ILA LP Model Solutions
Fall 2018

1. **Learning Objectives:**
1.   The candidate will understand various insurance products, markets, and regulatory regimes.

2.   The candidate will understand the relationship between product features, inherent risks, and the methods and measures to design and price products.

Learning Outcomes:
(1a)   Describe insurance product types, benefits, and features including reinsurance.

(1c)   Construct, evaluate and recommend product designs that are consistent with market needs, tax and regulatory requirements, and company business objectives.
   - Evaluate the feasibility of proposed designs. Recommend designs.

(2b)   Assess and critique performance measures, risk measures, and modeling approaches. Recommend their uses in product management.

Sources:
LP-126-13: Pricing Critical Illness Insurance in Canada, Mooney

LP-127-13: Product Design of Critical Illness Insurance in Canada

Commentary on Question:
This question tested the candidates' understanding of the challenges of critical illness products as well as the features that are available on critical illness products in the market. Since critical illness insurance products are relatively new, the question also tested the candidates' understanding of how to set incidence rates and any challenges in using incidence rates from other sources.

Solution:
(a)   Critique the product design of the above product.

   Commentary on Question:
   Overall, candidates did not do very well on part a. Most candidates suggested offering an enhanced version of CI by adding CABG (Coronary Artery Bypass Graft). However, few candidates mentioned that the cancer definition should be enhanced for life threatening cancer. Similarly, very few candidates critiqued the heart attack and stroke definitions.

1. Continued

As a rule of thumb, when there is a list of items in a question, one approach in the solution would be to discuss each item listed, even if it is to say you agree with item x because of y.

A number of papers did comment that Financial advisors and clients prefer guarantees; that there is a high probability of certain illnesses after age 75; the 30 day survival period is competitive; and that Return of Premium on survival is popular with advisors and clients. A number of papers mentioned that return of premium on surrender and expiry are also popular and that the benefit should be reduced at higher ages.

A number of papers commented that the 18-month contestability period was too long rather than too short. Very few papers mentioned that a Doctor or specialist should make the diagnosis of the illness and that often some kind of test result is required as proof of the illness, e.g., a blood test.

The solution below is sample solution. Candidates that had other reasonable critique also received full credit.

It is common in the market to offer the Big 4 illnesses, so to be competitive the company should add Coronary Artery Bypass Graft (CABG). These 4 illnesses account for approximately 85% of all claims and is favored by advisors and clients.

The purpose of Critical Illness insurance is to help people who have a serious illness, for this reason, the cancer definition should state that life threatening cancer is covered and it should explicitly state minor cancers that are excluded, such as cancer in situ. The 30-day exclusion period is too short and should be 90 days, which is common in this market, and helps reduce risk to the company.

The heart attack definition is too restrictive for the market and it also should include cardiac markers elevation.

Even though the 45 consecutive days in the stroke definition reduces risk and lowers cost for the company, it should be reduced to 30 days to be more in line with the market.

Financial advisors have a strong preference for products that are fully guaranteed. So, guaranteeing the definitions of eligible conditions will be popular with advisors and clients.

The potential for paying high benefits for certain conditions at higher ages is large, so the company should consider reducing the benefit after attained age 65 or 75 to reduce costs.

1. **Continued**

Proof of incidence with a Doctor's report is not sufficient. A diagnosis from a Doctor or specialist is required as well as objective evidence such as a blood test or biopsy.

The 30 day survival period is competitive with the market, so leave it as is. However, the accidental death benefit could be removed as it is an additional cost and risk.

The contestability period of 18 months should be increased to 24 months.

Return of premium on Survival (as well as all return of premium options) are favored by advisors and clients so keep this option.

(b)

(i) State the feasibility of using a UK experience study to establish incidence rate assumptions for this new CI product.

(ii) List all steps necessary to set the incidence rate assumptions.

Commentary on Question:
For (b) (i), candidates generally did well if they (1) stated whether using the UK experience study was appropriate or not, and (2) provided a reasonable justification. However, many candidates struggled to provide a reasonable justification other than to say that experience can be different from one country to another, without stating how it could be different. Partial credit was given for stating an opinion as to whether or not it was feasible.

For (b) (ii), approximately half the candidates did well. However, a number of candidates talked about how to derive company mortality rates and had a different set of procedures than those required for setting incidence rates. These papers talked more about how to maintain and monitor existing experience rates rather than how to initially set up experience rates. No credit was given for this approach.

(i) It is feasible to use a UK experience study as long as the differences between the two countries are taken into account and the incidence rates are adjusted appropriately. Even though Canada and the UK are developed countries, there can be significant differences in the incidence of critical illnesses, for example due to differences in health care systems and diet.

(ii) To set the incidence rate assumptions, start with the rates available, adjusted for the conditions being covered and any trends.

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1. Continued

Use ratios of insured lives to population mortality to adjust the incidence rates from general to an insured population

Use ratios of smoker to non-smoker mortality to segment aggregate incidence rates into smoker and non-smoker incidence rates

Similarly use ratios of select and ultimate insured mortality to create select and ultimate incidence rates

2. **Learning Objectives:**
1. The candidate will understand various insurance products, markets, and regulatory regimes.

2. The candidate will understand the relationship between product features, inherent risks, and the methods and measures to design and price products.

Learning Outcomes:
(1b) Evaluate insurance markets, consumer needs, distribution channels, and regulatory regimes.

(1c) Construct, evaluate and recommend product designs that are consistent with market needs, tax and regulatory requirements, and company business objectives.
- Evaluate the feasibility of proposed designs. Recommend designs.

(2a) Identify, assess, and develop appropriate assumptions to reflect factors such as product characteristics, risks, policyholder behavior, and company actions.
- Describe and apply the uses of predictive modeling.

Sources:
The Art and Science of Life Insurance Distribution, Actex, Ch. 3 – 7

LP-136-15: Marketing for Actuaries, 2000 Edition, Chapters 4 pp. 12 – 31

CIA 2015 - Lapse Experience under UL Level COI Policies, Sep 2015, pp. 4 – 8

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

Canadian Insurance Taxation, Swales and Erinc, 4th Edition, 2015, Ch. 10 & 11

Commentary on Question:
Commentary listed underneath question component.

Solution:
(a) Evaluate the appropriateness of the proposed distribution method.

Commentary on Question:
This question tested a candidate's knowledge of what is the appropriate distribution channel for a level cost of insurance Universal Life product.

Candidates were consistent in their responses in that most were able to identify the first two bullets below, but very few mentioned the remaining two bullets.

2. Continued

1. Home service agents usually sell in low income segments of the population; LCOI UL may be too expensive for that market.
2. Home service agents sell smaller face amount and traditional products. The minimum face amount of the LCOI UL is too high and sales agents may not have the LCOI UL knowledge to sell the product.
3. One of the challenges of home service is increasing cost of this distribution system. In addition to the complexity of the LCOI UL product, it is very difficult to price competitively.
4. Home service agent generally works in a defined geographical area which may result in limited sales production.

(b) Recommend changes to the proposed lapse rate assumption and justify your recommendations.

Commentary on Question:
This question tested the candidate's understanding of what should be considered when setting up lapse rate assumptions for LCOI UL.

Candidates generally identified the first two bullets, but struggled with the remaining five bullets. Many candidates identified the difference in proposed lapses between female and male and the 100% lapses in December as parts which should be changed, but were not able to propose a good solution and provide appropriate justifications. Very few candidates mentioned the impact of size group, issue age, and distribution channels.
One thing to emphasize is issue age. Candidates who mentioned age or attained age were not given any credit.

1. It is more appropriate to increase lapse rates in year 8. Lapse rates will generally spike after surrender charge has expired
2. Lapses should be varied by nonsmoker and smoker. Smoker lapses generally significant higher than nonsmokers. The proposed lapse rates could underprice smoker premiums or overprice nonsmoker premium rates.
3. The proposed lapse rates show female first year lapse is significant higher than male but the differential between male and female are relatively small. Would recommend narrowing the gap between male and female lapse rates.
4. For flexible premium policies, uniform distribution of lapses by month is more common. Lapses shouldn't skew to 100% at the end of year.
5. Lapses should differentiate by size group. Smaller size policies tend to have higher earlier duration lapses while larger policies have higher later duration lapses.
6. Different issue ages tend to have different lapse patterns. Lapse rates should vary by issue age
7. If this product will sell through Home Service or other channels, lapse rates should reflect the distribution channel's historical lapse patterns.

2. **Continued**

(c)

(i) Critique the proposal from an exempt test policy rules perspective.

(ii) Assess the feasibility of adding single pay and 20-pay level COI options for this product.

Commentary on Question:
This question tested the candidate's understanding of new exempt policy rules, and how additional features impact exempt status.

Most candidates were able to identify that with new exempt policy rules, the ETP is defined as having an 8-year payment with an endowment at age 90, cash value is gross of the surrender charge, and death benefit cannot increase by more than 8% per year. Candidates did not answer well on anti-avoidance rule.

Candidates were able to address the feasibility of adding single-pay or 20-pay but many candidates couldn't provide justifications.

(i)

1. Under New Exempt Policy Rules, the policy's accumulating fund must not exceed the accumulating fund of the ETP (Exempt Test Policy), on the policy issue date and the policy's first subsequent policy anniversary. It is no longer necessary to meet this test at every anniversary thereafter. The ETP is now defined as having a pay period of 8 years (8-pay) and an endowment date of when the policyholder turns 90.

2. Under new rules, the cash surrender value of a policy is determined without reference to surrender charges. This will impact the first 7 years of the projection period as the accumulating fund will not be reduced by the surrender charge. The policy's accumulating fund should be the max (cash surrender value, net premium reserve) minus any outstanding policy loans.

3. In determining the accumulating fund of the contract, a higher death benefit allows for higher cash value that can be accumulated in a policy on a tax deferred basis since the ETP's MTAR would also be higher. The rules limit the allowable increase in death benefit to 8% each year.

4. Anti-avoidance rule prevents large dump-ins or catch-up deposits. On the 10th or any subsequent policy anniversary of the policy, if the accumulating fund exceeds 250% of the accumulating fund on its third preceding policy anniversary, the ETP is deemed to have been issued on that third preceding policy anniversary. This is only applicable when the accumulating fund of the policy exceeds 3/20 of the total accumulating fund of the ETP at that time.

2. Continued

(ii)

1. It is very unlikely that the single pay product will be able to pass the exempt policy rules, as the accumulating fund of the policy will almost certainly be higher than the ETP's MTAR at time of the single premium payment, given that the ETP's payment period is 8 years.
2. The 20-pay product is feasible, but would still need to be diligently tested to ensure exempt status. Some factors that improve feasibility include:
   o Premium paying period is spread out over 20 years vs. 8 years for the ETP
   o Level COI is better than YRT COI since the cash surrender value of the policy in earlier years will be lower in an LCOI product

3. **Learning Objectives:**
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2. The candidate will understand the relationship between product features, inherent risks, and the methods and measures to design and price products.

Learning Outcomes:
(1a) Describe insurance product types, benefits, and features including reinsurance.

(2b) Assess and critique performance measures, risk measures, and modeling approaches. Recommend their uses in product management.

(2c) Develop and evaluate a product's performance, capital requirements, tax and regulatory requirements, and risk profile.

Sources:
LP-116-10: Variable Annuities, Kalberer and Ravindran , Chapters 5,9,10,11

Stochastic Modeling Text - Intro, Sections 1-4, Intro, I - I.B.2, I.E, II.A.1 - II.A.3, III, IV.A - IV.A.9, IV.B.2-4,IV.B.6,IV.C.3

Atkinson & Dallas, Life Ins. Products and Finance Chapters 2

Hardy, Investment Guarantees, Chapters 1, 2, 6, 7, 8, 12, 13

Commentary on Question:
Generally, candidates did well in parts b and c of the question. For part a, many candidates did not demonstrate that they understand why certain risks exist in each rider. For part d, candidates generally listed pricing and product considerations rather than modelling considerations.

Solution:
(a) You are working on pricing the following variable annuity riders:

- Guaranteed Lifetime Withdrawal Benefit (GLWB)
- Guaranteed Minimum Accumulation Benefit (GMAB)
- Guaranteed Minimum Maturity Benefit (GMMB)

Describe the risks of each rider.

Commentary on Question:
Candidates were required to demonstrate an understanding of the riders and the risks for each rider. Candidates that listed risks without any explanations were given partial credit. Many candidates listed similar risks under different names. As long as reasonable explanations were provided, credit was awarded.

3. **Continued**

GLWB: The design guarantees a withdrawal amount, commonly 4-7% of the benefit base to be paid for life. The main risks include the following:
- Longevity risk – Risk that the policyholder outlives the fund value supporting the withdrawals
- Shortfall risk – Lower than expected asset performance to cover the assumed biometric risk

GMAB: This guarantees the account value to at least grow by the amount guaranteed within a specified term. The policyholder may have the option to renew the contract at the end of the original term. The main risk is the following:
- Shortfall risk – Lower than expected asset performance to cover the embedded guaranteed return

GMMB: This guarantees a certain account value when the policy matures at a specific time. The main risks is the following:
- Shortfall risk – Lower than expected asset performance to cover the promised maturity value

(b) Compare and contrast the following risk measures:

(i) Conditional tail expectation (CTE)

(ii) Value at Risk (VaR)

Commentary on Question:
Candidates did well on this part of the question. Any valid differences between VaR and CTE were accepted for credit. Some candidates used the words comprehensive/consistent instead of coherent to describe the risk measures. Proper explanations were required to earn full credit.

- CTE is the average of losses exceeding the quantile point X
- VaR is the risk amount at a given quantile point X
- VaR does not capture tail risk (risks occurring with low frequency and high severity beyond a given quantile point), while CTE may be more appropriate for skewed distributions
- VaR is not a coherent risk measure; CTE is since it satisfies translation invariance, subadditivity, positive homegeneity and monotonicity.

3. Continued

(c)

    (i)   Calculate the GMAB liability using CTE(95).

    (ii)   Calculate the GMAB liability using VaR(92).

Show all work.

Commentary on Question:
Candidates generally performed well on this part of the question. Many candidates treated the continuous risk free rate as a discrete rate, or the discrete GMAB payoff rate as a continuous rate. For the VaR calculation, candidates were given credit if they performed the calculation on the 92nd or 93rd simulation value.

Calculate the guarantee fund value in 2 years
$1000*(1.02^2) = 1040.4$

Sort the fund value and determine the 5 scenarios that are in the money (<1040.4)
Calculate the GMAB liabilities in 2 years for the 5 scenarios:
1040.4 - 400 = 640.4
1040.4 - 600 = 440.4
1040.4 - 790 = 250.4
1040.4 - 950 = 90.4
1040.4 - 1000 = 40.4

Calculate the present value of the liabilities for these scenario
(Liability $\times e^{-0.06 \times 2}$)
$640.4 \times e^{-0.12} = 567.98$
$440.4 \times e^{-0.12} = 390.60$
$250.4 \times e^{-0.12} = 222.08$
$90.4 \times e^{-0.12} = 80.18$
$40.4 \times e^{-0.12} = 35.83$

CTE(95) = average(567.98, 390.60, 222.08, 80.18, 35.83) = 259.34
VaR(92) = GMAB liability at the 93rd scenario
        = max(0, (1040.4 – 1285)
        = 0

3. Continued

(d) Describe considerations in modeling a voluntary reset feature on a 2-year GMAB rider.

Commentary on Question:
Candidates did poorly on this question. Most candidates described pricing and product concerns rather than considerations for how to model the voluntary reset. Candidates that demonstrated understanding of the reset and identified policyholder behavior as the main risk were given credit.

Voluntary resets allows policyholder to reset the current guarantee value to the current account value. The guaranteed accumulation benefit is reset to the current account value and the term is usually extended. The accumulation benefit then continues from the newly reset value.

Therefore, the company will need to explicitly model the policyholder behaviour related to triggering the reset. Modelling should incorporate the contractual reset frequency such as periodic intervals or specific times. Modelling also needs to incorporate the extension of the term following the triggered reset.

The company needs to make an assumption about when resets will happen. A common approach is to set certain thresholds based on ratio of fund value to guarantee value.

Initially, the company's view on the reset assumption could be speculative. They can perform experience studies on when policyholder resets occur as industry or internal experience emerges.

Stochastic modelling would be an appropriate method to model this complicated feature.

4.

Learning Objectives:
2.   The candidate will understand the relationship between product features, inherent risks, and the methods and measures to design and price products.

3.   The candidate will understand actuarial requirements of product governance, implementation, operations, and management.

Learning Outcomes:
(2a)   Identify, assess, and develop appropriate assumptions to reflect factors such as product characteristics, risks, policyholder behavior, and company actions.
- Describe and apply the uses of predictive modeling.

(2b)   Assess and critique performance measures, risk measures, and modeling approaches. Recommend their uses in product management.

(2c)   Develop and evaluate a product's performance, capital requirements, tax and regulatory requirements, and risk profile.

(3a)   Describe governance and implementation requirements, principles, and practices.
- Describe and evaluate compliance with illustration regulations.
- Describe operational requirements such as administration, marketing, reinsurance, and underwriting. Assess their impact on managing products.

(3c)   Design and evaluate product management strategies. Recommend the product strategy.

Sources:
LP-130-14: Life Insurance Underwriting in the United States, Ch. 1, 2, 4, 5, 6, Klein

Predictive Modeling for Life Insurance, Deloitte

SOA – Society of Actuaries, Automated Life Underwriting: Phase 2, Deloitte, Aug 2010

The use of predictive analytics in the development of experience studies:

Commentary on Question:
This question was centered around Predictive Underwriting. I will give a more detailed commentary within each part of the question, but analyzing the question as a whole, most candidates were comfortable discussing the data underlying the predictive underwriting efforts and the benefits and risks that arise from predictive underwriting. Candidates were less comfortable discussing the impacts to mortality and lapse assumptions as a result of predictive underwriting and even fewer candidates were able to calculate the difference in underwriting costs between fully underwritten, simplified underwritten, and predictive underwritten policies.

4. Continued

Solution:

(a)   Describe how implementing a predictive underwriting model would affect the following assumptions:

   (i)   Mortality

   (ii)   Lapse

Commentary on Question:
Many candidates confused predictive underwriting with predictive analytics and how predictive analytics can be used to better estimate mortality and lapse assumptions. Very few candidates who did explain that mortality would improve attributed it to removing the subjectivity of underwriters. Even less candidates were able to attribute their change in lapse assumption to a better underwriting experience.

   (i)   Predictive underwriting will improve the mortality assumption. Using predictive underwriting eliminates the subjectivity and human error that results from using human underwriters. Predictive underwriting will also be able to better allocate candidates across different risk classes.

   (ii)   Predictive underwriting will lower the lapse assumption as many candidates will find the quicker underwriting time more satisfying which will increase the candidate's loyalty to the company.

(b)   You are introducing predictive analytics in developing experience studies. Critique the following statements:

   (i)   *You should include the same key drivers from the previous studies that were used in the traditional approach to speed up the adoption of the new predictive modeling method.*

   (ii)   *You should remove all questionable values in your data set because data quality is crucial in predictive modeling.*

   (iii)   *You should partition the data set into the three categories: "train", "test" and "validation", so that multiple individuals can work on the data simultaneously.*

   (iv)   *You should use the more refined assumptions developed using the predictive analytic approach in pricing and valuation.*

4. Continued

Commentary on Question:
Candidates scored the highest on this part of the question. Most candidates were able to answer parts i and ii and receive full credit. Some candidates confused "test" and "validation" on part iii. Most candidates mentioned that predictive analytics result in more granular assumptions than what is traditional used in pricing and valuation, but a much smaller portion of candidates mentioned that the granular assumptions would be easier to use in a pricing exercise compared to a valuation exercise.

(i) This statement is partially true. Including the same key drivers from the traditional approach is a good way to start. However, the benefit of predictive modeling is in the discovery of new assumptions that impact the lapse experience.

(ii) This statement is incorrect. While data quality is important, removing all questionable data can result in a biased sample. Removing questionable data can also result in useful information being removed from the analysis and can lead to credibility issues. Instead of removing questionable data, data cleansing efforts such as neutral estimate or best estimate approaches should be used.

(iii) This statement is partially true. The data set should be partitioned into three categories (train, test, and validation), but not so that multiple individuals can work on the data simultaneously. First, the train data set is used to calibrate the model. Validation is then used to validate the parameters that were calibrated using the train data set. Finally, the test data set is used to assess the predictive analytic results.

(iv) Predictive analytics result in assumptions that are more granular than what is traditionally used in pricing or valuation efforts. More granular assumptions are usually easier to incorporate into pricing efforts than valuation efforts which have certain regulatory requirements.

(c) Compare a traditional fully underwritten approach to an automated underwriting system for the following:

(i) Process

(ii) Benefits

(iii) Risks

4. Continued

Commentary on Question:
Many candidates did not explain the Process of a fully underwritten approach compared to an automated underwritten approach in enough detail. Most candidate explained the benefits and risks of automated underwriting, but many forgot to explain the benefits and risks of full underwriting.

(i) Fully Underwritten – consists of a full application which includes Part 1 and Part 2. These applications include medical questions and the process takes longer than an automated approach. An underwriter will then review the application and make a decision based on the information provided.
Automated Underwritten – Uses third party data and an automated system to make the underwriting decision. This process will be quicker than a fully underwritten approach. Certain policies can still be flagged and reviewed by an underwriter if needed.

(ii) Fully Underwritten – Has human judgment for more complex cases.
Automated Underwritten – More efficient process which reduces the time it takes to go through the underwriting process. This frees up the underwriters to spend their time on more complex cases, thus reducing the overall cost.

(iii) Fully Underwritten – As automated underwriting becomes more prevalent, companies that do not adopt automated underwriting could be at a competitive disadvantage due to the higher cost associated with full underwriting.
Automated Underwritten – The implementation of an automated underwriting system can be time consuming and resource intensive. Training junior underwriters can also be difficult as there are less cases to review.

(d) Calculate the anticipated annual cost savings of switching from full underwriting to the following:

    (i) Simplified underwriting

    (ii) Automated underwriting using predictive analytics

Show all work.

4.   Continued

Commentary on Question:
Very few candidates were able to get any of the calculations correct. Most candidates thought all of the costs listed in the question would be used for a fully underwritten policy. Answers for simplified underwriting had a wide range of assumed costs. Some candidates were successful identifying third party fees and some combination of MVR, MIB, or RX (or none of those) as the cost for automated underwriting.

Full underwriting would use all of the costs except for the third party data fees. This results in $330 per application which totals $24,750,000 for 75,000 applications.

Simplified underwriting would use the costs for MIB, MVR, RX, and Oral Fluid requirements. This results in $55 per application which totals $4,125,000 for 75,000 applications. The annual cost savings for simplified underwriting is $24,750,000 less $4,125,000 which equals $20,625,000.

Automated underwriting would use the third party data fees and may use MVR, MIB, or RX. This example uses third party data fees and a MVR test. The resulting cost is $11.25 per application which totals $843,750 for 75,000 applications. The annual cost savings for automated underwriting is $24,750,000 less $843,750 which equals $23,906,250.

5. **Learning Objectives:**
1.   The candidate will understand various insurance products, markets, and regulatory regimes.

Learning Outcomes:
(1c)   Construct, evaluate and recommend product designs that are consistent with market needs, tax and regulatory requirements, and company business objectives.
  • Evaluate the feasibility of proposed designs. Recommend designs.

Sources:
LP-123-13: NAIC Standard Non-Forfeiture Law for Individual Deferred Annuities

Atkinson & Dallas, Life Ins. Products and Finance Chapters 2

LP-121-13: Life Insurance and Annuity Non-forfeiture Practices

Commentary on Question:
This question tested candidates' understanding of NAIC Standard Non-Forfeiture Law for Individual Deferred Annuities.

Solution:
(a)   Calculate the maximum surrender charge (as a percentage of the fund value) in the third policy year in accordance with Standard Nonforfeiture Law. Show all work.

   Commentary on Question:
   Candidates generally performed well on this part. However, many candidates incorrectly interpreted the concept of guaranteed account value and mistakenly included commission within this calculation. Another common error was using the incorrect interest rate, however partial credit was given for subsequent calculations.

   Interest rate used for determining non-forfeiture amounts equals to 5-Year CMT reduced by 125 bps then rounded to the nearest 0.05%.
   4.12% - 1.25% = 2.87% rounded to 2.85%
   The resulting rate is not less than 1% or greater than 3%, so use 2.85%.

   Minimum non-forfeiture value equals initial premium (20,000) multiplied by 87.5% less annual $50 contract charge accumulated at 2.85%
   Then Min. non-forfeiture amounts are calculated as follows
        End of year 1: (20000 x 0.875 - 50) x (1 + 2.85%) = 17947.33
        End of year 2: (17947.33 - 50) x (1 + 2.85%) = 18407.40
        Beginning of year 3: 18407 -50 = 18357.40
        End of year 3: (18407.40 - 50) x (1 + 2.85%) = 18880.58

5. **Continued**

Guaranteed account value accumulates the initial premium less annual charge of 150 at guaranteed rates. Then Guaranteed account values are calculated as follows
End of year 1: (20000-150) x (1 +3.5%) = 20544.75
End of year 2: (20544.75-150) x (1 +3%) = 21006.59
Beginning of year 3: 21006.59 - 150 = 20856.59
End of year 3: (21006.59-150) x (1 +3%) = 21482.29

Max. surrender charge percentage at beginning of year 3 = (20856.59 - 18357.40)/20856.59 = 11.99%
Max. surrender charge percentage at end of year 3 = (21482.29 - 18880.58)/21482.29 = 12.11%

Surrender charge percent cannot be higher than 11.99% to ensure that CSV is greater than non-forfeiture amount.

(b)   You have been asked to consider how the concepts discussed in the "*Equities – Different points of view, a relative affair*" section of the Unruh Report might be applied to the annuity market.

   (i)   Identify three stakeholders and, for each, a provision in the NAIC Standard Nonforfeiture Law for Annuities that the stakeholder would view as equitable. Justify your answer.

   (ii)   Identify three provisions in the NAIC Standard Nonforfeiture Law for Annuities that would be viewed as inequitable from a terminating policyholder's perspective.

Commentary on Question:
Candidates generally struggled with this part. Many candidates did not fully describe how the stakeholder's interest would be affected by the Standard Non-Forfeiture Law. Credit was also given for other reasonable stakeholders and provisions if properly explained.

   (i)   Stakeholders taking the view that the provisions are equitable may include the following:
   1.   Continuing policyholders - if any of the 3 items were more generous, it's likely that rates offered would be less attractive
   2.   Selling agents - if the non-forfeiture amount were not set at 87.5%, the ability of the agent to keep their sales commission would be less secure on early surrenders.
   3.   Regulators - if the rate that non-forfeiture amounts are accumulated at were too high, regulators might be concerned for the solvency of companies if a prolonged period of low interest rates were to follow.

5. Continued

    (ii)   The terminating policyholder would consider inequitable any provisions that might reduce the cash surrender value that they receive. Therefore, the following 3 items could be viewed as inequitable.

        1. The reduction of the non-forfeiture amount to 87.5% of the premiums provided.

        2. The limitation of 3% on the interest rate that is used to accumulate the non-forfeiture amount even if prevailing market rates are much higher.

        3. The reduction of 125 basis points from the 5 year CMT rate to determine the rate used in non-forfeiture amounts.

(c)   XYZ has discovered that three competitors offer a deferred annuity with the same commission and have no annual charges. Their current interest credited rates are 3.75%, 3.50%, and 3.25%, respectively.

    (i)   Propose changes to XYZ's annuity that would be consistent with each of the five competitor-oriented pricing strategies.

    (ii)   Rank the pricing strategies in the order of best fit for XYZ. Justify your answer.

Commentary on Question:
Candidates generally performed well on this part. Most candidates were able to provide measures specific to each pricing strategies and fully describe their ranking and suggestions. Full credit was given for a well explained ranking that differs from the model solution

    (i)   Five competitor-oriented pricing strategies:

- Independent Pricing - This assumes the company has some protected niche within the market, so may want to slightly lower rates to improve profit margins, but still be within the range of competitors.
- Cooperative Pricing - No need to change the rate offered is within the range of competitors, but should remove annual charges to keep in line with the consistent pricing of the competitors.
- Adaptive Pricing - Again no need to change the rate offered as that is within competitive range, but could reduce annual charges to something more reasonable like $50, but still have something to offset fixed per policy costs.
- Opportunistic Pricing - Match the highest credited rate offered, remove annual charges, and raise commissions to 4.5%. There is very little profit, but if market share is gained the company could survive as the ones remaining are more efficient competitors.
- Predatory Pricing - Increase credited rates by 1.00%. This would cause profit margins to go negative, but the goal would be to drive the competitors to leave the market.

5. **Continued**

(ii)
- Rank adaptive pricing first, as this maintains most of the existing profit and brings the product more comparable.
- Rank independent pricing second, as this can maintain profitability, although it is in a smaller niche in the market.
- Rank cooperative pricing third, as low profitability is not very sustainable.
- Given slim profit margins, and the risk that other companies would re-price to compete, Opportunistic pricing is ranked 4th.
- Given the potential for financial ruin and regulatory scrutiny, predatory pricing approach is ranked last.

6. **Learning Objectives:**
2. The candidate will understand the relationship between product features, inherent risks, and the methods and measures to design and price products.

Learning Outcomes:
(2c) Develop and evaluate a product's performance, capital requirements, tax and regulatory requirements, and risk profile.

Sources:
Life Insurance Products and Finance, Atkinson & Dallas, Ch. 10, 11, 13

Commentary on Question:
Most candidates performed adequately on this question. Candidates were expected to either accept or refute the peer review actuary's comments and provide supporting comments. It was not necessary to provide alternative methods or approaches.

Solution:
Critique each statement in the memo. Justify your answer.

(a) Commercial mortgages as possible portfolio investment

Commentary on Question:
Most candidates recognized that commercial mortgages are riskier than government bonds. To earn full credit, candidates had to recognize the effect of this new asset class on both income and equity measures in the ROE formula.

- ROE = GAAP income/GAAP equity, or similar measure
- Commercial mortgages are riskier than government bonds, e.g. liquidity, default
- Additional risks mean required capital will increase
- Additional assets required to cover increased risk capital
- ROE numerator will increase, but so will denominator, so ROE may increase or decrease

(b) Pre- and post-tax ROI

Commentary on Question:
Candidate performance was mixed for this part. Many candidates confused pre- and post-tax profits with pre- and post-tax ROI. Credit was also given for answering in terms of GAAP ROI.

6. **Continued**

- ROI is rate that causes PV(distributable earnings) = 0
- If solvency reserves = tax reserves and tax rate level, then after-tax profits= level percentage of pre-tax profits
- Since after-tax profits are a level percentage of pre-tax profits, they will follow the same pattern
- Given the above, discounting both sets of cash flows to 0 will result in an identical ROI
- Very possible and somewhat common for pre- and post-tax ROIs to be similar

(c)   Discontinuing stochastic modeling

Commentary on Question:
Most candidates recognized that stochastic modeling is still advisable and that the effect of lapses in high interest rate environments was identified. Very few candidates identified possible actions to remedy the situation.

- As market rates move up and down, credited rate should move in order to remain competitive
- If market rates rise while credited rate remains low due to maintaining spread, policyholders will have greater incentive to lapse and invest with competitors
- Higher than expected lapses would hurt net profits
- If market rates drop, any guaranteed credited rate may cause spread compression
- Good to use stochastic modeling to analyze possible outcomes, especially with respect to lapses and where constant spread may not be possible
- Possible actions to remedy situation
  - Increase surrender charges
  - Adopt investment policy with shorter maturities

(d)   ROI in presence of negative earnings for years 1-3

Commentary on Question:
Most candidates recognized that there was only 1 sign change in the earnings, which would lead to a single logical ROI.

- ROI is rate that causes PV(distributable earnings) =0
- Number of roots in solving ROI equation is equal to number of sign changes in cash flow
- Since there is only 1 sign change in overall cash flow, there will be only 1 positive root
- Cash flows can be negative beyond 1st year, as long as there is only 1 sign change
- There will be only 1 logical root as ROI

6. Continued

(e) Higher assumed AIR

Commentary on Question:
Candidate performance was mixed for this part. To earn full credit, candidates had to demonstrate understanding that the higher AIR would result in a higher initial benefit, but a lower growth rate in benefit.

- Increasing the AIR (assumed interest rate) will lead to a higher initial benefit, since benefit amount = $AV/\ddot{a}_x^{(12)}$
- Annuity factor uses AIR and guaranteed mortality: the higher the AIR, the lower the $\ddot{a}_x^{(12)}$ and the higher the initial benefit
- Subsequent payments are determined by IncomeBen(t) = IncomeBen(t-1) * (1 +net interest rate)/(1+ AIR)
- Higher AIR will lead to an increased denominator above and a lower growth rate given the same NIR

(f) Using asset earned rate to discount distributable earnings

Commentary on Question:
Candidate performance was mixed on this part. Some recognized the limitations of using ROI. Credit was given for other rates suggested, provided the candidate provided justification.

- ROI is rate that makes PV(distributable earnings) = 0
- PV(distributable earnings) using ROI will always be 0
- Better to use asset earned rate, since it will produce a positive present value of profits
- Some investors demand rate of return that rises as risk of investment rises
- Company's hurdle rate is also an appropriate choice
- Hurdle rate based on company's WACC
- If PV>0, product creates value; if PV<0, product destroys value

7. **Learning Objectives:**
2.   The candidate will understand the relationship between product features, inherent risks, and the methods and measures to design and price products.

3.   The candidate will understand actuarial requirements of product governance, implementation, operations, and management.

Learning Outcomes:
(2c) Develop and evaluate a product's performance, capital requirements, tax and regulatory requirements, and risk profile.

(3b) Apply practices related to product management.
   • Describe how to monitor and evaluate actual experience such as benefits, persistency, and utilization including the use of experience studies and supplementary data sources.
   • Describe and assess practices related to data quality.
   • Recommend changes to non-guaranteed elements such as credited rates and policyholder dividends.

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

Expected Mortality: Fully Underwritten Canadian Individual Life Insurance Policies, CIA Education Note, July 2002 (excl. Appendices)

Experience Data Quality: How to Clean and Validate Your Data (Exclude Appendices) SOA/LIMRA Research Report

Commentary on Question:
Commentary listed underneath question component.

Solution:
(a)   Critique each guideline and recommend an appropriate action if necessary. Justify your answer.

Commentary on Question:
This question tested the candidates' knowledge of validating data and how it may be used to construct a mortality assumption.

Most candidates did well on this part of the question. To receive full credit, the candidate had to state if the statement was correct or incorrect and provided reasonable justification.

Candidates that did not state if the statement is fully correct or incorrect but provided reasonable support and alternatives to justify their response received full credit as well.

7. Continued

The solution below is based on the candidate stating whether the statement is correct or incorrect.

A. Correct. IJK Life should use industry experience data, as appropriate, since it does not have enough credible experience.

B. Incorrect. Random fluctuation is not a reason to ignore the spike. IJK Life should research further as there may be reasons for the increased claims such as natural disasters, epidemics, etc. IJK Life should also review cause of death claims for the period in question.

C. Correct. A review should be conducted to explain the spike.

D. Incorrect. Preferred underwriting data should be reviewed separately and in full to see if any pattern exists. Data from the company that showed preferred underwriting claims for the first time should not be excluded automatically. The data should be reviewed to see if there are any coding errors.

E. Incorrect. Data should not be duplicated. IJK Life should review and confirm that there is no error in the submission of all male claim data. Data could be ignored for gender distinct results but included in unisex results.

(b) Calculate the mortality cost at issue for 1,000 of pet insurance using an appropriate blending method. Show all work.

Commentary on Question:
This question required the candidate to identify an appropriate blending method for calculating the annual mortality rates and then use these rates to calculate the mortality cost.

The steps below lead to the answer that received full credit. Candidates that answered using an alternative but equally correct blending method also received full credit. Candidates received partial credit if completed partial steps correctly.

Most candidates understood what the question was asking, however, several candidates applied the blending method incorrectly, and if so, received partial credit.

7. Continued

Step 1: Derive Survival Table (ℓ_x)

ℓ_x	Year 1	Year 2	Year 3	Year 4	Year 5
Breed A	1000	1000*(1-.05) =950	1000*.95*(1-.02) =931	1000*.95*.98*(1-.13) =809.97	1000*.95*.98*.87*(1-.7) =242.99
Breed B	1000	1000*(1-.025) =975	1000*.975*(1-.5) =487.5	1000*.975*.5*(1-.313.) =334.91	1000*.975*.5*.687*(1-.2) =267.93

Step 2: Blend ℓ_x with 35% for Breed A and 65% for Breed B

Weighted ℓ_x	Year 1	Year 2	Year 3	Year 4	Year 5
	.35* 1000 + .65*1000 = **1000**	.35*950 + .65* 975 = **966.25**	.35*931 + .65*487.5 = **642.725**	.35*809.97 + .65*334.91 = **501.18**	.35*242.99 + .65*267.93 = **259.20**

Step 3: Calculate Mortality

Mortality	Year 1	Year 2	Year 3	Year 4	Year 5
	(1000-966.25)/1000 = **0.03375**	(966.25-642.725)/966.25 = **0.3348**	(642.725-501.18)/642.725 = **0.2202**	(501.18-259.20)/501.18 = **0.4828**	(259.20-0)/259.20 = **1.0000**

Step 4: Calculate Cost of Insurance

Cost of Insurance	Year 1	Year 2	Year 3	Year 4	Year 5
1000 x Sum of -->	0.03375 /1.05	0.3348* (1-0.03375) /1.05^2	0.2202 *(1-0.3348) *(1-0.03375) /1.05^3	0.4828 *(1-0.2202) *(1-0.3348) *(1-0.03375) /1.05^4	1.0000 *(1-0.4828) *(1-0.2202) *(1-0.3348) *(1-0.03375) \1.05^5

Final answer = 850.03

8. **Learning Objectives:**
2.   The candidate will understand the relationship between product features, inherent risks, and the methods and measures to design and price products.

Learning Outcomes:
(2a)   Identify, assess, and develop appropriate assumptions to reflect factors such as product characteristics, risks, policyholder behavior, and company actions.
   • Describe and apply the uses of predictive modeling.

(2b)   Assess and critique performance measures, risk measures, and modeling approaches. Recommend their uses in product management.

(2c)   Develop and evaluate a product's performance, capital requirements, tax and regulatory requirements, and risk profile.

Sources:
Atkinson & Dallas, Life Insurance Products and Finance, Chapters 10, 11, 13.

Commentary on Question:
Commentary listed underneath question component.

Solution:
(a)   Calculate the asset default risk for JCK Life's new product portfolio from each of the following perspectives:

   • JCK Life
   • Regulatory
   • Rating agency

Show all work.

Commentary on Question:
Candidates did very well on this part and most were able to correctly calculate the asset default risk. A common mistake was to use the factor for the 'Corporate bonds rated BBB' instead of the factor for the 'Corporate bond rate below BBB' for the BB-rated corporate bonds asset.

JCK Life Asset Default Risk = 0(100) + 0.006(255) + 0.03(45) + .05(100) = 7.88
Regulatory Asset Default Risk = .001(100) + .012(255) + .1(45) + .12(100) = 19.66
Rating Agency Asset Default Risk = 0(100) + .003(255) + .04(45) + .15(100) = 17.565

8. Continued

(b) You are given:

- JCK's competitors use the regulatory asset default factors in their pricing
- JCK uses rating agency factors for new products

Explain how JCK's choice of asset default factors affects their new products.

Commentary on Question:
Many candidates were able to correctly relate the amount of asset default risk to a pricing advantage for JCK against competitors. A common mistake was to not fully explain the relationship between the asset default factors, the amount of capital held and the pricing advantage/product competitiveness.

The rating agency factors which JCK is using are lower than what competitors are using. This could be a pricing advantage if the default risk is material to the pricing because they would be holding less capital. This also could mean they would have higher expected profitability.

JCK may also wish to use less commercial mortgages to reduce rating agency asset default requirements because the commercial mortgage factor is higher than the other asset class factors. This would result in a further competitive advantage.

(c) With regard to the liquidity and disintermediation risks of JCK's new product portfolio:

(i) Explain how these risks could affect JCK in a rising interest rate environment.

(ii) Describe ways to mitigate these risks.

Commentary on Question:
Most candidates were able to define disintermediation risk and liquidity risk. Common mistakes were to not fully describe how rising interest rates impacted the risk or to not clearly state which risk was what.

For part (ii) candidates did a good job listing strategies to mitigate risk however they sometimes struggled connecting the strategies to disintermediation and liquidity risk specifically. Or would list mitigation strategies that do not apply to these risks. To earn full credit candidates needed to describe at least 3 methods.

8. **Continued**

Disintermediation risk
When interest rates increase, policyowners could potentially earn higher interest rate elsewhere and if the company has invested in long-term assets they will not be able to match the higher interest rate. Therefore, many policies may loan from or surrender their policies creating a large unexpected cash outflow which forces the company to sell long-term investments. The higher interest rate depresses market values of long-term investments which will force the company to sell at a loss. Large losses may result in ratings downgrades and loss of confidence.

Liquidity risk
When interest rates rise and trigger lapses a large liability would have to be paid. Liabilities are payable on demand while most assets are invested long-term. In order to raise cash quickly to fund cash outflows assets may have to be sold in a short time at discounted prices. There may be little chance for the company to sell its more illiquid assets.

Ways to mitigate these risks:
- For both products, invest in assets with cash flows that closely match its liability cash flows
- Change the annuity product design to allow withdrawal with a partial or full market value adjustment
- Increase the surrender charge for the annuity product
- Focus on sale of the term life insurance product instead of deferred annuity since life insurance generally is classified as low interest rate risk
- Consider the use of reinsurance
- Since these are new products, target a modest level of sales for each product in times of expected rising interest rates

(d)   Calculate:

(i)   Distributable earnings in year 3

(ii)   Return on equity in year 3 using stockholder equity at the beginning of year as equity base

Show all work.

Commentary on Question:
Many candidates were able to correctly calculate the distributable earnings in year 3. However, very few correctly calculated the return on equity in year 3. Most were not able to calculate the stock equity in the ROE calculation. Common mistakes were to use values from year 3 instead of year 2 and to not include the deferred tax liability.

8. **Continued**

Distributable Earnings = Pre-tax solv Earnings + Inv Income of Req Cap- Tax - Inc in Req Cap
- Pre-tax solv Earnings: 325-204.25-8+14=142.75 (also given in the table as 143)
- Inv Income on Req Cap: 192*.07 = 13.44
- Tax: (142.75+13.44)*.35 = 54.67
- Inc in Req Cap: -(192-208)= -16

Distributable Earnings in year 3 = 142.75 + 13.44 – 54.67 – (-16) = 117.52

ROE = AfterTax Stock Earnings/Stock Equity

PreTax Stock Earnings = PreTax Solv Earnings + Inc Solv RSV - Inc Earn RSV – DAC + Inv Income on Req Cap
- PreTax Solv Earnings = 142.75
- INC Solv RSV: (350-358) = -8
- Inc Earn RSV: (-15-(-53)) = 38
- DAC = -24
- Inv Inc RC = 13.44

PreTax Stock Earning = 142.75 – 8 – 38 – 24 + 13.44 = 86.19

AT Stock Earnings = PreTax Stock Earning - tax
AT Stock Earnings = 86.19 * (1-.35) = 56.02

Year 2 Stock Equity = Solvency Reserve - Earnings Reserve + Req Cap - Deferred Tax Liability
- Yr 2 Solv RSV = 358
- Earn RSV = -53
- YR 2 Req Capital = 208
- Def Tax Liab = -127
  - Accrued tax = Pre-tax stock earnings * tax rate
  - Deferred tax provision = Accrued tax - (Pre-tax solvency earnings + Inv income on required capital) * Tax rate
  - Deferred tax liability in year 2 = 142 - 15 = 127

Stock Equity= 358 – (-53) + 208 - 127 = 492

ROE = 56.02/492 = 11.4%

8. Continued

(e)   Explain the advantages to JCK of using solvency earnings in their pricing.

Commentary on Question:
Few candidates were able to explain the advantages of using solvency earnings. Many candidates listed reasons that did not relate to using solvency earnings. To receive full credit candidates needed to explain at least two advantages.

- Solvency reserves and capital requirements drive shareholder investments and returns from the business
- Solvency results are more important to insurance rating organizations and regulators
- Solvency earnings are easier to calculate and understand

9. **Learning Objectives:**
1. The candidate will understand various insurance products, markets, and regulatory regimes.

Learning Outcomes:
(1c) Construct, evaluate and recommend product designs that are consistent with market needs, tax and regulatory requirements, and company business objectives.
- Evaluate the feasibility of proposed designs. Recommend designs.

Sources:
LP-122-13: NAIC Standard Non-forfeiture Law for Life Insurances: Sections 1-4, 5c, 6-9

Life Insurance and Modified Endowments Under Internal Revenue Code Sections 7702 and 7702A, Second Edition, 2015, DesRochers, Ch. 1-3, 6 and 7 (pp.205-252 up to Appendix 7.1)

Commentary on Question:
Commentary listed underneath question component.

Solution:
(a) Critique the following statements with respect to IRC section 7702:

   (i) *If a contract fails to meet the test conditions on any future date, the contract fails the test.*

   (ii) *Once a testing method is selected, it can be switched to a different test to maintain compliance.*

   (iii) *Cash surrender value used for testing is different from the general understanding of cash surrender value.*

   (iv) *There are no adjustments for applying dividends used to purchase a paid-up-addition.*

   Commentary on Question:
   In general, candidates did well on part (a), though many struggled with ii)
   (i) Candidates needed to recognize the retrospective and prospective nature of the two tests to obtain full points.
   (ii) Candidates performed poorly on this section in particular. Many incorrectly stated you could not switch tests or you could change tests, but failed to mention under what specific circumstances.
   (iii) Most candidates performed well on this question and were able to identify that the CSV under 7702 did not include surrender charges to obtain part marks. Full marks required recognition of at least two more differences.
   (iv) Most candidates recognized that a paid-up-addition does classify as an adjustment event.

9. **Continued**

(i) This statement is true only for CVAT, as it is a prospective test. If a contract does not meet the test in some future dates during the term of the contract, it is considered failed the test at issue. This statement is false for the guideline premium tests as it is a retrospective test. The contract is assumed to be in compliance with the test until an actual failure occurs.

(ii) This statement is false if CVAT is the original selected method of test, since it is a prospective test. If guideline premium test is selected originally, there are two exceptions where switching to CVAT is allowed:
(a) upon elections of a non-forfeiture option
(b) if switching to CVAT is needed to "cure" a failed contract

(iii) True statement. CSV under 7702 is similar to the general understanding of AV. It is the greater of maximum amount payable under the contract or the maximum amount the policyholder can borrow. It does not take into consideration of cash surrender value, policy loans, nor dividends.

(iv) False statement. The purchase of paid-up-additions are an adjustment event, changing the coverage, and requiring a recalculation of the test.

(b) Calculate the minimum cash surrender value for a 48 year old, issued at age 45 in year 2018 under NAIC Standard Nonforfeiture Law. Show all work.

Commentary on Question:
The candidates did not do well on part (b). They did receive partial marks if they failed to determine the correct discount rate, or if they used incorrect sets of Ax and äx from the provided chart.

Interest/discount rate used in the calculation = 125% x stat valuation rate rounded to nearest 0.25%. Given the issue year, Stat valuation rate = 4%. Discount rate = 125% x 4% = 5% (still 5% with rounding)

Net level premium = Level Face Amount * Ax / äx   x = 45 (issue age)
= 250,000 * 0.32 / 18.25
= 4,383.56

PV of Premium(adj) = PV (Guaranteed Benefits) + 0.01 x (Face Amount) + 1.25 x min(0.04 x Face Amount, Net Level Premium)
= 250,000 * 0.32 + 0.01 * 250,000 + 1.25 x min (0.04*250,000, 4383.56)
= 87,979.45

Adjusted Premium = PV of Premium (adj) / äx
= 87979.45 / 18.25
= 4,820.79

9. Continued

At age 48, minimum Cash surrender value = PV3(Guaranteed Benefits) - PV3(Adjusted Premium)
= Face Amount * Ax - Premium(adj) * äx   x = 48 here
= 250,000 * 0.356 - 4820.79 * 17.29
= 5,648.54

(c)   Management recommends calculating the guaranteed cash value of the product using an interest rate of 2% and applying the formula for the Standard Nonforfeiture Law.

Recommend a choice of 7702 compliance tests for this revision. Justify your answer.

Commentary on Question:
Candidates performed poorly on part (c). Many failed to give adequate justification for the 7702 compliance test they recommended. Partial marks were given if CVAT was chosen along with valid explanations as to why it was recommended.

Recommend using Guideline Premium and Cash Value Corridor Test for this revision.

Lowering the cash value interest to 2% will increase the guaranteed cash value well above that which would support the level death benefit the CVAT corridor will allow, which is based on 4% interest rate.

The CV corridor test has a much lower corridor requirement, therefore more likely supporting the level death benefit.

The guideline level premium is likely equal to or greater than the gross premium, which is based on 6.25% interest rate and reasonable charges for expenses and permitted mortality charges. The minimum interest rate allowed in the GLP calculation is 4%, and 6% for the GSP if prepayments are allowed.

The death benefit will have to be increased above the level amount in order to meet the definition of life insurance under CVAT.

10. **Learning Objectives:**
1. The candidate will understand various insurance products, markets, and regulatory regimes.

3. The candidate will understand actuarial requirements of product governance, implementation, operations, and management.

Learning Outcomes:
(1c) Construct, evaluate and recommend product designs that are consistent with market needs, tax and regulatory requirements, and company business objectives.
  - Evaluate the feasibility of proposed designs. Recommend designs.

(3c) Design and evaluate product management strategies. Recommend the product strategy.

Sources:
SOA Research 2015 - Transition to a High Interest Rate Environment

LP-105-07: Life and Annuity Products and Features

LP-123-13: NAIC Standard Non-forfeiture Law for Individual Deferred Annuities

Commentary on Question:
Commentary listed underneath question component.

Solution:
(a) Describe how each of the above product features affects the surrender rates.

   Commentary on Question:
   Most candidates were able to describe how each of the product features affects the surrender rates with an appropriate amount of detail. One common misconception was that an increase or decrease in the renewal rates in itself would cause a change in surrender rates. However, the surrender rates are a function of the renewal rate compared to the competitors' rates.

   - There may be shock lapses during the 30-day period where the surrender charges are waived. Policyholders who are looking to lapse their policies are more likely to wait until there is no surrender charge. The shock lapse rate will depend on renewal rate offered by competitors.

   - Having no renewal commission will lead to a shock lapse at the renewal period. Agents will have no incentive to keep policies in force, and instead are incentivized to have policies lapse and sell new policies.

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10. Continued

- The surrender charge, which is quite high during the 5 years between the renewal periods, will keep lapse rates low. There may be an increase in lapse rates if market rates increase significantly compares to the credited rates.

- The bailout provision may result in a higher lapse rate when interest rates rise since this provision offers the right for customers to lapse without paying a surrender charge

(b) Critique the proposed commission schedule.

Commentary on Question:
This question required the candidate to think of the impact of the relationship between commission rates and multiple other product features. Most candidates were able to identify that the CD annuities should have both first year and renewal commissions. However, very few candidates were able identify potential issues that arise for an insurance company when the first year commission rate is higher than that year's surrender charge.

- The initial surrender charge is less than the first year commission, which means that the insurer would have to pay more in commissions than received in surrender charges for policies lapsed in the first year. The relationship between first year commissions and the surrender charge may give agents the incentive to sell policies knowing that they will lapse in year one.

- Many CD annuities are designed to pay commissions on renewal for contracts that renew. Implementing a renewal commission either equal or less than the first year commission would be a more appropriate compensation structure to encourage policyholder persistency.

(c) Contrast pricing considerations for bailout provisions against Market Value Adjustment (MVA) features for the above product.

Commentary on Question:
In asking for the pricing considerations, this question was focusing on the impact on IRR, statutory reserves and required capital. Most candidates correctly identified the impact on lapses, but did not discuss the impact of the bailout provision or market value adjustment on the metrics noted above.

Additional surplus strain from the bailout provision will reduce the internal rate of return. This is because bailout provision prevents surrender charges from being incorporated into the statutory reserving and required capital calculations. Thus reserves and required capital are higher than they otherwise would be, lowering the internal rate of return.

10. Continued

Alternatively, products with an MVA still account for the surrender charges in their reserve and capital calculations, and generally have more favorable statutory reserving and required capital provisions.

The bailout option increases the lapse risk by waiving the surrender charges in a rising interest rate environment. MVA reduces risks from potential excess lapses in increasing interest rate scenarios.

There are two options to calculate the cost of the bailout provision:
- o Average lost surrender charge x excess lapse rate x probability of trigger
- o Dynamic interest scenario testing (preferred method)

(d) Critique the following statement:

"To quantify the interest rate risk, the model was run over 10,000 interest rate scenarios. The interest rate scenarios were built based on Treasury rate history from the last fifty years. RHK's lapse experience for CD annuities since 2010 was also used as inputs to the model. The analysis found little interest rate risk from this product. This is primarily because RHK has outperformed the market with its alternative one-year fixed income instruments, eliminating disintermediation risk."

Commentary on Question:
This question required candidates to understand the subtle shortfalls of a complex statement. Although many candidates understood the limitation of using a one-year fixed income instrument, most did not comment on the downfall of using an alternative asset. Most candidates noted the limitation of using historical data, given the monetary policy changes over the last couple of decades, but many believed that using 10,000 (or 1,000) stochastic scenarios was appropriate.

Using lapse experience since 2010 only captures experience where interest rates have been historically low (ie. 2008 and beyond). In order to fully understand the disintermediation risk, RHK needs to study lapse experience that includes periods with higher interest rates to understand the correlation between a higher interest rate environment and lapse rates.

High initial performance from alternative asset classes is difficult to maintain. Alternative asset classes are especially susceptible to excessive optimism as early adopters have success in a small market and a demand surge follows, driving prices above economic values until demand moves on to new opportunities and prices drop. This is particularly an issue for the asset/liability mix here, since the assets have a life span of 1 years, compared to the 5-year terms.

10. Continued

Treasury rate history will have limited value. Historical data is less useful for interest rate projections due to policy change from the U.S. central bank, the increasing integration of interest rate markets that feed back upon one another, and the increasing activity of other central banks around the world in managing exchange rates and interest rates with a goal of impacting economic activity.

A handful of well-crafted deterministic scenarios are more valuable than large volumes of stochastic scenarios. Stochastic scenarios have limited value, because they often repeat similar scenarios rather than testing plausibly stressful conditions occurring in the tail of the distribution. In low interest rate environments, these model generators often do not allow negative rates and experience a slow tug toward a historical mean. Long periods of depressed rates or severe spikes do not occur frequently. A small number of deterministic scenarios enable a modeler to test the primary risks and implications, if properly selected.