ILA LPM Model Solutions
Spring 2022

1.

Learning Objectives:

1. The candidate will understand the designs and risks of the common life and annuity products and features, as well as the methods and metrics used to design and price these products.

Learning Outcomes:

(1q) Describe and evaluate the types of assumptions commonly used in actuarial pricing and product development.

(1s) Describe the framework, process, and significant considerations for creating mortality tables. Describe and apply the methods for determining exposures, and considerations for developing select period mortality rates.

Sources:

Table Development, Feb 2018 (excluding Appendices C, D, F, G & H)

LPM-107-07: Experience Assumptions for Individual Life Insurance and Annuities

LPM-155-19: Understanding Profitability in Life Insurance

Commentary on Question:

Commentary listed underneath question component.

Solution:

(a)

    (i)   List the three components of a life insurer's earnings analysis.

    (ii)   List the drivers and indicators for each component.

Commentary on Question:

Most candidates were able to identify the drivers and indicators required for full credit. However, many candidates were unable to list the components of a life insurer's earnings analysis. Instead, many candidates listed the drivers and indicators.

    (i)   The three components of a life insurer's earnings analysis are as follows:
        1) Underwriting result
        2) Investment result component
        3) Fee income component

1. Continued

    (ii)   The drivers and indicators for each component are as follows
1) Underwriting result
   a. Mortality / morbidity / longevity experience
   b. Lapses / surrender experience
   c. Actual to expected expenses
2) Investment result component
   a. Asset allocation
   b. Investment performance / yields
   c. Crediting rates and investment spreads
3) Fee income component
   a. Investment management fees
   b. Assets under management

(b)

    (i)   Calculate the total exposure using the daily rate exposure method for the study population assuming an annual adjustment of 365.25. Show all work.

    (ii)   Explain why using the daily rate exposure method, rather than the annual rate exposure method, is more accurate in this case.

Commentary on Question:
Candidates generally did well on part (i) of this question. Many candidates gave a full year of exposure for the policyholders who died, which is incorrect. The adjustment to ensure that policyholder 6 had a full year of exposure was required to get full credit for this question.

Candidates generally struggled with part (ii) of this question. Many candidates said the daily rate method was superior to the annual rate method because 2020 was a leap year, but this is not relevant. To get full credit candidates needed to explain why the annual rate exposure method is inappropriate and understated that the mortality rate was high, and explain that the mortality rate is expected to decrease in the future as the pandemic comes to an end.

1. **Continued**

(i)

Policyholder	Entry Date	Exit Date	Days	Portion of Year (Days/365.25)
1	May 15, 2020	Dec 31, 2020	230	0.6297 = 230/365.25
2	Jan 1, 2020	Aug 15, 2020	227	0.6215 = 227/365.25
3	Apr 15, 2020	Dec 31, 2020	260	0.7118 = 260/365.25
4	Jan 1, 2020	Dec 1, 2020	335	0.9172 = 335/365.25
5	Mar 15, 2020	Jul 15, 2020	122	0.3340 = 122/365.25
6	Jan 1, 2020	Dec 31, 2020	365.25	1.000 Manually change the # of days to ensure full year of exposure
7	Feb 15, 2020	Dec 31, 2020	320	0.8761 = 320/365.25
8	Aug 15, 2020	Oct 15, 2020	61	0.1670 = 61/365.25
Total			1920.25	**5.2567**

(ii) The daily rate exposure method is more accurate than the annual rate exposure since there was a high mortality rate and very few exposures. The annual rate method will overstate the total exposure for policyholders who died, and therefore understate the mortality rate. We also expect mortality to decrease in future years as we exit the pandemic. If the study contained more lives or more years, then an annual rate exposure would be appropriate.

(c) Recommend experience assumption methodology improvements to enhance the quality of the experience study. Justify your answer.

Commentary on Question:
This question tested whether candidates understood the various methodologies required for producing a suitable experience study.

Many candidates were able to receive maximum credit by correctly identifying appropriate methodology improvements. However, not many candidates mentioned that studies could be compared to existing tables to identify trends in experience.

1. **Continued**

Methodology improvements that may enhance the quality of experience are as follows:
- Perform an Actual to Expected analysis by comparing experience to the existing assumption tables
- Use industry or reinsurance data to enhance the quality, especially when the company's own experience is not credible
- Perform the study based on amount rather than on count to understand the true economic impacts of the assumption
- Extend the study period to ensure that the assumption being set uses more than the experience from the height of the pandemic.
- Significantly increase the number of policyholders in the study to have a more credible study

2.

Learning Objectives:

1. The candidate will understand the designs and risks of the common life and annuity products and features, as well as the methods and metrics used to design and price these products.

2. The candidate will understand the theory of "Value Creation" for life and annuity products and how to evaluate the patterns of earnings emergence under various regulatory regimes.

Learning Outcomes:

(1p) Describe and apply methods for pricing term conversions.

(2b) Describe and apply the common profit metrics (IRR, Value of New Business, Embedded Value, ROE) used in pricing insurance products.

(2e) Describe and evaluate fundamental strategies for enhancing value through active in-force and operational management.

Sources:
Term Conversions: Pricing and Reserving, Product Matters, Mar 2017

Relationship of IRR to ROI on a Level Term Life Insurance Policy, Product Matters, Jun 2013

Evolving Strategies to Improve Inforce Post-Level Term Profitability, Product Matters, Feb 2015

Commentary on Question:
This question tested the candidates' knowledge of topics related to level term products, including conversion and post-level term experience, premiums, and post-level term optimization. Candidates who did well provided recommendations with justification where asked. Candidates generally did well on parts b and d but struggled with part c.

Solution:

(a) Recommend the most suitable premium scale for the term product using the given lifetime IRR and GAAP ROI. Justify your response.

Commentary on Question:
Candidates were given full credit for recommending a premium scale with appropriate justification. Any premium scale could have been recommended with appropriate justification for full credit. Candidates who provided less thorough justifications such as "Premium scale A has the highest IRR" or "Premium scale C minimizes the differences between IRR and ROI" received partial credit. No credit was given for recommending a premium scale without justification. Examples of full credit responses are given below.

2. **Continued**

Product B has the highest ROI, which uses GAAP assumptions. This is a more accurate representation of actual earnings

Or

I recommend premium scale B which has the second highest lifetime IRR to ensure we have enough cash flow at later duration to cover high death benefits after the shock lapse. It also has the highest GAAP ROI at issue.

(b) Explain possible reasons for the difference in values between lifetime IRR and GAAP ROI, even when experience emerges as expected.

Commentary on Question:
This question tested the candidate's knowledge of slope-inducing variables that create differences between annual ROI and lifetime IRR. Candidates were given full credit for identifying why annual ROI and lifetime IRR cannot, in reality, be equal and for identifying 3 or more slope-inducing variables. Partial credit was given for identifying fewer slope-inducing variables or for stating that unreasonable assumptions must be met without listing any examples.

Some of the assumptions and methodologies that are necessary to produce expected level annual ROIs equal to lifetime IRR are either actuarially unsound or outside of statutory and GAAP accounting conventions. The assumptions and methodologies that are necessary to produce level annual ROIs equal to lifetime IRR, also known as slope-inducing variables, include:

- DAC interest rate equal to IRR rate
- No required capital based on assets, reserves, or insurance inforce net of reserves
- No DAC tax
- Statutory reserves equal to GAAP reserves
- GAAP reserve mortality equal to pricing mortality
- GAAP reserve interest rate equal to pricing earned interest rate
- Lapse rate for GAAP reserves and DAC amortization equal to pricing lapse rate

(c)
    (i) Calculate the term conversion premium rate per thousand of face amount at issue using the given assumptions.

    (ii) Explain what concerns could exist about the cost of term conversions.

2. Continued

Commentary on Question:
Candidates generally struggled with part (i) but did well on part (ii).

For part (i), candidates were expected to calculate premium for a converted policy and a non-converted policy separately and calculate the difference as the term conversion premium. Many candidates calculated one premium using the differenced in the converted and non-converted mortality rates as the mortality rate. Many candidates struggled with calculating survival probability incorporating the expected lapse rate. Credit was given to candidates for reasonable attempts at calculating ABAR and death benefit per $1,000 even if they didn't match the model solution precisely.

For part (ii), candidates who provided 2 or more concerns, one of which must have been related to mortality/anti-selection, were given full credit. Partial credit was given for providing only one concern or for not mentioning mortality/anti-selection of conversions. Examples are provided below but other reasonable responses were accepted for full or partial credit.

(i)

Non-Converted Premium:

Duration (t)	Lapse	Mortality	q_x(total)	p_x	Abar	DB per $1,000	EOY PVFB
0					1		
1	2.5%	0.038	0.062	0.938	0.695	26.4	25.7
2	2.5%	0.044	0.068	0.932	0.639	28.1	26.5
3	2.5%	0.051	0.075	0.925	0.612	31.2	28.6
4	2.5%	0.059	0.083	0.917	0.581	34.3	30.5
5	2.5%	0.068	0.091	0.909	0.543	37.0	31.9
6	2.5%	0.078	0.101	0.899	0.498	38.8	32.5
7	2.5%	0.090	0.113	0.887	0.441	39.7	32.3
8	2.5%	0.104	0.126	0.874	0.370	38.5	30.4
9	2.5%	0.120	0.142	0.858	0.279	33.5	25.7
10	2.5%	0.138	0.160	0.840	0.160	22.0	16.4

Where:

Lapse rate = provided
Mortality rate = provided
$q_x =$ =1-(1-mortality rate)*(1-lapse rate)
p_x = 1- q_x (credit was also given for calculating $_tp_x$)
Abar = any reasonable attempt at calculating Abar was given full credit. A precise formula was not needed.
DB per $1,000 = 1,000 * mortality rate * Abar

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2. **Continued**

EOY PVFB = DB per $1,000 / (1.03)^t

Non-Converted Premium = SUM(EOY PVFB) = 280.3

Converted Premium:

Duration (t)	Lapse	Mortality	q_x(total)	p_x	Abar	DB per $1,000	EOY PVFB
0					1		
1	2.5%	0.042	0.066	0.934	0.690	28.8	28.0
2	2.5%	0.048	0.072	0.928	0.668	32.3	30.5
3	2.5%	0.056	0.080	0.920	0.642	36.0	33.0
4	2.5%	0.065	0.088	0.912	0.611	39.6	35.2
5	2.5%	0.075	0.098	0.902	0.573	42.9	37.0
6	2.5%	0.086	0.109	0.891	0.527	45.2	37.9
7	2.5%	0.099	0.122	0.878	0.469	46.4	37.8
8	2.5%	0.114	0.137	0.863	0.396	45.3	35.7
9	2.5%	0.132	0.154	0.846	0.300	39.6	30.4
10	2.5%	0.152	0.173	0.827	0.173	26.3	19.5

Where:

Lapse rate = provided
Mortality rate = provided * 1.1
q_x = =1-(1-mortality rate)*(1-lapse rate)
p_x = 1- q_x (credit was also given for calculating $_tp_x$)
Abar = any reasonable attempt at calculating Abar was given full credit. A precise formula was not needed.
DB per $1,000 = 1,000 * mortality rate * Abar
EOY PVFB = DB per $1,000 / (1.03)^t

Converted Premium = SUM(EOY PVFB) = 324.9

Term Conversion Premium = Converted Premium – Non-Converted Premium = 324.9 – 280.3 = 44.6

(ii)

1. Anti-selective behavior: The conversion decision is generally one of self-selection: based only on information known to the policyholder, of which none is known to the insurer. This will increase mortality costs.

2. Company must consider who should bear the cost of conversions: the originating term product or the converted WL product.

2. **Continued**

(d)

    (i)   Explain what concerns could exist about post-level term profitability.

    (ii)   Recommend a possible solution to address concerns about post-level term profitability. Justify your answer.

Commentary on Question:
Candidates generally did well on part (d). On part (i), full credit was given to candidates who thoroughly discussed the shock lapse phenomenon on level term products and resulting poor mortality. Partial credit was given for only mentioning lapses or mortality but not both. On part (ii), candidates who did well provided one of three possible solutions, defined the solution, and justified their recommendation. The three acceptable answers are given below but only one was needed for full credit. Many candidates described all three options but did not provide an explicit recommendation. These candidates were given partial credit.

    (i)   The increase in premium at the end of the level-term period leads to a shock lapse event where all but the worst risks are almost guaranteed to lapse and seek new, more affordable coverage. The remaining lives are expected to be in poor health, as they have the greatest incentive to keep their policies in force. Poor mortality on the remaining block reduces profitability of the product.

    (ii)   I recommend simplified re-underwriting. In this scenario, the company offers the insured the option to answer a simplified issue underwriting questionnaire as the PLT approaches. Those who decline to reply default to the traditional guaranteed YRT rate. Under this scenario, the policyowner obtains the benefit of a possible PLT rate discount, while the insurer can be somewhat confident that the discount is warranted. This may encourage healthier policyholders to persist, improving mortality on the PLT block.

        Or

        I recommend the graded approach. This involves using a graded approach when setting premium rates, where PLT rates increase at much smaller increments until a future anniversary. Following the end of this graded period, rates jump to the original YRT schedule. If the premium increases gradually instead of spiking at the end of the level term period, more policies will stay inforce longer, increasing the amount of premium paid to the company over time.

2. **Continued**

Or

I recommend the class continuation approach where the PLT rate is modified based on the insured's select risk class at issue, with rates converging to an ultimate rate in later durations. The continuing-class approach seems to be the fairest approach in that is relies upon the select underwriting to determine the magnitude of the PLT jump. However, the structure, also lends itself to the highest selective lapsation risk among the approaches. Lower rates for healthier individuals, at issue, will improve persistency of healthier policyholders and improve mortality on the PLT block.

3. **Learning Objectives:**
1.   The candidate will understand the designs and risks of the common life and annuity products and features, as well as the methods and metrics used to design and price these products.

Learning Outcomes:
(1a)   Describe the designs of the common life and annuity products and evaluate their associated features and inherent risks.

(1e)   Describe considerations and practices related to "Lapse-Supported" insurance.

(1j)   Describe the operation of Life Acceleration Riders and their role in meeting market needs.

Sources:
LPM-152-19: Lapse Supported Insurance Analysis

LPM-165-20: Life Products and Features

Life Insurance Acceleration Riders, SOA Reinsurance News, 2013, pp. 35-38

Commentary on Question:
This question tested candidates' understanding of two different life insurance riders in the context of a ULSG product. Candidates were expected to understand how product design and assumption development for these riders may differ from base products that the riders could be attached to or patterned after. Candidates were also expected to be able to evaluate these riders in a competitive context.

For both parts (a) and (b), candidates generally performed well when asked to critique the proposed design and assumptions, with many candidates displaying strong understanding of these riders. Some candidates did not perform as well when asked to recommend design changes to minimize risk. Candidates that suggested assumption updates instead of design changes for these parts did not receive credit.

Solution:
(a)   With respect to the proposed 20-year guaranteed level premium term rider:

(i)   Critique the proposed design and assumptions.

(ii)   Recommend design changes to minimize risk.

Commentary on Question:
See commentary above. Many candidates successfully received credit for recognizing that term rider assumptions may be significantly different than ULSG assumptions, and that the shadow account design may not be completely compatible with a term insurance rider.

3. Continued

    (i)   Setting the lapse assumption for the term rider equal to that of the ULSG product is not appropriate. In particular, we would expect a shock-lapse at the end of 20 years which would not be present in the ULSG assumptions. This shock lapse would also be associated with increased anti-selective mortality. Pricing may also need to differ from that of a standalone term product because of different mortality characteristics associated with permanent insurance when compared to term.

           The product design is also flawed in that the charge for the rider is designed to be deducted from the base product account value. However, many ULSG products are designed to have zero account value, so there may not be any account value available to cover the monthly deductions.

    (ii)   One way to minimize risk on the rider is to reduce the maximum face amounts and issue ages allowed on the rider. By doing this, expected claims on the rider are expected to be reduced. The product should also be modified to charge for the rider with an explicit premium to avoid issues with no account value being available.

           Additionally, terminating the rider at the end of 20 years, instead of including an annually increasing post-level-term period, would minimize anti-selective risk associated with shock lapses on term insurance.

(b)   With respect to the proposed chronic illness acceleration rider:

    (i)   Critique the design and risk control considerations.

    (ii)   Recommend design changes to minimize risk.

Commentary on Question:
See commentary above. Candidates performed very well on this section and displayed strong knowledge of chronic illness acceleration riders and associated risks.

    (i)   Underwriting approaches used for the base policy may not be appropriate for the chronic illness rider, as morbidity risks associated with chronic illness claims are not always assessed in standard life underwriting.

           Offering the rider up to age 85 is also risky, as is offering the rider to substandard insureds. In each of these cases, the volume of chronic illness accelerations could be higher than expected in pricing.

           The product should also have strong risk controls around qualifying for a rider acceleration to avoid fraudulent claims.

3. Continued

    (ii)   Limiting the maximum issue age to something lower, such as 65, and not offering the rider to substandard insureds will reduce risk.

        The company should also consider limiting the maximum and/or annual acceleration amounts, as accelerating 100% of the base product's face amount could substantially increase risk.

        Finally, the company could consider using the lien or actuarial discount method rather than a separate rider charge. By doing this, the company avoids much of the risk associated with anti-selective claims on chronic illness riders.

(c)   Recommend changes to the ULSG product design and pricing in consideration of the following:

    (i)   Updated lapse experience

    (ii)   The two new riders

    (iii)   Competitive considerations

Commentary on Question:
Candidates did not perform as well on this section. Many candidates provided general commentary on these items without providing recommendations. These types of responses generally received partial credit.

Candidates were also expected to understand that improved persistency hurts profitability on a lapse-supported product. Answers that suggested that improved persistency improved profitability and competitiveness did not receive credit.

    (i)   Because lapse experience has been lower than expected, we recommend that the company reduce the lapse assumption used in pricing.

        The company should also consider making changes to the shadow account design to provide less favorable guarantees, which may help to bring persistency more in line with what was originally expected.

    (ii)   The term insurance rider may result in additional anti-selective mortality occurring in the post-level-term period if more policies than expected maintain their coverage. This additional mortality needs to be reflected in the mortality assumed for the base product.

3. **Continued**

The availability of the chronic illness rider may further improve persistency as it provides additional motivation for policyholders to maintain their policies. In this case, the company would need to further reduce lapse rate assumptions which will also have a negative impact on profitability.

(iii) In light of the considerations above, premiums will likely need to be increased. This will hurt competitiveness and potentially reduce sales or lead to anti-selective mortality results.

Introducing a Return of Premium rider would help to counteract these considerations and help return the product to a desirable competitive position. The ROP rider would both provide an additional marketing advantage and also may increase lapses at the end of the term period, reducing the profitability impact from lower lapses on a lapse-supported product.

4. **Learning Objectives:**
1.   The candidate will understand the designs and risks of the common life and annuity products and features, as well as the methods and metrics used to design and price these products.

Learning Outcomes:
(1b)   Describe and evaluate methods and metrics used to design and price these products, and assess their profitability.

(1c)   Describe and assess insurance and annuity distribution approaches and the impact of emerging technologies.

(1f)   Describe methodologies, approaches, considerations and tools related to the Underwriting function.

Sources:
LPM-134-15: Digital Distribution in Insurance: A Quiet Revolution

Life Insurance for the Digital Age: An End-to-End View, Product Matters, Nov 2017

LPM-147-17: Life Insurance: Focusing on the Consumer (exclude appendices)

Commentary on Question:
Commentary listed underneath question component.

Solution:
(a)   Propose design elements for a term product to be sold in the direct to consumer channel.

Commentary on Question:
The question is looking for what is important for a direct to consumer product to have, to be successful. Very few papers mentioned making sure the language in the policy be simplified and non-confusing.

Overall this part of the question was not done well. Very few papers commented on the need for simplified, non-confusing language in the policy. Some candidates did mention no complicated riders, no conversion options and/or simplified underwriting.

In the direct to consumer market it is important to have simplified, non-confusing language in the policy. Keep the product simple. No conversion options; no complicated riders; no cash values or non-forfeiture values. Simplified underwriting process. Credit was given for other product features that supported a simple design.

4. Continued

(b) Critique the following statements:

A. *The products offered in the direct to consumer channel should accept alternative forms of payment such as credit card.*

B. *In designing the end-to-end process for purchasing life insurance, there is no need to consider agent involvement since this is a direct to consumer sale.*

C. *The new direct sales channel currently accounts for a small portion of the market so only a small portion of resources should be allocated to the development of this direct to consumer product.*

D. *Conversion options and other complex product options should be clearly described during the online sales process.*

Commentary on Question:
This question is also trying to determine how products in the direct to consumer market need to be different from the traditional sales process products.

Overall this question was not answered well. It seemed candidates were not thinking about the fact this market is fairly new for life insurance sales and that there are going to be growing pains.

A. Most papers did support credit card payments and provided a reason why. Some papers also discussed challenges this option may present.
B. Most papers did recognize agents will still be needed.
C. Most papers recognized the growth potential, and that resources should be allocated to the development of the direct to consumer product, but most didn't discuss the challenges and changes required.
D. A number of papers did not mention that it would be best to keep the products and options simple for online sales, especially in the early stages of using this market.

A. Credit card payment may facilitate identity verification. The increased flexibility in premium payment methods could improve the customer experience. However this could result in higher transaction costs or new compliance requirements or administration changes. Policyholder behavior may change.

B. Modern consumers may prefer to do their own research without the use of an agent, but the advice of agents will still be needed by some customers especially for complex risks. This means the insurer will have to manage multiple distribution channels efficiently.

4.   Continued

Some segments of the target market may be more or less comfortable buying online without interacting with an agent. Older individuals who may be more likely to need or afford insurance may prefer dealing with an agent,

C. Current online sales are a small portion of the market. But there is tremendous growth potential in this market. It's important to invest in this market. Investment in overhauling IT systems to account for multi-channel distribution systems and mobile friendly apps may result in a competitive advantage for the company. Strong customer service will also be important.

D. Consumers are generally happy with their insurance, but also lament the complexity and fine print associated with product descriptions. It is easy for customers to experience information overload. So, ideally complex products and options should not be provided in the direct market. It is better to keep products and options simple and use plain language to explain them. If a more complicated option is provided, the company should be sure to use plain language.

(c)   Recommend four appropriate data elements that this predictive model should use. Justify your answer.

Commentary on Question:
This question was answered fairly well. Partial credit was given for listing the data element even if it wasn't justified. There are other data sources from the 4 listed below such as Public Data, Social Data, and Population-level Open Data and credit was given for any 4 sources and justifications.

Medical Information Bureau (MIB) …. this data source validates prior medical history which helps access current and future mortality depending on the applicant's health.

Prescription (Rx) history ,,,, this source can give clues about potential medical conditions that they are being treated for either for purposes of screening for conditions or verifying responses on an application.

Motor Vehicle Records (MVR) can help identify risky behavior by providing a history of moving violations such as speeding or running red lights, which may be predictors of propensity to engage in other hazardous activities.

Credit Score can be used as a predictor to predict mortality risk, especially for low risk individuals.

5.

Learning Objectives:
5. The candidate will understand the role of the Investment Actuary and the Portfolio Management Process in the Life Insurance company context, as well as the common forms of Fixed income securities and their uses, and the methods and processes used for evaluating portfolio performance and asset allocation.

Learning Outcomes:
(5d) Describe and assess Fixed Asset Portfolio management methods, and immunization (including derivatives) and cash matching strategies, including:
- Considerations such as managing funds against a bond market index, the classification of possible strategies, the impact of risk factors and tracking risk, and the use of indexing and active strategies
- Considerations such as managing funds against liabilities, the use of dedication strategies and immunization strategies, the assessment of risk minimization for immunized portfolios, and the use of cash flow matching and combo strategies
- The use of derivative enabled strategies, and the use of futures, swaps, and options

(5h) Describe and apply conventional yield metrics used in bond performance evaluation.

Sources:
Managing Investment Portfolios, Maginn, John L. and Tuttle, Donald L., 3rd Edition, 2007 - Ch. 6: Fixed-Income Portfolio Management (sections 1-5)

LPM-164-19: Ch. 7 (sections 7.2-7.5 & 7A), McDonald, 3rd Edition

Commentary on Question:
Commentary listed underneath question component.

Solution:
(a) Compare and contrast the following strategies to manage the asset portfolio backing the liabilities:

- Immunization
- Cash flow matching
- Derivatives enabled

Commentary on Question:
Candidates did fairly well explaining the basic ideas behind the three strategies. More credit was given if candidates identified that immunization/ cash flow matching used purchased assets while a derivative enabled strategy used derivatives to protect against interest rate exposure.

5. Continued

- It is important to realize that all three strategies are designed to protect against interest rate risk.
- Immunization attempts to build a portfolio that provides a predetermined return that is unaffected by interest rate fluctuations.
- Cash flow matching builds a portfolio that meets future liabilities by using the coupon and the yield to maturity payments of a bond. Since the bond is held to maturity, the payments are predetermined and will not change with interest rate fluctuations.
- Both immunization and cash flow matching are considered passive dedication strategies since they use fixed income assets to meet liability cash flows.
- A derivative enabled strategy (i.e. future, swaps, options) is used to protect against interest rate risk. Unlike immunization and cashflow matching, this strategy does not own the assets that back the liabilities.

(b) Calculate the amount of cash HLC Life should invest in each of the available assets to implement an immunization strategy.

Commentary on Question:
Candidates did well calculating the present value and duration of the liabilities but struggled with setting them equal to those of the assets. While some candidates used Goal Seek in Excel to determine the cash investment required, most solved two equations and with two unknown variables to determine a solution. Both methods were given full credit.

- Calculate present value and duration of liabilities

Year	Cash Flow	Spot Rate	Present Value of Liabilities	Present Value of Liabilities*Year
1	1,100	2.70%	1071.08	1071.08
2	400	3.10%	376.31	752.61
3	300	3.30%	272.16	816.47
4	200	3.50%	174.29	697.15
5	200	3.80%	165.98	829.88
		Total	2059.81	4167.20

5. **Continued**

Present Value of Liabilities = Σ(Cashflow/(1+Spot Rate)^Year)
= 2059.81

Macaulay duration = Σ(Present Value of Liabilities*Year)/
Σ(Present Value of Liabilities)
= 4167.20/2059.81
= 2.023

- Calculate the duration of the asset

Asset	Maturity	Yield	Present Value of Bond	Present Value of Bond* Maturity	Duration
2-yr zero coupon bond with a yield of 7%	2	7%	.873	1.746	2
4-yr zero coupon bond with a yield of 10%	4	10%	.683	2.732	4

Present Value of Bond = 1/(1+ Yield)^Maturity
Duration of Bond = Present Value of Bond*Maturity/Present Value of Bond

- Solve by setting the Present Value and Duration of Liabilities equal to the Present Value and Duration of the Assets

Solve for Present Value of 2-yr bond purchased and Present Value of 4-yr bond purchased using the following equations:

Equation #1: Present Value of Liabilities = Present Value of 2-yr bond purchased + Present Value of 4-yr bond purchased

Equation #2: Duration of Liabilities = (Present Value of 2-yr bond purchased *Duration of 2-yr bond)/(Present Value of Liabilities) + (Present Value of 4-yr bond purchased *Duration of 4-yr bond)/(Present Value of Liabilities)

Sample Solution
A = Present value of 2-yr bond purchased
B = Present value of 4-yr bond purchased

Equation #1: 2059.81 = A+B
Equation #2: 2.023= A*2/2059.81 + B*4/2059.81

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5. Continued

> A=2036.02
> B=23.79

One year later on 12/31/2022, there was no change to the expected liabilities and the yield curve had a level shift down.

(c)   Assess the impact to the proposed immunization strategy.

Commentary on Question:
Candidates struggled to explain how a level interest rate shift would impact the immunization strategy. Very few were able to conclude that the timing of the yield curve shift would impact the present value of asset and liabilities.

- The present value and duration of both the asset and liability will change due to the interest rate shift.
- Since the yield shift occurred shortly after immunization started and the yield shift was level, the expected difference in present values and durations should be small.
- The duration of the liability will increase since the expected first year cashflow increased more than latter year cashflows.
- Rebalancing the immunized portfolio may be necessary when interest rates change. Too frequent rebalancing may result in increased transaction costs while infrequent rebalancing may cause durations to deviate from target.

(d)   Critique each of the following statements made by the CEO:

A.   In order to manage interest rate risk, our company needs to duration match the liabilities with a portfolio of fixed income assets at time 0, with no further action until all the liabilities are paid out, with no liquidity considerations.

B.   By using fixed income assets to back the liabilities, interest rate risk is the only risk we will need to consider.

C.   Our company should have a portfolio risk indicator when implementing an immunization strategy. This will allow us to compare different asset portfolio options.

Commentary on Question:
Candidates did well on this part of the question. Critiques shared by most candidates lined up with expectations but additional credit could have been awarded with more robust justification.

5. **Continued**

A. False. If there are changes in the yield curve, rebalancing may be required to meet financial objectives. Liquidity concerns should be a key issue when selecting assets during rebalancing.

B. False. Risks such default risk, cap risk and contingent claim risk are other risks that should be considered. If rebalancing is required, reinvestment risk and price risk must also be addressed.

C. True. Having a risk measure for the portfolio would help track its performance and would be a good idea. Some examples of portfolio risk measures include variance, semi-variance, shortfall risk and Value at Risk (VAR).

6. **Learning Objectives:**

3. The candidate will understand common issues and practices related to In Force and New Business Product Management, and how experience studies are designed and used for evaluating past experience and for setting assumptions.

4. The candidate will understand the various forms of traditional reinsurance, will be able to assess how and when they are effectively used, and will be able to perform the associated accounting (from both ceding and assuming perspectives) for basic reinsurance transactions.

Learning Outcomes:

(3a) Recommend and justify changes to nonguaranteed elements such as credited rates, policy charges, policyholder dividends and guaranteed renewable premiums.

(3b) Describe and evaluate compliance with applicable regulations (including NY Reg. 210).

(3d) Describe and evaluate the challenges insurers face in a low and potentially rising interest rate environment.

(4e) Describe and evaluate how strategic/customized reinsurance solutions may enhance insurer prospects.

Sources:
LPM-110-07: Policyholder Dividends

LPM-160-19: Strategic Reinsurance and Insurance: The Increasing Trend of Customized Solutions, pp. 1-4, 14-15 & 18-31

Commentary on Question:
This question tests the candidate's knowledge of reinsurance and participating business. The backdrop is a simple business plan with the objective of entering the par business, and all the considerations required such as governance related to nonguaranteed elements (such as dividends), and dividend best practices. The candidate will understand the various forms of traditional reinsurance, will be able to assess how and when they are effectively used.

Solution:

(a) Describe three types of strategic or customized reinsurance solutions which could help XYZ Life achieve its business plan objectives.

   Commentary on Question:
   Most candidates performed well on this part.

6. Continued

Full credit was given to candidates who described 3 strategic solutions and explained how each solution applied to one or more of XYS business objectives. Partial credit was given if a correct reinsurance solution was provided but did not describe how the solution applied to one of XYZs business objectives.

Monetization of inforce business can be used. As XYZ plans to stop new sales of fixed annuities and it might want to obtain the capital or profits of the inforce fixed annuities. Reinsurance can be used to monetization profits with reinsurer paying ceding commission in exchange for rights to future cashflows under the contract.

Reinsurance solutions for developing a new product which enables strategy and growth can be used to help XYZ switch from selling universal life with lifetime secondary guarantee to participating whole life. XYZ could gain experience in developing and launching participating whole life products. or might gain information about the market, reinsurers can provide capital as a funding for the new product, as well as the underwriting expertise to help developing the product.

Reinsurance solutions of surplus relief and risk transfer can reduce the required capital can help to increase available capital for future growth. Reinsurance can be used to transfer risks to reinsurers and reduce the required capital so that the capital that is freed up can be invested in other more profitable areas and in other projects for future growth.

Alternative solution:

100% Coinsurance of the fixed annuities: Under such agreement, the risk embedded in the fixed annuities is shared proportionally with reinsurer, which minimize the related risks. Also, XYZ could gain reserve credit and available capital released for further growth.

Assumption reinsurance. This reinsurance agreement is like the sale of whole block of business to the reinsurer. Given the low interest rate environment, the sales of the ULSG business could help XYZ gain capital for its business development.

Modified coinsurance for Participating Whole Life product. With the Mod-co, the Par whole life product's risk is split proportionally with the reinsurer. This agreement allows XYZ gain reserve credit and release of capital for its business plan.

6. Continued

(b) Assess how XYZ Life may need to update its corporate governance to prepare for issuing participating whole life policies.

Commentary on Question:
Most candidates received only partial credit on this part.

The objective of this question is to test the candidate's ability to identify key considerations for establishing a dividend policy. Full credit was given for 4 reasonable considerations identified by the candidate. The candidate did not need to explain what sort of approach the company should take for each consideration since there can be multiple valid approaches for some.

Solution (any 4 reasonable considerations such as):

XYZ's corporate governance may need to be updated to establish the level of aggregate dividends to be distributed as approved by the board. This includes how the dividend scale will be managed.

Establish methodology for managing pattern of scale over time such as relying on pegging or substitution ("dividend stabilization")

Establish how different groups/classes will be determined based on experience or how investments are tracked/managed Dividend strategy

Determine how investment income will be allocated / credited, such as the treatment of unrealized gains/losses for certain asset classes or if returns are measured using portfolio earned rates vs new money (investment year) rates

Ensure that expenses are fairly allocated between classes based on factors such as inflation and higher maintenance costs later in a policy's lifespan

The participating account surplus should be managed to avoid excessive terminal dividends to avoid creating tontines

Ensure there is clear guidance on how surplus flows between participating and non-participating accounts/funds (e.g. if surplus needs to be borrowed and repaid)

6. Continued

(c) Critique each of the following product design proposals for the new participating whole life product:

A. *To help promote the launch of the product, XYZ Life's illustration software will reflect a special one-time dividend paid out of retained earnings from its non-participating term business.*

B. *The cost to migrate to a new policy administration system will be borne by newly issued policies by embedding it in acquisition expenses.*

C. *Because of low fixed income yields, the investment strategy includes a greater amount of equities than other asset classes; realized gains are paid to the policyholders through the investment component of the dividend scale, once the stock is sold.*

Commentary on Question:
Most candidates did well on this part.

Full credit was given for each part stating whether the statement is appropriate or not and justifying the answer.

A. This is an inappropriate initiative: Exceptional one-time dividends should not be illustrated to new business

B. This may be appropriate: In general, expense allocations should not favor new business at the cost of older in force policies; consideration would need to be made in terms of how expense savings are measured, and if the decision to invest in the system was driven by new business (e.g. would not have been done if the in force was being run off).

Alternately
This is inappropriate: Assuming the new admin system will support inforce business as well new business, the cost should not be considered an acquisition expense.

C. This is not appropriate: Capital gains (realized or unrealized) is an intergenerational equity issue. If the equity is material, the earnings should be paid to the block of business producing the cash flow before most of the policies terminate. So, if there is no guarantee the assets will be sold over that timeframe, the company might impute some form of bond-type return to common stock or real estate and monitor against the actual underlying assets.

7. **Learning Objectives:**
4.   The candidate will understand the various forms of traditional reinsurance, will be able to assess how and when they are effectively used, and will be able to perform the associated accounting (from both ceding and assuming perspectives) for basic reinsurance transactions.

Learning Outcomes:
(4a)   Evaluate and analyze traditional and advanced reinsurance transactions, and prepare related financial statement entries.

(4b)   Describe and evaluate indemnity reinsurance and evaluate its use, forms, and requirements.

(4c)   Describe risk transfer considerations, and evaluate their impact on reinsurance agreement provisions.

(4e)   Describe and evaluate how strategic/customized reinsurance solutions may enhance insurer prospects.

Sources:
Life, Health & Annuity Reinsurance, Tiller, John E. and Tiller, Denise, 4th Edition, 2015
- Ch. 4: Basic Methods of Reinsurance

Life, Health & Annuity Reinsurance, Tiller, John E. and Tiller, Denise, 4th Edition, 2015
- Ch. 7: Reinsurance of Inforce Risks

Life, Health & Annuity Reinsurance, Tiller, John E. and Tiller, Denise, 4th Edition, 2015
- Ch. 9: Risk Transfer Considerations (pp. 269-280)

Commentary on Question:
Commentary listed underneath question component.

Solution:
(a)   Propose an appropriate type of reinsurance for AWL Life. Justify your answer.

Indemnity reinsurance is an appropriate option for AWL Life.

- If the subject business generates gains over the long term and incurs little upfront costs, under indemnity reinsurance, gains can be amortized over future years while losses can be recognized immediately, this type of reinsurance can lock in some level of future profits and may therefore be more favorable for AWL Life.
- Since AWL Life has an existing agency force selling similar products, indemnity reinsurance is preferred; it allows AWL Life to continue utilizing existing agency forces to sell similar products.

7. **Continued**

- Indemnity reinsurance is a quicker process and allows recapture with relative ease; if AWL Life is looking to recapture the block of business at a future date, indemnity reinsurance is preferred.

(b)   For the proposed reinsurance transaction.

(i)   Calculate the premium per thousand on a Yearly Renewable Term basis, if AWL Life expects to increase total capital by at least 20%. Show all work, using the financial statements in Excel.

(ii)   Calculate the ceding percentage on a Modified Coinsurance basis if ONA Re is unwilling to accept a reduction in capital of more than 20%. Show all work, using the financial statements in Excel.

Commentary on Question:
The question asked candidates to construct financial statements to evaluate and analyze two basic reinsurance methods – YRT and Mod-co. Candidates generally did not perform well on this question. Many candidates could not demonstrate how YRT or Mod-co work. Some of the common mistakes included the following:
- *Not using Terminal reserve in the NAR calculation under YRT transaction*
- *Not calculating reinsurance allowance for premium under Mod-co transaction*
- *Not applying ceding% on Mod-co premium*
- *Treat Mod-co ceded reserve as a liability for ONR Re*

Candidates that got incorrect value for early steps were still given full credit for later steps as long as the methodology in later steps was correct. Candidates also received full credit for the correct calculation whether they assumed the face amount was denominated in units or thousands of units.

Full Income Statement and Balance Sheet are shown in the Excel. Only major steps are listed below. All numbers are in thousands

(i)   AWL Life

Without Reinsurance
Gross Premium = face amount × direct premium per thousand
$$=5,000 \times 0.95 = 4,750$$
Investment Income from Surplus = initial Surplus × investment return
$$= 1,500 \times 17\% = 255$$
Total Revenue = Premium + Investment Income = $4,750 + 255 = 5,005$
Reserve Increase = time 1 reserve – time 0 reserve = $850 - 100 = 750$

7. Continued

Commission = Gross premium × commission%=4,750 × 80%= 3,800
Premium tax = Gross Premium × Premium tax% = 4,750 × 2.5%=119
Expense = Commission + Underwriting expenses + maintenance + premium tax
    = 3,800 + 300 + 50 + 119 = 4,269

Net Income = Revenue – Reserve Increase – Expense
    = 5,005 – 750 – 4,269 = (14)
Total capital = Initial Surplus + Net Income = 1,500 – 14 = 1,486

With YRT Reinsurance
NAR for YRT =(Face amount-Terminal Reserve) × (1-Retention%)
    =($5,000-$250) × (1-10%)=$4,275
Ceded Premium = YRT NAR × YRT Premium per thousand
Ceded reserve = YRT NAR × Yearly Renewable Term mean reserve per thousand
    = 4,275 × 0.14= 599
Reinsurance allowance = Ceded Premium × Premium tax
    = ceded premium × 2.5%

To allow AWL life to meet its post-transaction capital requirement: minimum of 20% increase in capital, the total capital has to increase from $1,486 to $1,784 (1,486 × 120% = 1,784)

Use goal seeker to solve for YRT premium per thousand to be 7.2%

(ii)   ONA Re
Without Reinsurance
Investment Income from Surplus = Initial Surplus × investment return
    = 3,000 × 20% = 600
Total Revenue = Investment Income = 600
Net Income = 600
Total capital = Initial Surplus + Net Income = 3,000 + 600 = 3,600

With Mod-co Reinsurance
ModCo premium = Face amount × Mod-Co Premium × Mod-Co Ceding%
    =5,000 × 0.8 × Mod-Co Ceding%

Reinsurance allowance for Premium tax= Modco Premium × Premium tax
    = ModCo premium × 2.5%
Reinsurance allowance for expense allowance= Modco Premium × expense allowance% = Modco premium × 90%

ModCo Adjustment = Reserve Increase × Mod-Co Ceding%

7. **Continued**

ModCo adjustment is a "benefit" item, not a "revenue" item or an "expense" item for ONA Re; there is no interest on prior period reserve in the ModCo adjustment because this is a new transaction, interest is paid at the beginning of the year, and prior period reserve is 0 for ONA Re

Unlike YRT or Coinsurance, the ceded reserve is not a liability item for ONA Re's, AWL Life maintains the entire reserve balance, instead, the reserve increase is funded by the ModCo adjustment

To allow ONA Re life to meet its post-transaction capital requirement: maximum of 20% decrease in capital, the total capital has to decrease from $3,600 to $2,880 ($3,600 \times 80\% = 2,880$)

Use goal seeker to solve for Mod-Co Ceding% to be 97.8%

(c)   Critique the following statement:

The block of business contains flexible premium universal life products. After examining the significant risks of the business, ONA Re agreed to provide surplus relief to AWL Life for the next year. Under the surplus relief treaty, all underlying assets backing the liabilities will be transferred from AWL Life to ONA Re, and the appropriate amount of reserve credit will be provided to AWL Life.

Commentary on Question:
This question tests candidates' understanding of the Life & Health Reinsurance Agreement Model Regulation and identify all risks that are significant for flexible premium universal life products. Most candidates understood that in order to receive reserve credit, all significant risks have to be transferred, but they failed to identify that the treaty cannot be on temporary basis just for next year.

- Under the Life & Health Reinsurance Agreement Model Regulation, the treaty does not appear to transfer adequate amount of risk, and is short-term in nature, hence reserve credit may be denied.
- It is appropriate for ONA Re to examine all significant risks of the subject block of business, however, flexible premium universal life products possess more than asset risk, mortality and lapse are also significant risks that need to be considered.
- Transferring the assets backing the liabilities only partially legitimates the treaty, in order for AWL Life to receive the desired amount of reserve credit, mortality and lapse risks must also be transferred.
- Surplus relief treaties that are short-term in nature may be viewed as illegitimate under Life & Health Reinsurance Agreement Model Regulation.

8.

Learning Objectives:

3. The candidate will understand common issues and practices related to In Force and New Business Product Management, and how experience studies are designed and used for evaluating past experience and for setting assumptions.

Learning Outcomes:

(3d) Describe and evaluate the challenges insurers face in a low and potentially rising interest rate environment.

(3f) Describe and evaluate approaches for quantifying the price of VA guarantees and evaluating hedge effectiveness.

Sources:

LPM-156-19: The Impact of Stochastic Volatility on Pricing, Hedging and Hedge Efficiency of Withdrawal Benefit Guarantees in Variable Annuities

Transition to a High Interest Rate Environment: Preparing for Uncertainty, SOA Research, Jul 2015, Executive Summary, section IV: parts C (1-4 & 8-11 only), D, E & H

LPM-157-19 Diversification of Longevity and Mortality Risk.pdf

Commentary on Question:

Candidates who did well on this question had a solid understanding of the various benefit designs and basic mathematical workings of the product and had a solid intuition with respect to the risk exposure of particular product features.

Solution:

(a) Calculate the permitted withdrawal benefit in each year for a policyholder, assuming the benefit is elected in year 1 for each of the following two scenarios' market returns on the variable subaccount.

Year	Scenario 1	Scenario 2
1	0%	6%
2	-3%	9%
3	6%	-5%
4	9%	0%
5	-5%	-3%

Commentary on Question:

On the whole candidates did fairly well on this part of the question. However, candidates struggled to receive full credit on this part because they failed to correctly reflect the impact of regular withdrawals (the question mentioned to assume the benefit was elected in year 1). Partial credit was also given for the correct construction of the benefit base value and guaranteed withdrawal amount.

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8. Continued

Solution: see spreadsheet from rubric

(b)   Evaluate how each of the following product changes would impact the volatility of the product cash flows and hedging of the product. Assume the same initial annual withdrawal percentage.

    (i)   Removal of the ratchet feature.

    (ii)   The addition of a remaining withdrawal benefit base ratchet.

Commentary on Question:
Candidates performed poorly on part b). While most candidates were able to correctly identify the different benefit structures and describe the implications for cash flow volatility, many struggled to completely capture the hedging considerations across each benefit. Partial credit was awarded where candidates were able to identify the impact but failed to fully evaluate the impact, as well as credit for responses that only considered product cash flow volatility or only considered hedging.

    (i)   Removal of the ratchet reduces the GLWB upside potential and would extend the period before the AV is exhausted. Additionally, without the ratchet there would no longer be any volatility around the withdrawal benefits -- providing a known deterministic cash flow. Removal of the ratchet increases the delta because the guarantee is not adjusted when fund prices rise.

    (ii)   The Remaining WBB Ratchet has a higher likelihood of increasing the GLWB amount since the market only has to out perform fees instead of fees and the GLWB. Due to the increase in the GLWB amount, all else equal, this design would exhaust the AV more quickly. The higher ratchet increases the vega since the ratchet will gain in more value as volatility is increased. Increased delta or vega increases the cost of the hedges which reduces profitability.

(c)   Compare how a rising interest rate environment would impact this VA with a GLWB versus a fixed deferred annuity without a GLWB.

Commentary on Question:
Candidates performed consistently well on this part of the question, however they tended to have weaker responses when considering the impacts of the rising rate environment on the VA – tending to account for the underlying investment accounts or the guarantee option value but did not consistently account for both.

8. Continued

The main risk in a rising interest rate environment for fixed annuities is disintermediation risk. This is the risk that assets are sold at a loss in order to fund the cash flow needs created by excess lapses. As interest rates rise, new money rates will also rise and customers are likely to leave older policies for those higher rates. Surrender charges and MVAs provide some dampening effects to this. In contrast, for the VA with GLWBs the guarantees would be worth less as interest rates rise and therefore would be cheaper to provide/hedge for. Contracts are also less likely to be in-the-money as interest rates rise.

(d) Evaluate the impact to MSQ's risk exposure of adding a new term life insurance product to MSQ's current product portfolio.

Commentary on Question:
On the whole candidates did very well at identifying the natural hedge between the existing longevity exposure from the annuity business and the mortality exposure from the proposed term business. However, most candidates failed to recognize that the mortality and longevity risks are not always perfectly offsetting and therefore additional analysis is required.

Annuities (especially GLWB features) expose the company to longevity risk. Decrease in mortality rates will result in losses. These losses can be offset by reduced life insurance death claims. There is a relative diversification benefit between the longevity of an annuity product and mortality of a life insurance product. However, the actuary should not presume this is a perfect offset. It is important to analyze the direct risk interaction between different types of business. This can be done by varying the volume of the life insurance versus annuity business. Nevertheless, the addition of term life would, in general, improve the risk exposure of MSQ.

9.

Learning Objectives:

5. The candidate will understand the role of the Investment Actuary and the Portfolio Management Process in the Life Insurance company context, as well as the common forms of Fixed income securities and their uses, and the methods and processes used for evaluating portfolio performance and asset allocation.

Learning Outcomes:

(5b)   Describe and evaluate how a company's objectives, needs and constraints affect investment strategy and portfolio construction (including capital, funding objectives, risk appetite and risk return tradeoff, tax and accounting, accounting considerations, and constraints such as regulation, rating agency ratings and liquidity.

(5c)   Describe and assess the role of and significant considerations related to the design and function of asset allocation strategies.

(5e)   Describe and assess Alternative Investment Portfolios (including real estate) in the context of an insurance company portfolio.

(5f)   Describe and apply methods and processes for evaluating portfolio performance, including performance attribution, sources of earnings analysis on investment income, benchmarks, metrics, and risk adjusted performance appraisals (including total return vs reported earnings).

(5i)   Describe the attributes of US Treasuries, Agency Debt Securities, Municipal bonds, Corporate bonds, Private Money Market securities, Floating Rate Agreements, Agency Mortgage Backed securities, Agency Collateralized Mortgage securities, Interest Rate Swaps and Swaptions, Credit Derivatives and High Yield Bonds, and the markets they are traded in.

Sources:

Managing Investment Portfolios, Maginn, John L. and Tuttle, Donald L., 3rd Edition, 2007 - Ch. 5: Asset Allocation (sections 2-4)

Managing Investment Portfolios, Maginn, John L. and Tuttle, Donald L., 3rd Edition, 2007 - Ch. 8: Alternative Investments Portfolio Management (section 3)

Handbook of Fixed Income Securities, Fabozzi, Frank J., 8th Edition, 2012 - Ch. 62: Interest-Rate Swaps and Swaptions (pp. 1445-1468 & 1475-1478)

Handbook of Fixed Income Securities, Fabozzi, Frank J., 8th Edition, 2012 - Ch. 66: Credit Derivatives (pp. 1541-1559)

Commentary on Question:
Commentary listed underneath each question.

9. Continued

Solution:

(a) List two criteria that can be effective when specifying an asset class as part of a strategic asset allocation.

Commentary on Question:
Generally, candidates did well on this question. However, no point was given to candidates answered how to identify the asset class, such as minimum return and short fall risk.

- Assets within a class should be homogenous
- Asset classes should be mutually exclusive
- Asset classes should be diversifying
- The asset classes as a group should make up a preponderance of world investable wealth
- The asset class should have the capacity to absorb significant fraction of the investor's portfolio without seriously affecting the portfolios liquidity

(b) Propose an asset allocation method for each of the following scenarios. Justify your answer.

    (i) RPS Life believes international equities will outperform domestic equities in the next few months.

    (ii) RPS Life's primary investment objective is to generate stable returns to meet claims obligations in the long term. It is not interested in risky assets, instead, it favors corporate bonds or stocks of large cap companies.

Commentary on Question:
Overall, the candidates did very well on this question, they explained the characteristics of each asset allocation method and linked to the scenario.

part i) - recommend tactical asset allocation
- tactical asset allocation involves making short-term adjustments based on short-term expectations
- if RPS Life's investment horizon is the next few months, it is short-term in nature
- tactical asset allocation entails adjustment asset class weights in the short-term, if RPS life would like to invest in international equities in the short-term, tactical asset allocation is more suitable

9. Continued

part ii) - recommend strategic asset allocation
- strategic asset allocation takes the investor's objective, risk tolerance level, investment constraints into consideration with a long-term view
- RPS life possesses a clear objective (to meet claims obligations), low risk tolerance level, and a clear preference in terms of investment vehicles (corporate bonds or stocks of large cap blue chip companies), therefore, strategic asset allocation is more suitable

(c) Identify the asset allocation with the highest risk-adjusted expected return while satisfying Roy's Safety-First criterion. Justify your answer.

Commentary on Question:
Overall candidates did well on this calculation question and wrote down the correct formula. For the risk-adjusted expected return, points were deducted if standard deviation of return was used instead of variance. Points were also deducted if candidates calculated the safety-first threshold level as -2.5%.

Part c)

$$U_m = E(R_m) - 0.005R_A\sigma_m^2$$

Asset Allocation	Expected Return	Standard Deviation of Return
A	15%	20%
B	15%	25%
C	3%	1%

Step 1) Calculate the risk-adjusted expected returns for each process

Ra	0.50
Assets	200
Maximum loss	5

A	15%
B	15%
C	3%

Process A and B have the same risk-adjusted expected return, therefore the choice will need to be made after examining the safety-first ratios

Step 2) Max loss threshold/Total assets = $5M/$20   2.50%
This implies the safety-first threshold level is 2.5%

$$SFRatio = \frac{E(R_P) - R_L}{\sigma_P}$$

Step 3) Calculate the safety-first ratio for process A and B

A	63%
B	50%
C	50%

Process A has the highest safety-first ratio and the highest risk-adjusted return, hence is the optimal choice

9. Continued

(d)   Critique the following statements:

    A.   Credit Default Swaps have an upfront payment that is always paid by the protection buyer to the seller. The premium leg paid by the buyer is constant and calculated as the coupon rate multiplied by the notional amount, and then multiplied by the fractional year.

    B.   It can be beneficial for RPS Life to purchase direct ownership in commercial real estate buildings instead of REITs.

    C.   From 1990-2004, the NCREIF Index had a standard deviation of 3.4%, while S&P 500 had a 14.7% standard deviation, and the Lehman Aggregate Bond Index had 3.9%. Therefore, direct real estate investments are the least volatile, comparing to equities and bonds.

    D.   Interest rate swaps are low risk investment vehicles and do not expose the firm to additional risks. All securities and commercial banks can be swap dealers.

    E.   Credit Default Swaps are terminated upon a credit event and are not payable on soft credit events.

    F.   In a credit event, the protection leg must payout a cash amount equal to par minus the recovery price, determined by an auction.

Commentary on Question:
To get full credit on each statement, the candidate needed to confirm if the statements were True or False and provide rationale and implications of the statements. Partial credit was given for identifying True or False, or providing rationale or implications. No credit was given if candidates did not explicitly conclude "correct" for A (second statement) and E (first statement).

A. The first statement is incorrect - the upfront payment can be positive or negative. A negative payment can occur if the fixed coupon is higher than the credit spread. This is common if the credit quality has improved (buyer pay or seller pay)
The second sentence is correct.

B. Incorrect - If RPS Life only wants to spare a small amount of money in real estate investment, it will not have the ability to invest in direct ownership of commercial real estate buildings; investing in REITs is a better choice. REITs can securitize illiquid assets and permit smaller investors to gain real estate exposure.

9. Continued

C. Incorrect - NCREIF Index is representative of the performance of private real estate funds; the low standard deviation is indicative of volatility dampening associated with smoothing because of stale valuations, correcting for smoothing, the volatility increases substantially, which doesn't make it the least volatile investment when comparing to equities and bonds. If RPS Life has low risk tolerance, bonds are still the best option.

D. Incorrect - the first statement is incorrect - Interest rate swaps expose the firm to default risk (called counterparty credit risk) which is something RPS Life should seriously consider.
The second statement is incorrect - not all securities firms and commercial banks can be swap dealers because of counterparty risk, in fact, some firms have established subsidiaries that are separately capitalized, so they have a high credit rating that permits them to enter into swap transactions.

E. The first statement is correct - CDS are terminated upon a credit event.
 The second statement is incorrect - CDS are payable on restructures, which is the only soft credit event.

F. Incorrect - The market provides two mechanisms for the protection seller to affect the payment of protection:
  1) pay a cash amount equal to par minus the recovery price determined by an auction
  2) request physical settlement which means they will pay the contract notional in cash and receive the corresponding face value of deliverable obligations at the price determined by the auction.

10. **Learning Objectives:**
1. The candidate will understand the designs and risks of the common life and annuity products and features, as well as the methods and metrics used to design and price these products.

Learning Outcomes:
(1b) Describe and evaluate methods and metrics used to design and price these products, and assess their profitability.

(1n) Describe and apply the requirements of applicable ASOPs on Life and Annuity Product Pricing and Assumptions

Sources:
LPM-165-20: Life Products and Features

ASOP 2: Non-guaranteed Charges or Benefits for Life Insurance Policies and Annuity Contracts, exposure draft, June 2020 (excluding Appendices)

Commentary on Question:
Overall, the candidates did well for this question. For parts (b) and (c), maximum credits were obtained by the candidates who clearly specified whether they agree or disagree with the statements, and then supported by providing rationale.

Solution:
(a)
(i) Compare and contrast the new money crediting method versus the portfolio crediting method.

(ii) Analyze the impact of interest rate anti-selection on UL product pricing and profitability.

Commentary on Question:
Most of the candidates answered this section appropriately.

(i)
- The portfolio crediting method credits the same interest rate to all fund values for all policies of a given plan or plans, which is often based on a portfolio of assets that the company is managing to back these policies.
- In contrast, the new money interest crediting method will credit varying interest rates to different pieces of a fund's value according to when premiums were received.
- New money crediting products can appear more competitive in times of rising interest rates, because the credited rate on new premiums can rise by an equal amount, and the credited rate is quicker to respond to changes in interest rates.

10. Continued

- On the other hand, the credited rate on portfolio crediting products will lag interest rate changes, which is a competitive advantage in a decreasing interest scenario.
- From an operational standpoint, the portfolio crediting method is also simpler to explain and administer.

(ii)

- In the event that external interest rates become significantly higher than the rate credited to the cash value on a UL policy, the policyholder may choose to withdraw some or all of the cash value and invest it at higher rates elsewhere (i.e., disintermeditation risk).
- This issue is further compounded by the reduced market value of the assets held by the company that have to be sold to fund the resulting lapse or partial withdrawal (i.e., capital loss), which can result in a significant hit to profitability.
- UL products are particularly sensitive to interest rate risk because of the credited interest rate and greater availability of partial withdrawals. Therefore, the pricing actuary should develop and analyze a range of investment and interest crediting strategies under different interest scenarios (e.g., via stochastic scenario analysis), in order to quantify the appropriate charge for the interest rate risk. Furthermore, the base and dynamic lapse assumptions should be reviewed and periodically updated to reflect emerging experience, since policyholder behavior can significantly impact profitability as well.
- From a product design perspective, the actuary should also consider the implications of any guarantees offered on this product, such as guaranteed COIs, expenses, and/or minimum crediting rate.

(b)

(i) List four considerations when recommending a revision to NGE scales.

(ii) Critique each of the following statements excerpted from your company's NGE framework:

A. *NGE scales on in-force policies should be reviewed no less frequently than every 3 years.*

B. *Policy class assignments for in-force policies should be redetermined during each NGE review cycle.*

C. *Any changes to the defined profitability metrics for the purpose of evaluating NGEs are discouraged.*

10. Continued

Commentary on Question:
For (i), while most of the candidates stated the anticipated experience factors, they stumbled on highlighting other considerations. Some candidates listed the requirements instead of considerations.

For (ii), it was expected that the candidate would first comment whether the statement is correct or not, and then provide rationale. Most of the candidate failed to recognize that there is nothing wrong with the periodic review happening at least once every three years.

(i)   Listing any four points would get the full credit
   - Time elapsed since NGE scales were last reviewed
   - The anticipated experience factors that are used for revising NGE scales
   - Deviations in emerging experience from what was assumed in the prior determination of NGE scales
   - How any recommended revision could affect reserves, capital, reinsurance, taxation and regulation
   - The appropriateness of the profitability metrics and objectives
   - The change in the prospective profitability due to the change in anticipated experience factors and any other relevant additional factors
   - The complexity of the analysis needed
   - Whether other analyses, such as sensitivity analysis, are needed
   - Costs, practical implementation difficulties, and materiality of making revisions to the NGE scale
   - Potential impacts on the policyholder or insurer of revising or not revising NGE scales to reflect changes in anticipated experience factors

(ii)
   A. No edits needed - per ASOP No. 2, the NGE determination policy should consider periodic review of NGEs on in-force policies, such as the maximum time period between successive insurer reviews of NGEs. It should not exceed five years.

   B. Edits are needed - per ASOP No. 2, the actuary should recommend that in-force policies remain assigned to their policy classes, unless there is new information that is material to the anticipated experience factors and supports reassigning the policies to different policy classes.

10. Continued

        C. Edits are needed - per ASOP No. 2, when considering whether to recommend a revision to NGE scales, the actuary should also consider the appropriateness of the profitability metrics and objectives at that point in time.

(c)   Evaluate compliance with ASOP 2: Non-guaranteed Charges or Benefits for Life Insurance Policies and Annuity Contracts, with respect to your coworker's analysis.

Commentary on Question:
This question was answered well by most of the candidates. However, some candidates failed to comment on the pattern of profits to determine compliance.

        A. Expense charges – Complies with ASOP2. The pattern of profits remains in line with those of original pricing, and the NPV is not materially greater than baseline NPV, so the proposed NGE scale **does not violate the guidance** set forth in ASOP No. 2.

        B. COI charges – Does not comply with ASOP2. The pattern of profits deviates materially from those of original pricing (i.e., significantly greater throughout), and the NPV is also materially greater than baseline NPV, so the proposed NGE scale **violates the guidance** set forth in ASOP No. 2.

        C. Crediting rate – Does not comply with ASOP2. The NPV is not materially greater than baseline NPV, but the pattern of profits deviates materially from those of original pricing (i.e., there is a projected spike in 3 years), so the proposed NGE scale still **violates the guidance** set forth in ASOP No. 2.