(d) Explain two ways that effective ALM can reduce regulatory capital requirements.

Commentary on Question:
Candidate performance was mixed on this part of the question. Many candidates correctly stated high-level benefits of ALM but did not clearly take the final step of explaining ***how that translates into lower capital requirements.*** *Those responses received partial credit.*

Candidates struggled to provide two points that were sufficient and often times gave very brief answers with only a short phrase for each point and no explanation.

Additionally, candidates generally identified ways in which ALM can affect regulatory capital with fewer properly tying that into the mechanism for impacting capital.

1. Investing in higher quality corporate bonds directly reduces RBC (C1 risk), as these investments carry a lower capital charge.
   ALM strategies that tightly align the durations and cash flows of assets and liabilities can reduce interest rate and market risk, which in turn lowers the capital charges assigned under regulatory frameworks.
2. Effective asset-liability management (ALM), such as immunization or cash-flow matching, helps minimize interest rate risk by accurately aligning asset and liability cash flows.
   Effective ALM can strategically influence product design and liability structure to reduce the capital needed for insurance risks (e.g., mortality, longevity, lapse). ALM-informed decisions about product mix (e.g., annuities vs. term life) can shift exposures toward liabilities that carry lower capital charges. Shifting toward products that may have more predictable cash flows and hedging opportunities can lower required capital.

7. Learning Objectives:

4. The candidate will understand common valuation and capital techniques used in US, Canadian, and international regulatory frameworks.

Learning Outcomes:

(4a) Describe the US statutory actuarial framework, including the principles-based reserves and calculate basic life insurance reserves.

Sources:

*Statutory Valuation of Individual Life and Annuity Contracts, Volume I,*Chapter 11 – Valuation Methodologies (exclude 11.3.9 to 11.3.11)

ILA101-110-25: Fundamentals of the Principle-Based Approach to Statutory Reserves for Life Insurance, July 2019

Commentary on Question:

Commentary listed underneath question component.

Solution:

(a)

(i) Calculate the reserve at the end of policy year 2 using the Net Level Premium (NLP) reserve method.

(ii) Calculate the reserve at the end of policy year 2 using the Full Preliminary Term (FPT) reserve method.

Commentary on Question:

Part (i) was answered very well by majority of candidates. Some candidates provided an alternative way to calculate the reserve by using the retrospective method which provided full credit for a good application.

Part (ii) was struggled by majority of candidates. Most of the time, candidates could not calculate correctly the FPT expense allowance. Also, a lot of candidates did not recognize that the expense allowance was part of the net level premium which was an important item to understand for the full preliminary term reserve method. An alternative method which was to calculate the premium using the shortcut A1/a1 and performed the reserve calculation correctly was also given full credit.

See Excel Solution.

7. Continued

(b) Critique the following statements from a PBR Actuarial Report for term insurance business under VM-20.

A. Since the group of term policies passes both the Deterministic and Stochastic Exclusion Tests, only the Net Premium Reserve is calculated.

B. Company mortality data is 100% credible, so no margins are included in company mortality assumptions until after the sufficient data period in the deterministic reserve projection.

C. The expense assumptions used are fully allocated and include all federal income taxes.

D. For the deterministic reserve, the present value of cash flows was calculated using the path of 1-year US treasury rates from the prescribed scenario multiplied by 1.05 as the discount rate.

E. The reinsurance credit for coinsurance was calculated as one half of the one-year mean reserve for an annual increasing term policy using the prescribed valuation mortality.

Commentary on Question:
Many candidates were able to answer well A) and B).

For C), on average, candidates recognized that the first part of the statement regarding fully allocating of expenses was appropriate. To earn full credit, they had to clearly state that the second part, which was recognizing federal income taxes was incorrect.

Statement D) showed a moderate understanding where many candidates were able to identify the statement as incorrect but did not provide a good explanation. To earn full credit, candidates could have either recognized that the description referred to the stochastic reserve or instead correctly defined the deterministic reserve.

Statement E) was answered the weakest overall. Candidates often did not recognize that the statement applied to YRT reinsurance. Full credit could be earned by defining the calculation for the reinsurance credit as being the difference between the reserve without reinsurance and the reserve with reinsurance.

7. Continued

A. Incorrect. A group of term policies under VM-20 is not eligible for the deterministic exclusion test and must calculate the Deterministic Reserve.

B. Incorrect. Margins are prescribed and required in deterministic reserve calculation, regardless of credibility.

C. Incorrect. Federal income taxes should not be included in expense assumptions for reserve projections under VM-20.

D. Incorrect. Present value of cash flows for the stochastic reserve should be calculated using the path of 1 year US treasury rates *1.05. Deterministic reserve uses path of discount rates for corresponding model segment.

E. Incorrect. Coinsurance should be modeled for a principle based reserve calculation. Only for YRT reinsurance with non-guaranteed premium rates should the reinsurance credit be calculated as one half of the one year mean reserve for an annual increasing term policy using the prescribed valuation mortality.