ILA LPM Model Solutions
Fall 2024

1.   **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:
(3i)   Describe standards for illustrations in both the United States and Canada

Sources:
LPM-172-23: Canadian Life and Health Insurance Guidelines (CLHIA) - Guideline G-6 – Illustrations

ASOP 24: Compliance with the NAIC Life Illustrations Model Regulation , December 2016

Commentary on Question:
The question was to test the candidate's knowledge of illustrations. Overall, many candidates didn't answer this question well. Many candidates misinterpreted what information was being asked for and provided irrelevant responses. Part (c) was generally the most poorly done, while (a) and (b) received partial credit. Answers were largely consistent across candidates with most credit being received for the same sections.

Solution:
(a)   Identify two missing or incomplete elements of each of the following sections of the illustration in accordance with CLHIA Guideline G-6:

      (i)   Policy Information

      (ii)   Policy Values

      (iii)   Illustration Scenarios

      Commentary on Question:
      Many candidates recognized the second scenario should be less favorable or assumptions should have been provided. Many critiques provided on Information and Values were irrelevant. Most candidates lost points as they didn't state the generic product description, the abbreviation of CSV should not be used in the illustration, or note that the start date of the illustration was incorrect.

1. Continued

> (i).
>
> - The product name should avoid company-specific or product-specific terminology that does not clearly indicate the nature of the product. A consumer-friendly description should accompany the terminology. The product appears to be paid up at age 65 but is not stated in the description.
>
> - Since the illustration states that the policy has a loan balance, the current policy loan value should be disclosed.
>
> (ii).
>
> - The illustration does not specify which values are guaranteed vs non-guaranteed which is required in an illustration.
>
> - CSV should be written out as cash surrender value. All terminology should be evaluated carefully to determine whether it is understandable by a reasonable consumer. If the terminology could be misinterpreted or is not likely to be understood by a reasonable consumer, it should be avoided.
>
> - An in-force illustration should reflect the current status of the policy. This illustration shows scenario values since inception of the policy instead of actual current cash value and dividend accumulations.
>
> (iii).
>
> - An illustration should include at least two scenarios. One of these scenarios, the primary scenario, should be drawn from an identified range of scenarios that the insurer judges as reasonable. The second scenario should be less favorable than that primary scenario.
>
> - The illustration does not outline the key assumptions used within the scenarios as required.

(b)   Critique the following excerpts from JET Life's illustration in accordance with CLHIA Guideline G-6:

> A.   *The illustrated scenarios above represent reasonable projections of possible scenarios. The actual value of your policy may vary but will likely be higher than the primary scenario.*
>
> B.   *Illustrated dividends are based on the current dividend scale as of the date of this illustration and cannot be guaranteed.*
>
> C.   *Dividend accumulations will be credited an interest rate to be determined by the insurer annually.*
>
> D.   *The scenarios shown in this illustration are consistent with those developed at the time of the pricing of your policy.*

1. Continued

(A).
- Illustrations are not meant to be predictive. The assessment that actual values of non-guaranteed elements may be higher than illustrated is not appropriate in an illustration.

(B).
- The statement accurately states that dividends are a non-guaranteed element.

(C).

- The illustration should indicate whether there is a minimum guaranteed rate and, if there is, what that minimum is or if a formula exists for determining the rate.

(D)

- The process of identifying a range of scenarios should be done at least annually. If the new identified range differs from the previous one, the new basis should be implemented within a reasonable period of time, i.e., 90 days. The scenarios should not be the same as those developed at pricing.

(c) Contrast how the following elements of an illustration differ between Canada and the US.

(i) The role of the actuary preparing an illustration

(ii) Illustration of non-guaranteed elements

(iii) Mortality assumptions

1. Continued

(i).

- In the US, an illustration actuary must be appointed in writing, and the actuary must meet the qualifications described in the Qualification Standards for Actuaries Issuing Statements of Actuarial Opinion in the US.

- Canada does not require appointment of an illustration actuary.

(ii).

- In the US, the illustrated scale must be no more favorable than the currently payable scale or the disciplined current scale at any duration.

- In Canada, at least two scenarios of non-guaranteed amounts should be displayed. One of these scenarios, the primary scenario, should be drawn from an identified range of scenarios that the insurer judges as reasonable. The second scenario should be less favorable than that primary scenario. Other scenarios are optional.

(iii).

- In the US, assumptions should be based on actual experience when available or other reasonable and appropriate experience from similar business. ASOP 24 specifies that no improvement in assumptions may be assumed beyond the effective date of the illustration.

- In Canada, the assumptions may be set as the insurer judges reasonable and should be disclosed in the illustration.

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.

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

Sources:
The Rise of Registered Index-Linked Annuity (RILA) Products, August, 2022
Annuity Product and Features, Chapter 1, 2020

Commentary on Question:
Commentary listed underneath question component.

Solution:
(a)

(i)   Describe two potential challenges SLAC will face in implementing effective hedging strategies.

(ii)   Describe the hedge position(s) SLAC may or would need to take to fully immunize market risk under each of the following:

- The crediting structure being currently offered
- A 10% floor instead of the buffer

Commentary on Question:
Candidates performed well in this section. For part (i), some candidates were not able to provide challenges specific to SLAC for implementing a hedging strategy. Partial marks were given for correct challenges identified without explanation. Candidates identifying that SLAC's small size makes it challenging to achieve economies of scale for hedge trades also received credit. For part (ii), most candidates were able to correctly identify the call and put option combinations needed to hedge SLAC's position for each RILA structure.

(i)
1.   One challenge to SLAC for implementing an effective hedging strategy is operational complexity. Implementing and managing a hedging strategy requires sophisticated systems and expertise, which may pose challenges for smaller insurance companies or those with limited resources like SLAC.
2.   Another challenge for SLAC would be counterparty risk. There is heavy reliance on counterparties for executing option trades. This exposes SLAC to counterparty risk, particularly in volatile market environments or during periods of financial instability.

2. Continued

(ii) To achieve the current 15% cap and 10% buffer structure, SLAC would need to:
- Buy at-the-money call option
- Sell 15% (cap) out-of-the-money call option
- Sell 10% (buffer) out-of-the-money put option

To achieve a structure of 15% cap and 10% floor, SLAC would need to:
- Buy at-the-money call option
- Sell 15% (cap) out-of-the-money call option
- Sell at-the-money put option
- Buy 10% (floor) out-of-the-money put option

(b) Critique the following statements from the SLAC pricing report:

A. *SLAC is required to perform an interim value calculation on RILA contracts only to determine the death benefit and annuitization amount at any time.*

B. *The market value approach to the interim value calculation is preferable because it provides a method that is easier for advisors, contract holders, and regulators to understand. However, because of its simplicity it maximizes the volatility in financial statements of the company.*

C. *The interim value lock feature can either automatically lock a prespecified target interim value set when the contract is issued or give an option to the contract holder to manually lock the interim value as of the last market close.*

D. *There is no risk to SLAC to offer a value lock feature since all the information is known regarding the timing or target of the interim value to lock.*

Commentary on Question:
Most candidates were able to identify the valid and invalid statements for this question. Candidates earned full credit by critiquing each statement, explaining its correctness or identifying inaccuracies and providing corrections or clarifications where necessary.

2. Continued

A) This statement is incorrect.

   SLAC is required to include an interim value calculation to determine the death benefit, withdrawal amount, annuitization amount, or surrender value at any time other than the start date and end date of an index term. They also require an interim value calculation due to the risk of potential mismatches between the account value and the option portfolio within an index term.

B) This statement is incorrect.

   The market value approach to the interim value calculation is preferred by regulators and minimizes insurance company balance sheet volatility compared to the pro-rata approach. The pro-rata approach is less complicated and easier to explain to advisors and contract holders.

C) This statement is partially correct.

   The interim value lock feature can either be automatic or manual.

   The automatic lock is based on a target interim value, which can be reset after issue if a lock has not already taken effect. If the closing interim value hits the target, the lock is automatically invoked and cannot be changed.

   The contract holder can elect a manual lock during the index term on any day other than the anniversary to lock in the day's interim value as of the market close. A manual lock cannot happen at previous day's market close.

D) This statement is incorrect.

   SLAC is exposed to hedging risk. Once a lock is invoked, the hedging needs to be readjusted to reflect the new floor. The use of options requires expertise in hedging, investments, asset liability management, and contract design. Other risks, such as administration risk and operational risk, would still remain.

(c) Calculate the account value progression through the end of year 5 for each of the four policies, assuming an initial deposit of 1,000. Show all work.

Commentary on Question:
Candidates generally did well on this part. Candidates who correctly applied participation rates, caps, buffers, and floors and demonstrated the difference between annuity product mechanics received full credit. Candidates that only calculated the rates but not the account values received partial credit.

2. Continued

For policy 1, some candidates failed to apply the 70% participation rate correctly, while other candidates incorrectly applied a cap or floor.

Candidates did well calculating the account value progression for Policy 2.

For policy 3, some candidates failed to correctly apply the cap, while other candidates incorrectly applied the participation rate from policy 1.

For policy 4, some candidates failed to apply the cap and buffer correctly, while other candidates incorrectly applied the participation rate from policy 1.

The solution is in Excel.

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:
(1i) Describe how predictive analytics can be used in life and annuity pricing applications.

Sources:
The Use of Predictive Analytics in the Development of Experience Studies, The Actuary, Oct/Nov 2015

Predictive Modeling for Life Insurance: Ways Life Insurers Can Participate in the Business Analytics Revolution, Product Matters, Jun 2018

Commentary on Question:
Commentary listed underneath question component.

Solution:
(a) Critique each of the following statements from the consultant's report:

  A. *Predictive analytics will allow EFG to introduce new factors in underwriting without having to rely on traditional A/E results.*

  B. *Predictive analytics will help EFG deal with the lack of experience data at older ages.*

  C. *The refined assumptions from predictive analytics may be applied easily in both the pricing models and the valuation models.*

  Commentary on Question:
  The question assessed candidates' understanding of how predictive analytics could impact underwriting and modelling. Most candidates scored fairly well, as they were able to demonstrate an understanding of the implications of using predictive analytics.

  For statement A, candidates received full credit if they were able to elaborate on why the statement weas true, and that traditional A/E analysis was no longer necessary.

  For statement B, to receive full credit, candidates needed to elaborate on how predictive modeling is applied when lacking data at older ages. Strong responses included examples such as extrapolating data for older ages or the need for utilizing industry data.

3. **Continued**

Statement A: This statement is correct. Predictive analytics will allow EFG to use new factors in addition to traditional ones to have a better understanding of the drivers of experience and the relationship among various factors. EFG no longer needs to rely on the A/E results, as they may not be credible with new factors.

Statement B: This statement is correct. Predictive analytics is better than traditional modelling in developing assumptions where experience is missing, especially at older ages. However, it may still require judgment or the use of industry data due to the lack of data available at older ages.

Statement C: The more refined assumptions may be challenging to apply in both the pricing models and the valuation models. It's likely more challenging for valuation models, as pricing models can be more dynamic and can often accommodate adjustments and refined assumptions more easily.

(b) EFG is developing a predictive model to improve its underwriting process. They have begun the model building process by collecting and organizing the data.

Describe the four activities in the data preparation process.

Commentary on Question:

1. Variable Generation
This is the process of creating variables from the raw data. Each data field is assigned a name and format. Data fields can be combined to generate additional fields, such as using height and weight to calculate the body mass index (BMI).

2. Exploratory Data Analysis
This process involves building an understanding of the properties of each variable, such as min, max and mean. This process allows one to understand the data and may determine if there are any data issues. After the initial analysis, a univariate analysis can be conducted to determine the relationship with the target variable.

3.   Continued

3. Variable Transformation
This process helps to find and address defects in the data. Data issues can be mitigated by:

      i) Grouping excessive categorical values;
      ii) Replacing missing values;
      iii) Capping extreme values or outliers;
      iv) Capturing trends

4. Partitioning the Model Set
The data is divided into 3 equal parts: Train, Validation, and Test sets. The Train and Validation sets are used to build the model, and the Test set should be used to assess the appropriateness of the model. Afterwards, a fairly complex and iterative process is used to determine the most appropriate model for the particular dataset.

(c)   EFG is concerned about anti-selection from applicants and their advisors when predictive modeling is used for underwriting.

Describe two actions EFG can take to guard against anti-selection.

Commentary on Question:
To receive full credit, candidates were required to identify and describe two actions EFG can take to guard against anti-selection and describe how they prevent anti-selection when using predictive modeling for underwriting. No credit was given for actions that did not prevent anti-selection from using predictive modeling.

Many candidates correctly identified that being able to randomly select a percentage of applicants to go through full underwriting was an appropriate action. However, very few candidates also listed the use of third-party marketing data as an action to guard against anti-selection.

EFG can randomly select a percentage of applicants, who would have otherwise forgone additional requirements, to go through traditional underwriting. This will allow EFG to disguise the profile of applicants who are eligible for streamlined underwriting and offer a baseline for monitoring results.

EFG can also use third-party marketing data as input into the predictive model. This data cannot be easily manipulated by applicants as it is reported directly by third-party agencies and is based upon trends captured over time rather than sudden changes in behaviour.

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

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

Sources:
LPM-155-19: Understanding Profitability in Life Insurance

LPM-153-19: Life in-force Management: Improving Consumer Value and Long-Term Profitability

Evolving Strategies to Improve Inforce Post-Level Term Profitability, Product Matters, Feb 201

Commentary on Question:
Commentary listed underneath question component.

Solution:
(a)   Critique each of the following statements:

   A.   ROE is an accounting-based metric that provides a product level view of earnings performance. It is less volatile than book value per share. There is a strong correlation between ROE and price-to-book ratio.

   B.   Operating margin is an accounting-based metric and captures the general trends in earnings. It reflects the timing of profits and losses and the relative riskiness of the business. Statutory operating margins vary by country due to product mix and regulatory regimes.

   C.   Market Consistent Embedded Value (MCEV) values liabilities using book value and assets on a market-consistent value basis. The MCEV consists of two components: value of in-force business (VIF) and required capital.

   Commentary on Question:
   In critiquing the statements most candidates got part credit – usually missing the accuracy of one or more parts of the statements.

4. Continued

A Statement is partly true. ROE provides a portfolio level (and not product level view) of earnings performance. It tends to be more volatile, not less, than book value per share. Its correlation with the price-to-book ratio is true.

B. Statement is partially true. Operating margin does capture the earnings trend but does not reflect the timing or riskiness. It does vary by different countries regulatory regimes.
C. Statement is incorrect. Liabilities are valued on a Market Consistent Basis and not by book value. MCEV consists of three components including free surplus.

(b)   Describe two methods to improve consumer value or long-term profitability within each of the following areas of inforce management:

     (i)   Steering liability portfolios

     (ii)   Increasing persistency

     (iii)   Improving claims management

Commentary on Question:
On part (i) a number of candidates focused on assets rather than liabilities. Parts (ii) and (iii) were generally better done with most candidates getting half or more of the available grading points.

     (i)   -Redesign products to have lower guaranteed benefits.
           -Add profitable business through cross and up-selling
           -Consider selling or reinsuring unprofitable blocks

     (ii)   -Increase involvement with the consumer through current and new communication channels.
           -Consider premium holidays to retain valued clients

     (iii)   -Invest in improving operational efficiencies to speed up claim times.
           -Communicate with clients to explain what their policies cover and what they don't.
           -Improve fraud detection through training and software if necessary

(c)   ORD Life's term products have a level premium period followed by increasing premiums in the post-level term (PLT) period.

     A.   Describe three approaches to improve profitability during the PLT period.

     B.   Discuss the advantages and disadvantages of each approach.

4. Continued

Commentary on Question:
This part was generally very well answered with many candidates receiving all or most of the grading points. Many combined A and B, which was fine

A. -Simplified Re-Underwriting Approach – Client is sent a simplified underwriting questionnaire to determine risk class. If not answered client defaults to traditional YRT rate.
-Graded Approach – rates are increased in smaller steps rather than jumping to the YRT schedule immediately.
-Class-Continuation Approach – Rate increase varies based on the risk class at issue.

B. -Simplified Re-Underwriting: Advantage- Insurer has confidence in risk class
   Disadvantage – May increase lapses by warning clients of impending increases
   Graded Approach: Advantage-The smaller steps appear to lower lapses
     Disadvantage – More complex administration and no credible YRT experience data as yet
   Class-Continuation: Advantage – Considered the fairest approach
     Disadvantage- Preferred risks will have the steepest increases to the ultimate rate

5.   **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.

(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
Chapter 4: Basic Methods of Reinsurance and Chapter 7: Reinsurance of Inforce Risks

Commentary on Question:
This was a challenging question for candidates where the concepts were generally understood but had difficulty putting them into clear practice with the calculations.

Solution:
(a)   Explain the advantages and disadvantages of each reinsurance proposal for ABC.

   Commentary on Question:
   Candidates generally had a pretty good grasp of the key advantages and disadvantages of the reinsurance types.

   Coinsurance Advantages
   - Relatively simple to administers and well understood by regulators. Provides for a clear transfer of risk.
   - As all risks are reinsured the accounting is simpler as a % of all premiums, claims, reserves, etc. are transferred.

   Coinsurance Disadvantages
   - Main disadvantage is the need to transfer assets from insurer to reinsurer. This brings exposure to credit risk of the reinsurer and investment strategy of the reinsurer
   - If the reinsurance is terminated the reinsurer must transfer assets back which could lead to capital gains implications

5. **Continued**

YRT Advantages
- Typically a cheaper form of reinsurance as it is focused just on mortality risk
- Limits the reinsurance exposure to investment risk as unlike coinsurance assets are not transferred.
- The reinsurance pricing and yearly renewable feature may be competitive leading to lower cost

YRT Disadvantages
- The lower cost may lead to less possible future profits
- Also not the best form of reinsurance for surplus relief

(b) Explain why the change in XYZ Re's Gain from Operations in year 1 may not mirror the change in ABC's Gain from Operations in year 1 under either proposal. No calculations are required.

Commentary on Question:
Many candidates understood the main point of why the gain from operations may be different with reinsurance. Some candidates got confused with other concepts and put information that was not relevant.

When facilitating reinsurance XYZ will incur its own maintenance and acquisition costs/expenses to process and assess the deal. These costs would not exist if it was just being assessed by ABC without reinsurance. These additional costs are why XYZ Re's gain from operations will not exactly mirror ABC's gain on a proportionate basis.

(c)

(i) Determine the minimum first year expense allowance as a percent of ceded premium that would be needed in Proposal 1 for ABC to avoid a negative Gain from Operations in year 1. Show all work.

(ii) Determine whether XYZ Re could afford to pay this first year expense allowance without exhausting all of its surplus in year 1. Show all work.

Commentary on Question:
Candidates did reasonably well here. Many understood what was being asked and how to get at the answer. Few got full marks often missing a piece of the complete calculation along the way but still showed good understanding.

See accompanying Excel file.

5. **Continued**

(d)   ABC would like to avoid additional surplus strain in the first two policy years. To help meet this objective, ABC plans to ask XYZ Re to offer a ZFT scale (zero first year YRT premium) instead of the proposed premium scale, which requires an increase in the YRT rates in subsequent years to offset the cost.

Determine the maximum increase that ABC could accept in the second year YRT premium, as a percent of ceded face per 1,000. Show all work.

Commentary on Question:
This question was very challenging for candidates. Many did not understand what was being asked or how to formulate a response. For those that did respond there was confusion about what were the relevant parts of the question to use and how to apply them in formulating a response.

See accompanying Excel file.

6.   **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.

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

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

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

(1n)   Describe and evaluate the role of Behavioral Economics in understanding and modeling policyholder behavior in the life and annuity context.

Sources:
Experience Assumptions for Individual Life Insurance and Annuities; Lapse Supported Insurance Analysis

Overview of Non-guaranteed Elements (NGEs), SOA Research Institute, Cook, Koon, Motiwalla, and Rudolph, 2022

ASOP 54: Pricing of Life and Annuity Products, Jun 2018

Life Products and Features; Ch. 9 of Life Insurance Products and Finance, Atkinson and Dallas

Commentary on Question:
This question tested candidates' knowledge and understanding about "lapse-supported" insurance, the criteria of the actuary's principle and the relevant characteristics of product, and life insurance product feature and finance. The candidates are expected to demonstrate how to analyze the data and establish the appropriate assumptions commonly used in actuarial pricing and product development. The candidates are also expected to describe nonguaranteed elements (NGEs) and apply requirements of applicable ASOPs.

6. Continued

Solution:

(a) Critique each of the following statements:

    A.   *There is no reason to worry about the product being lapse supported because it's a limited-pay whole life product.*

    B.   *To determine relevant characteristics of the product, only the chief operating officer and chief actuary were interviewed on how the product will be administered. They were asked about limitations in administrative or valuation systems that could impact the product design or pose operational risks. There was no reason to interview the chief marketing officer.*

    C.   *For a non-participating whole life product, cash values are fixed at issue, making current interest rates irrelevant to the consumer.*

Commentary on Question:
In general, most candidates were able to articulate 20-pay limited pay may cause lapse-supportedness and adding the ROP can make the product more lapse-supported. However, most struggled with explaining why a product is lapse-supported (i.e. not paying the fair assets share or cash surrender value and competitive pricing are the drivers for lapse-supportedness). Most candidates did reasonably well in part (B) and articulate that the CMO is important in the designing and marketing of the products. Candidates did not do as well on part (C) as they did not articulate how interest rate change can impact the company's earnings and well non-forfeiture values but most able to articulate the disintermediation risk from lapse/surrender.

(a)

A – False:
- All limited pay policies have a degree of lapse support, but most are purely technical and will not cause problems for the company.
- Adding a ROP rider will result in backloaded pay out and convert the policy to be lapse supported.
- It is the cash values (which are benefits paid early) that help lower the degree of lapse support.
- Unrealistic lower initial premiums along with high ultimate lapse rates can cause the product to be lapse supported.

6.   Continued

B – First sentence is true but second is false for the following reasons since chief marketing officer would know:
- What's the intended design objectives of the product
- What's the intended market, anticipated sales, and the competitive alternatives to
- the product
- How the product will be sold, for example, underwriting, distribution, and marketing

C – First part is true but second part is false:
- Interest rates affect the nonforfeiture values required by the states

- Interest rates may affect sales since consumer may want higher cash values/ lower premiums from a UL policies the reflects current interest rate environment
- Interest rates also affect the premium that is charged since pre-tax income would increase/decrease with higher/lower interest

(b)   Calculate the duration 20 mortality rate for issue age 45 using the mortality rates provided in the case study (see the Excel spreadsheet.) Show all work.

Commentary on Question:
Many candidates didn't do well on this calculation question. A common mistake was to calculate the duration 20 mortality rate by taking the weighted average of male and female mortality at attained age 65. A few candidates were able to receive the full credit by correctly calculating the blended lx and then duration 20 mortality rate.

$$Male\ L_{45} = Female\ L_{45} = 100{,}000$$
$$Blended\ L_{45} = 60\% \times Male\ L_{45} + 40\% \times Female\ L_{45} = 100{,}000$$
$$L_{x+1} = L_x * (1 - Q_x/1000)$$
$$Blended\ L_{x+1} = 60\% \times Male\ L_{x+1} + 40\% \times Female\ L_{x+1}$$
$$Blended\ Q_x\ /\ 1{,}000 = \left(1 - \frac{Blended\ L_{x+1}}{Blended\ L_x}\right) \times 1{,}000$$

6. Continued

Age	Blended Qx	Male lx	Female lx	60% Male lx	40% Female lx	Blended lx	Qx / 1,000
45	1.47	100,000.00	100,000.00	60,000.00	40,000.00	100,000.00	1.47
46	1.58	99,813.00	99,914.00	59,887.80	39,965.60	99,853.40	1.58
47	1.70	99,614.37	99,818.08	59,768.62	39,927.23	99,695.86	1.70
48	1.83	99,404.19	99,710.28	59,642.51	39,884.11	99,526.62	1.83
49	1.98	99,180.53	99,589.63	59,508.32	39,835.85	99,344.17	1.98
50	2.13	98,942.49	99,455.18	59,365.50	39,782.07	99,147.57	2.13
51	2.30	98,689.20	99,306.00	59,213.52	39,722.40	98,935.92	2.30
52	2.49	98,418.79	99,142.15	59,051.28	39,656.86	98,708.13	2.49
53	2.69	98,128.46	98,962.70	58,877.07	39,585.08	98,462.15	2.69
54	2.91	97,817.39	98,767.74	58,690.43	39,507.10	98,197.53	2.91
55	3.15	97,482.85	98,556.38	58,489.71	39,422.55	97,912.26	3.15
56	3.41	97,121.19	98,327.73	58,272.72	39,331.09	97,603.81	3.41
57	3.70	96,730.77	98,081.91	58,038.46	39,232.76	97,271.22	3.70
58	4.02	96,308.05	97,816.11	57,784.83	39,126.44	96,911.27	4.02
59	4.38	95,849.63	97,529.51	57,509.78	39,011.80	96,521.58	4.38
60	4.80	95,351.21	97,219.36	57,210.72	38,887.74	96,098.47	4.80
61	5.27	94,806.75	96,882.98	56,884.05	38,753.19	95,637.24	5.27
62	5.79	94,211.37	96,516.77	56,526.82	38,606.71	95,133.53	5.79
63	6.39	93,559.42	96,117.19	56,135.65	38,446.87	94,582.53	6.39
64	**7.07**	92,844.63	95,678.89	55,706.78	38,271.56	93,978.33	**7.07**
65	7.85	92,059.16	95,196.67	55,235.50	38,078.67	93,314.17	7.85
66	8.73	91,194.73	94,662.62	54,716.84	37,865.05	92,581.88	8.73
67	9.73	90,242.65	94,070.98	54,145.59	37,628.39	91,773.98	9.73
68	10.87	89,193.13	93,412.48	53,515.88	37,364.99	90,880.87	10.87
69	12.16	88,036.30	92,677.32	52,821.78	37,070.93	89,892.71	12.16
70	13.63	86,762.41	91,854.35	52,057.45	36,741.74	88,799.19	13.63

The duration 20 mortality rate for issue age 45 (per 1,000) = Blended l_{65} / Blended l_{64} = $(1-93.314.17/93.978.33) \times 1,000 = 7.07$

(c)   The chief actuary has proposed using indeterminate premiums in the product design to reduce the product's risk.

  (i)   Explain how the proposal will reduce risk.

  (ii)   Describe three elements of ASOP 2, "Nonguaranteed Elements for Life Insurance and Annuity Products", that TTPD should consider in developing an indeterminate premium whole life product.

6.   **Continued**

Commentary on Question:
In general, most candidates struggled with this question. Most candidates were able to articulate how indeterminate premium structure helps with risk mitigation and competitiveness of the product design. However, most did not articulate the indeterminate framework and ASOP 2 requirements well. Candidates will receive bonus credit by commentating that a premium adjustment cannot be used to recoup past losses or distribute past gains.

(i) Explain how the proposal will reduce risk.

Indeterminate premiums: Some typically older term and permanent traditional products specify a guaranteed premium scale and a nonguaranteed premium scale (the indeterminate premium). The current premium scale may be guaranteed for some period of time.
- Levels of these NGEs are set at the time of product pricing based on anticipated future experience at the time. Once issued, contract language allows insurers to revise these elements and defines a guaranteed maximum or guaranteed minimum level for each element. Charges cannot be increased higher, and credits cannot be decreased lower than guaranteed levels, though the insurer typically enjoys broad discretion on adjustments within those guaranteed limits.
- From the insurer's perspective, product performance depends on how well the NGEs align with anticipated experience. At the time of product pricing, levels of NGEs are set based on anticipated experience factors to meet the insurer's profit objectives. In the future, if experience emerges differently than originally anticipated, the insurer, in accordance with the provisions in the policy form and insurance laws and regulations, may revise NGEs to reflect new anticipated experience factors

(ii) Describe three elements of ASOP 2, "Nonguaranteed Elements for Life Insurance and Annuity Products", that TTPD should consider in developing an indeterminate premium whole life product.

ASOP 2 provides guidance for the practicing actuary to consider when determining NGEs for life insurance and annuity policies written on individual policy forms, where NGEs may vary at the discretion of the insurer.
- Determination applies to both the initial NGE determination at product pricing or issue, and subsequent NGE determinations for inforce business at dates after issue.
- ASOP 2 introduces the concept of an NGE Framework, which is defined as a combination of the company's determination policy, method by which the insurer defines a policy class, and any other relevant criteria or principles that are used to determine NGEs.

6. **Continued**

- The determination policy reflects the insurer's governing principles or objectives for determining NGEs. The policy could be a single document or a collection of documents. It includes profitability and capital objectives, along with requirements for and frequency of reviews of NGEs. Per ASOP 2, while a specific cadence is not prescribed, the company should declare a "maximum time period" that is not exceeded between successive reviews of NGEs.
- Each of these reviews affords the actuary the opportunity to assess whether the existing NGE scale can be revised given the currently anticipated experience factors applicable to the inforce business in question.
- Policy classes are policies that are grouped together when determining NGEs. The methodology for defining classes for both future sales and inforce policies is included in the NGE framework. Different NGEs can have different class definitions, as long as they are appropriately reflective of differences within anticipated experience factors.
- Class definition is not expected to change after issue but if necessary, it can be redefined or combined if new information supports the change.

7. **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:

(3f) Describe how alternative data might be used to supplement mortality rate estimates.

(3j) Describe methodologies, approaches, considerations and tools related to the Underwriting function.

Sources:

NAIC Accelerated Underwriting In Life Insurance Educational Report (excluding appendix A), April 2022

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

Commentary on Question:

The question attempted to test the candidate's knowledge of the strengths and weaknesses of an accelerated underwriting approach. A well prepared candidate was able to discuss not only the actuarial considerations but also regulatory and data integrity issues when using an non-traditional underwriting approach.

Solution:

(a)

(i) List three non-traditional data sources used in the life insurance underwriting process.

(ii) Describe considerations for use of these non-traditional data sources according to the NAIC Life Accelerated Underwriting in Life Insurance Educational Report.

Commentary on Question:

In this section most candidates performed well. They did a good job identifying non-traditional data sources but struggled to recall how the Educational Report should be applied. No credit was given for traditional data sources.

(i) Three examples of non traditional sources include public records, marketing and social media, and wearable device data

7. **Continued**

    (ii) Considerations for the use of non-traditional data sources include the following:

- Risk characteristics should lead to an expected outcome
- Rating factors may not have a disparate impact on demographic groups
- Consumers may not have access to how data may have impacted their application.
- Some data may not be required to be disclosed to consumer
- Privacy concerns with non-traditional data

(b)   With respect to the new end-to-end accelerated underwriting process:

    (i)   Explain how risk classes are determined by the triage process vs. the historical traditional underwriting process.

    (ii)   Explain how regulatory considerations may impact the use of data inputs and predictive models/algorithms.

    (iii)   Critique the triage process of using only RAS scores to sort applicants into preferred risks or to be routed to the traditional underwriting process. Justify your response.

    (iv)   Critique the triage process of routing only applicants assessed as standard and below risk classes to the traditional underwriting process. Justify your response.

Commentary on Question:
Candidates had a more difficult time with this section. The main issue was that candidates did not provide additional insights beyond what was described in the case study. No credit was given for restating information from the case study.

(i) There are two ways to predict mortality risk using RAS tool:
    1) use it to predict the risk class or
    2) use it to predict mortality and the associated risk class.

Using the RAS tool, the predicted risk class can be different than what a traditional underwriter would have determined.

(ii) Regulatory considerations may have an impact in the following ways:
    1) Ensure data is transparent, accurate, reliable and without bias.
    2) External data sources, algorithms and predictive models must be based on sound actuarial principles.
    3) Ensure models or machine learning algorithm forecasts its intended outcome accurately.

7.   Continued

4) Confirm that models and algorithms are not unfairly discriminatory.
5) Have a correction mechanism in place, if needed.

(iii) One possible shortcoming of the RAS system is that it does not use any external rules engines, which would complement a predictive model. The RAS system only addresses a few non-medical questions. The external rules engine would calculate a risk factor that would be used to determine a risk class.

(iv) There are times where algorithmic based underwriting has difficulties with the fast-track process, such as when an applicant has a poor RAS score. Other carriers may have a different algorithm that may accept qualified applicants that were rejected from TTPD systems. To minimize this problem, TTPD must have a means to direct these unique applicants to traditional underwriting.

(c)   Sales under the new program have been 20% less than expected. This is mainly due to fewer preferred risk class placements than expected. Early A/E studies reveal preferred classes overall are 110% of A/E mortality whereas the standard and substandard classes are exhibiting 99% A/E. A higher percentage of accidental deaths, anti-selective cancer claims and cardiovascular deaths has occurred than was experienced with the fully underwritten process.

Recommend changes to the accelerated underwriting process to improve preferred risk class placements and improve the mortality A/Es. Justify your answer.

Commentary on Question:
Candidates performed well on this section and provided a wide variety of good quality recommendations which were awarded credit. Such an example is provided below but is not the only solution eligible for full credit.

The following changes could improve preferred risk class placements and/or improve mortality:
1. Include an external rules engine to add experienced-based rules for non-medical questions, which could include family history questions related to early mortality due to cancer, heart attack, stroke and diabetes.
2. Try to determine if applicant has any risky avocations (e.g. skydiving) by adding a question to the application or relying on other data sources. This will help decrease the risk of anti-selection.