ILA LP Model Solutions
Spring 2018

1. Learning Objectives:

1. The candidate will understand various insurance products, markets, and regulatory regimes.

Learning Outcomes:

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

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

Sources:

Life Insurance and Modified Endowments Under IRC §7702 and §7702A, v2

Life Insurance Acceleration Riders, Filmore - Reinsurance Section, July 2013, pp. 35 – 38

Commentary on Question:

This question tested candidates' understanding of life insurance acceleration riders, their associated tax treatments, and required them to calculate guideline premium tests under section 7702 of the Internal Revenue Code.

Solution:

(a) Describe the three common chronic illness acceleration rider designs.

Commentary on Question:

Candidates generally performed well on this question, however some candidates described alternate critical illness acceleration rider designs appropriate for annuity/long term care insurance combinations for which no credit was awarded.

Actuarial discounting of the face amount being accelerated

- A reduced amount of the face amount is accelerated in a given year
- Reduction reflects actuarial discount for time value of money associated with benefit being paid early as well as foregone premiums related to accelerated amount

Accelerated benefit through a lien against the death benefit of the policy

- Amount of lien equals cumulative accelerated death benefit plus interest
- Death benefit ultimately paid is reduced by outstanding lien balance

1. Continued

Charge an explicit additional premium at the time the critical illness acceleration rider is added to the policy

(b) Describe additional underwriting risk control measures your company should consider when developing the rider.

Commentary on Question:
Candidates generally struggled with this question. Many candidates did not provide measures specific to underwriting risk and/or did not fully describe their suggestions. Credit was given for other reasonable underwriting risk control measures if properly explained.

- Focus on conditions that may result in morbidity associated with activities of daily living (ADL) losses that may not be included in a typical life insurance application
- Probe regarding ADL losses or other current disabilities
- Ask questions related to other living benefits coverage inforce (for example: Long term care, critical or terminal illness acceleration riders)
- Limit issue age at which chronic illness rider can be added
- Only offering rider on policies up to a specified maximum rating
- Requiring an approved licensed healthcare practitioner to confirm the policyholder is unable to perform ADLs

(c) Assess whether each the following will receive favorable tax treatment under section 101(g) of the Internal Revenue Code:

(i) Unable to perform at least three activities of daily living due to a loss of functional capacity.

(ii) The only insurance protection provided under the universal life policy and chronic illness acceleration rider is coverage of qualified long-term care services.

(iii) Chronic illness acceleration rider reimburses for all expenses incurred.

Justify your answer.

Commentary on Question:
Many candidates had difficulty with this question and didn't provide appropriate justification for their responses.

1. Continued

(i) - A policyholder qualifies for non-taxable benefits if he/she is unable to perform at least 2 out of 6 activities of daily living (ADLs)
- As it is permissible to have a more stringent benefit trigger, requiring the policyholder to be unable to perform at least 3 ADLs will receive favorable tax treatment under section 101(g) of the Internal Revenue Code

(ii) - This meets the definition of a qualified long term care insurance contract (QLTCI) as defined in section 7702B
- Any chronic illness benefits provided on a periodic, lump-sum, or other non-reimbursement basis are excludable from income only to the extent of the per diem limitation of section 7702B
- Benefits received from the insured's chronic illness will be excludable from income (i.e. tax-free) and therefore qualify for favorable tax treatment under section 101(g) of the Internal Revenue Code

(iii) - The primary purpose for the expenses must be related to care required or needed assistance due to the insured's chronic illness
- Personal expenses with no relationship to the insured's needed medical assistance cannot be reimbursed
- Therefore, Chronic illness acceleration rider reimbursing for all expenses incurred does not qualify for favorable tax treatment under section 101(g) of the Internal Revenue Code

(d) Compute the Guideline Single Premium and Guideline Level Premium under section 7702 of the Internal Revenue Code.

Show all work.

Commentary on Question:
Almost all candidates used the appropriate interest rates for each calculation. Many candidates were able to correctly compute the Guideline Single Premium and Guideline Level Premium. Common errors included using the guaranteed expense charge, including the chronic illness rider, or excluding the disability waiver rider.

<u>Assumptions required for both calculations:</u>

Per IRS rulings on the reasonable expense charge rule, assume current charges for contracts providing both current and guaranteed expense charges.
Therefore, annual administrative charge = $60.

Premium load = 7%

1. Continued

The disability waiver rider is a Qualified Additional Benefit (QAB).
Therefore, include disability waiver rider charge of $500 in both Guideline Single Premium (GSP) and Guideline Level Premium (GLP) calculations.

The chronic illness rider is not a QAB.
Therefore, exclude chronic illness waiver rider charge in both Guideline Single Premium (GSP) and Guideline Level Premium (GLP) calculations.

Interest rate used for GSP
= maximum (6%, guaranteed minimum interest rate)
= maximum (6%, 3%)
= 6%

Interest rate used for GLP
= maximum (4%, guaranteed minimum interest rate)
= maximum (4%, 3%)
= 4%

GSP = [(Death Benefit * $A_{55, 6\%}$) + (Disability waiver rider charge * $\ddot{a}_{55:10, 6\%}$) + (Annual Admin Charge * $\ddot{a}_{55, 6\%}$)] / (1 – Premium Load)
GSP = [(100,000 * 0.225) + (500 * 7.184) + (60 * 12.870)] / (1 – 0.07)
GSP = 26,864.20 / 0.93
GSP = 28,886.24

GLP = [(Death Benefit * $A_{55, 4\%}$) + (Disability waiver rider charge * $\ddot{a}_{55:10, 4\%}$) + (Annual Admin Charge * $\ddot{a}_{55, 4\%}$)] / [$\ddot{a}_{55, 4\%}$ * (1 – Premium Load)]
GLP = [(100,000 * 0.345) + (500 * 7.909) + (60 * 16.207)] / [16.207 * (1 – 0.07)
GLP = 39,426.92 / 15.07251
GLP = 2,615.82

2. 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.

Sources:

Experience Data Quality: How to Clean and Validate Your Data

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

Proposed ASOP on Setting Assumptions, December, 2016

Commentary on Question:

Commentary listed underneath question component.

Solution:

(a) Describe the principles which should be followed in analyzing the mortality and persistency experience of XYZ's whole life insurance block of business.

Commentary on Question:

Overall, students did well. The most common issue was students gave a lot of detail about Quality of Data, but overlooked discussing the other principles. It is better to give fewer details about one aspect of the solution but touch on as many principles as possible, as opposed to writing down everything you know about one principle and exclude discussing the other principles.

1) Evaluate the credibility of the data
- requires actuarial judgment, need to consider the homogeneity of data and reasonability of methods and results

2) Evaluate the quality of data
- data which is completely accurate is seldom available
- objective of data cleansing is to have valid and accurate data

- should find and correct common data validity errors first before moving on to complex data checks
- data validity errors are more common and frequent in inter/intra company studies than data accuracy errors
- frequently data entry errors are to blame for data validity and accuracy errors within the source data

2. Continued

3) Use actual (or similar) experience
- experience used should be determinable, available and statistically credible

4) Reflect trends in experience as appropriate
- it is not enough to just look at experience in the last year to set an assumption
- need to evaluate any trends in experience over time, and make a judgment whether any trends will continue

5) Reflect company and external factors
- review company business practices and reflect them in setting the assumption
- especially true if company practices have changed or are expected to change
- one example is to consider the company's underwriting rules
- mortality rates should reflect the selection criteria for each rating class, the frequency underwriters make exceptions to the rules, the requirements for reinstatement, etc.

6) Sensitivity test the assumptions
- actuary should conduct sensitivity tests of the impact of likely deviations in experience that could have a material impact
- standard statistical tests or historical experience can help establish range of likely deviation

(b) The most recent experience study showed significant differences in mortality and persistency experience compared to previous experience studies. This experience was used to price a new product and filed with the Department of Insurance. An error was discovered in the data and corrected results now show minor differences from previous experience studies.

List disclosures required by the Proposed ASOP—Setting Assumptions.

Commentary on Question:
Part b was answered well by the majority of students. One suggestion is to give a ***reason*** *for your comment. For example, part marks were given if a student wrote, "Disclose material assumptions". But more marks were given if a student said why material assumptions should be disclosed … ie "to permit another qualified actuary to assess the reasonableness of the assumptions."*

The pricing actuary (pa) should disclose:
Refer to ASOP #41, Actuarial Communications for the appropriate disclosures contained therein
Disclose material assumptions in detail to permit another qualified actuary to assess the reasonableness of assumptions
Description should include a disclosure of any explicit margin for adverse deviations
Disclose material changes in assumptions since most recent actuarial report should be communicated, so state that there are differences from previous reporting but differences were reconciled

2. Continued

According to ASOP 41, state any changes as regards subsequent events or changes that became known after the information date that would have affected the assumptions set as of the information date
Material inconsistencies among assumptions and reasons for such inconsistencies
However in case of prescribed assumptions set by law, pa's disclosure may be limited to identify the possibility of an inconsistency with other assumptions
Use professional judgment when setting assumptions or assessing whether asumptions used in the experience study are reasonable
Consider to what extent it is appropriate to adjust the assumptions to compensate for known deficiencies in the data
Consider the reasonableness of the material assumptions and whether it is reasonable in the aggregate

Disclose any reliance on the other actuaries assumptions used in experience study

(c) XYZ used the Forced Method to end the mortality table at attained age 100.

Calculate mortality rates to age 120 using two alternative methods that are less conservative than the Forced Method, using the mortality table below:

Age (x)	q_x
96	0.36
97	0.40
98	0.45
99	0.55
100	1.00

Show all work.

Commentary on Question:
Part c was very well done. Be sure to show your work though. A value for every single age did not have to be shown, but enough information and values needed to be provided to indicate what your approach was. It would be a good idea to show a few q's …. Say at ages 101-103 and then a few q's at the end of the table … say ages 118, 119 and 120. Part marks were given if not enough detail was provided.

Candidate should extend ultimate age to address conservatism concerns.
Blended method: select an ultimate age and blend the rates from some earlier age to dovetail smoothly into
1.000 at the ultimate age

2. Continued

Pattern method: let the pattern of mortality continue until the rate approaches or hits 1.000 and set that as the
ultimate age.

Less than one Method: Select an ultimate age but end the table at whatever rate is produced at that age so that the ultimate rate is less than one.

Blended method: candidate should apply appropriately to a higher ultimate age (e.g. 120). Could linearly interpolate between .55 at age 99 and 1 at age 120.
Pattern method: candidate should extend using the pattern in the table given (variety of answers)
Less than one: candidates should select an ultimate age and end the table at whatever rate is produced at that age (a rate less than one) … variety of answers.

3. 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.

(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:

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

SOA - Society of Actuaries - Product Development Section Newsletter (Product Matters!), Term Conversions – A Reinsurer's Perspective, June 2012, pp. 1, 5 – 6
LP

LP-110-07: Policyholder Dividends

Commentary on Question:

Commentary listed underneath question component.

Solution:

(a) Describe a term conversion privilege.

Commentary on Question:
Question sought the definition of a term conversion. Most responses provided general definition of a conversion. Not many candidates provided the specific details as outlined below.

A term conversion privilege allows the policyholder of term life insurance product to convert to any whole life permanent insurance products without evidence of insurability.
Maximum credit given if it was stated that the same rate class is guaranteed.

(b) Explain two primary ways to cover the cost of anti-selective mortality due to term conversions.

3. Continued

Commentary on Question:
Candidates received full credit for a response similar to below (ie identifying where to place the cost and an explanation). About two thirds of the candidates received full credit. Others received partial credit for just saying "include in term pricing" and "include in permanent life pricing" with limited explanation.

1. Include in term pricing:
   a. Aligns the cost to the product that will experience the increased mortality
2. Include in permanent life pricing:
   a. Difficult to determine volume of permanent life sales
   b. Difficult to predict utilization rate
   c. Term products are price sensitive

(c)

Overall Commentary on Question:
This section tested the understanding of the pegging and substitution methods. Full credit was given if candidates provided a good definition for each method, calculated the present values, and justified their recommendation. Some candidates demonstrated full understanding while others struggled with the definition of the methods.

(i) Compare and contrast the following methods for changing a dividend scale:

Commentary on Question:
Most candidates understood this question and provided a definition, however, only about half received credit for providing the correct definition. For the comparison portion of the question, about one third provided enough information to receive full credit.

- Pegging method: Pays at least as much as the prior dividend
- Substitution method: Replaces the entire current scale with the prior scale
- Similarities:
  - Applies when the current scale of the dividend is less than the prior dividend scale
  - Consider the equity between the block of business
  - Slightly improves persistency
  - Consider additional cost
- Differences:
  - Substitution works best for recent issues while pegging applies broader
  - Pegging makes spot changes to the current dividend scale while substitution replaces the entire dividend scale

3. Continued

(ii) Calculate the present value of the future dividend scale as of the end of 2018 using the two methods above and an interest rate of 3%. Show all work.

Commentary on Question:
The solution to this question varied across candidates. Multiple solutions for the future dividend scale under the pegging method were accepted. Candidates had to show an increasing scale, with the initial dividend greater than 10 and not decreasing. On the contrary, there was only one correct solution for the substitution method. For both methods, credit was given for the discounting being done correctly even if the scales were not fully correct.
Credit was also given if the candidate assumed that the 2018 dividend had already been paid and only 3 years of dividends were discounted.

Below is the most common answer shown for the pegging scale and the only solution for the substitution scale:

Pegging Scale = 11, 12, 13, 14
PV of scale = 11 + 12/1.03 + 13/(1.03^2) + 14/(1.03^3) = 47.72

Substitution Scale = 12, 14, 16, 12
PV of scale = 12 + 14/1.03 + 16/(1.03^2) + 12/(1.03^3) = 51.66

(iii) Recommend a method that MBB should use to change the dividend scale. Justify your answer.

Commentary on Question:
The majority of the candidates received partial credit for just making a recommendation of either method (ie. no justification). Additional credit was given if a reasonable justification to the recommendation was provided.

Recommend Substitution method:
Scale hasn't been changed in 10 years, reasonable for the company to make a change now.

OR

Recommend Pegging method:
Slower impact to policyholders
PV is less costly

3. Continued

(d) List the four main sources of earnings that drive a dividend scale.

Commentary on Question:
A list was sufficient for full credit. Most candidates received full credit on this question.

1. Investment earnings or interest
2. Mortality experience
3. Expense experience
4. Persistency experience

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.

Learning Outcomes:

(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-113-09 Economics of Insurance How Insurers Create Value for Shareholders Swiss Re

Risk Based Pricing—Risk Management at the Point of Sale, Product Matters, June 2009

Commentary on Question:

Commentary listed underneath question component.

Solution:

(a) List the disadvantages of using Economic Value in the evaluation of IJK's products.

Commentary on Question:

This question tested a candidate's knowledge of what problems might be anticipated when switching from an Embedded Value to an Economic Value framework.

Most candidates were able to identify that an Economic Value framework compared to the current Embedded Value framework would have its share of disadvantages, mainly from a complexity of modelling or explanation to senior management perspective, but very few identified that there would be very few disadvantages from a Valuation perspective.

From a valuation perspective, there are no disadvantages in using the Economic Value framework versus the current Embedded Value framework.

The Economic Value framework is more complicated to explain to Senior Management. From a modelling perspective, there are disadvantage such as the need to create a replicating asset.

4. Continued

(b) Explain how a Replicating Portfolio could be used within the Economic Value Framework.

Commentary on Question:
Many candidates were able to identify the first two points below. However, to receive full credit candidates had to expand on the value of splitting returns between the insurance and investment functions.

The following is how a Replicating Portfolio could be used within an Economic framework:

- The insurer constructs a replicating portfolio that best matches the insurance liability cashflows.
- The replicating portfolio is used to determine the cost of the liability cashflows and the required investment return to support the insurance liabilities.
- The insurance function is deemed to have purchased the replicating portfolio from the treasury function to minimize its exposure to market risk.
- The treasury function properly allocates investment returns and capital costs between the underwriting and investment functions based on the replicating portfolio.

(c)

(i) Describe the benefits of using a treasury function to measure a product's performance.

(ii) Calculate the economic profit for each of the following components:

- Insurance
- Investment
- Treasury

Show all work.

(iii) Assess whether product performance is acceptable.

(iv) List two ways to increase product performance based on the calculations above.

4. Continued

Commentary on Question:
This question tested the candidate's understanding of why companies use the Treasury function in determining a product's Economic Performance.

Candidates generally did well on part (i) but struggled with part (ii). In part (ii), many candidates struggled to calculate the various components in the determination of the Economic profit for the Insurance, Investment, and Treasury functions. In order to receive full credit, the candidate needed to complete the table as shown below. Candidates that calculated incorrect values in part (ii) were still given full credit for part (iii) and (iv) as long as the answers were appropriate in respect to part (ii).

(i) The benefits of using a treasury function to measure a product's performance are:
- Explicitly breaks out the product's insurance and investment performance so that profitability of each can be analyzed.
- Insurers generally do not invest solely in the replicating portfolio. It is therefore important to benchmark the actual investment performance with the theoretical replicating portfolio return.

(ii) **Bolded Values in table were given in the question.**

General Formulas used in the table:
Economic Profit = Profit from each Department + Capital Cost
Profit from each Department = Premium + Investment Income – Claims – Expenses – Increase in Liabilities
Capital Cost = Base Cost of Capital + Risk Cost of Capital
Total = Insurance + Investment + Treasury

Income Statement	Total	Insurance	Investment	Treasury
Premium	40[a]	**40**		
Investment Income	12[c]	-3[g]	12[c]	3[f]
(-1) * Claim	-20[a]	**-20**		
(-1) * Expense	-2[a]	**-2**		
(-1) * Increase in Liabilities	-15[a]	**-15**		
Profit from each Department	15	0	12	3
(-1) * Base Cost of capital	**-9**	0[b]	-6[d]	-3[e]
(-1) * Risk Cost of capital	**-1**	-1[b]	0[b]	0[b]
Capital cost	-10	-1	-6	-3
Economic Profit	5[h]	-1[h]	6[h]	0[h]

4. Continued

[a] Values for premium, claim, expense and increase in liabilities are only used in the calculation of the Insurance profitability.

[b] Base Cost of Capital is 0 for Insurance department. The Risk Cost of Capital is only applicable to the calculation of the Insurance Economic Profit, and is 0 for both the Treasury and Investment departments.

[c] Total Investment Income for the Investment department, which is also the Total Investment Income for the company, is

= Assets of $120 * Return on invested assets of 10% = 12

[d] Investment's Return of the Replicating Portfolio = Assets of $120 * Rate of Return of 5% = 6

Note to Candidate: The insurer holds total assets of 120 and the Investment department earns a return of 10% compared with a return on the replicating portfolio of 5%. The Investment function receives the total investment return and is charged with the return of the replicating portfolio.

[e] Given the Total Base Cost of Capital is 9 and Investment' Base Cost of Capital is 6, as it is charged the return earned on the replicating portfolio, the Base Cost of Capital for Treasury is 3

[f] Treasury is profit neutral. Therefore, Treasury's Investment Income is 3

[g] This then implies that the Investment Income for Insurance is -3

[h] Economic Profit = Profit from each Department + Capital Cost

(iii) The product's performance is unacceptable as there is a $1 million loss on the Insurance department's underwriting activities. By splitting the profitability between Insurance and Investment, it can be seen that the product's overall profitability is driven by the Investment department's ability to generate improved performance over the amount that could be earned by the replicating portfolio.

(iv) Given that Insurance department's performance is causing the overall profitability to be unacceptable, IJK could increase premiums or decrease expenses to improve profitability.

4. Continued

(d) IJK is also considering moving from traditional pricing methods to risk based pricing using a market consistent approach.

Assess the effects on profit margin for each of IJK's products with respect to the following:

- Investment guarantees
- Asset returns
- Insurance adjustability

Commentary on Question:
This question tested candidate's understanding of how product features impact profitability under a risk based pricing versus a market consistent approach.

Most candidates were able to identify that the Variable Annuity product would perform worse under the market consistent approach. However, many candidates struggled with their understanding of the impact of the features for Term.

Note: Under a market consistent approach, some products will perform better than others. The results will vary depending on the level of guarantees in the product, the amount of asset risk borne by the insurers, and whether or not the product allows adjustments to the product at management's discretion. In other words, a product with more guarantees, more asset risk, and without management levers to mitigate adverse experience will be considered a riskier product than a similar product with opposite characteristics. Therefore, the pricing metric will be worse in the case of the former versus the latter.

- Term does not have investment guarantees, therefore switching to a risk based pricing using a market consistent (MC) approach will increase the profit margin.
- The short term asset nature of Term invested in low asset risk classes means switching to a risk based pricing using an MC approach will increase the profit margin.
- Term does not have any adjustability levers, therefore switching to a risk based pricing using an MC approach will decrease the profit margin.

- Variable Annuities (VA) have investment guarantees, therefore switching to a risk based pricing using a MC approach will decrease the profit margin.
- The long-term nature of the VA product may have increased asset risk which means switching to a risk based pricing using an MC approach will decrease the profit margin.
- VAs do not have any adjustability levers, therefore switching to a risk based pricing using an MC approach will decrease the profit margin.

5. Learning Objectives:

1. The candidate will understand various insurance products, markets, and regulatory regimes.

Learning Outcomes:

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

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

Sources:

Quantification of the Natural Hedge Characteristics of Combination Life or Annuity Products Linked to Long-Term Care Insurance, March 2012

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

Commentary on Question:

Commentary listed underneath question component.

Solution:

(a) Describe the key risks associated with a standalone Long-Term Care Insurance (LTCI) product

Commentary on Question:

Many of the candidates received full credit for describing all three of the key risks associated with standalone LTCI, or partial credit for describing one or two of the three key risks. Candidates received no credit if they only listed the risk(s) without supporting description(s), as they were required to show that the candidate understood why the item is a risk for standalone LTCI.

Below is one possible solution. Credit was also given for other descriptions of these risks that reasonably demonstrated the candidates understanding of the risks.

Key risks for standalone LTCI are:

- Persistency – Higher persistency reduces profits because more policyholders retain coverage into the later durations where the annual premium is insufficient to cover the claim costs.
- Investment Returns – Standalone LTCI is a level premium product with a claim cost curve that increases dramatically with age. Excess premiums are invested in early years to cover the cost of LTCI in later durations.
- Morbidity Risks –higher claim incidence rates and/or lower claim termination rates than expected will reduce profits.

5. Continued

(b) LTCI sales have been declining. LWS is considering offering a LTCI and annuity combination product.

(i) Describe how LTCI combination products reduce risk versus a standalone LTCI, which provides the same LTCI benefit amount.

(ii) Describe the benefits to consumers of LTCI combination products with extension of benefit riders.

(iii) You are given the following sensitivity test scenarios for a proposed LTCI and annuity combination product:

Scenario	Sensitivity
A	80% of Active Life Mortality
B	130% Annual Lapse rate
C	110% LTC Incidence Rates
D	115% Claim Termination Rates

Assess the impact on product profitability for each scenario. Justify your answer.

(iv) Recommend a LTCI and annuity combination product that minimizes the risk to LWS for each of the following product designs:

A. LTCI and annuity combination with a 2 year acceleration benefits, without inflation
B. LTCI and annuity combination with a 2 year acceleration benefit and 4 year extension of benefit rider, without inflation
C. LTCI and annuity combination with a 3 year acceleration benefit and 3 year extension of benefit rider with inflation

Justify your answer.

Commentary on Question:
Part (i):
This part of the question required candidates to describe how LTCI combination products reduce risk to the company versus a standalone LTCI. Some candidates described how LTCI combination products reduce risk to the insured; in that case credit was given, as appropriate, in part (b)(ii).

Credit was given for either LTCI and annuity combination products or LTCI and life combination products.

5. Continued

Part (ii):
Below is a sample solution which would receive full credit. Credit was also given for other reasonable answers. Candidates did well on this section.

Part (iii):
Full credit was given to candidates who assessed the impact of the scenarios on each of the three components of a combination product (i.e. standalone LTCI, standalone annuity, and the combination product). Partial credit was given to candidates who assessed the impact of the scenarios on two of the three components. No credit was given to candidates who only assessed the impact of the scenarios on a single component.

Many candidates assessed the impact of the scenarios only for the combined product (no credit was given) or the impact of the scenarios on only the LTC and combined product (partial credit was given). Many candidates also assumed the annuity was a payout annuity instead of a deferred annuity (or that the annuity had death benefits or withdrawal benefits). No credit was given for the impact of the scenarios on the annuity component of these answers, but it was recognized that the annuity impact was attempted.

Credit was given to candidates that assessed the impact of the scenarios on the components of a LTCI and life combination product instead of a LTCI and annuity combination product.

Part (iv):
Most candidates failed to recommend which one of the three product designs minimizes the risk to LWS. Candidates often answered by recommending which of the three approaches for payout structures (tail, coinsurance, or pool) should be used with each of the three product designs. No credit was given for those answers. Even those candidates who answered in the correct manner by recommending one of the three product designs usually chose the wrong product design.

Of the candidates who answered in the correct manner, many evaluated the risks of the product features without considering the impact on a LTCI and annuity combination product. For example, the risks of an inflation rider are significantly diminished for a LTCI and annuity combination product compared to a standalone LTCI product.

5. Continued

Part (i):

- LTCI riders commonly pay out monthly long-term care benefits over two to three years, after which the annuity accumulated value is depleted, maximum long-term care benefits have been paid, and the entire coverage ends. It represents a reduction to the risk to the insurance company versus coverage provided under stand-alone LTCI, since the company would be required to pay that same dollar amount to the policyholder ultimately via the annuity.
- Some of the pricing factors that normally reduce profit in a standalone annuity plan have a dampened impact when that same base plan is sold with an LTCI rider, creating a form of internal hedging effect of risks for the insurance company.

Part (ii):

- Most combination products are single premium products and provide cash values for policyholders who discontinue their coverage. This overcomes a concern for purchasers of standalone LTCI, the risk of never receiving any benefits from the policy.
- Extension of benefit (EOB) riders provide LTCI protection for an additional period of time that is often one to two times the length of the acceleration benefit (AB) period. This provides more comprehensive coverage for catastrophic LTCI needs.

Part (iii):

Scenario A (80% active life mortality):

- The annuity base plan profits are slightly increased, given that the time over which acquisition expenses can be amortized is longer.
- The stand-alone LTCI profits are decreased due to decreasing decrements and increasing long-term LTCI costs.
- The combination product profits are decreased (the losses from the LTCI are partially offset by the gains on the annuity).

Scenario B (130% annual lapse rate):

- The annuity base plan profits are decreased because deferred annuities are persistency supported.
- The stand-alone LTCI profits are increased because LTCI is lapse supported.
- The combination product profits are increased (especially at younger ages due to positive impact of higher lapses on standalone products on LTCI profits is greatest at the younger ages, with possible increases at later ages) as normal lapse assumptions for combination plans are much lower than those used for annuities lessening the negative impact from annuity component.

5. Continued

Scenario C (110% LTC incidence rates):

- The annuity base plan profits are not impacted by an increase in LTC incidence rates.
- The stand-alone LTCI profits are decreased due to the increase in LTCI benefit payments.
- The combination product profits are decreased. However, given that policy holders are cross-funding the first two years of coverage in the combination plans from their own policy values, the profit sensitivity to incidence rates is diluted compared to stand alone LTCI, especially for annuity combinations.

Scenario D (115% claim termination rates):

- The annuity base plan profits are not impacted by an increase in claim termination rates.
- The stand-alone LTCI profits are increased due to the reduction in the time period during which LTCI benefit payments are made.
- The combination product profits are increased. However, the increase is diluted compared to stand alone LTCI due to the cross-funding elements of the LTCI and annuity combination.

Part (iv):

Product design C minimizes the risk to LWS.

- Volatilities are increased for plans with inflation benefits, but greater benefits are realized by the combination plans due to the internal hedging characteristics.
- Plans that accelerate over three years with a three-year EOB provision further dampen the risks of combination plans versus combination plans with a two year AB + four-year EOB
- For the three-year AB + three-year EOB plan, the policyholder is "cross-funding" the first three years of coverage and the profit sensitivity to LTCI incidence rates is even further diluted than under a two-year AB + 4-year EOB plan. Longer AB has additional profitability benefits.

(c) The CEO of ~~XYZ~~ LWS has proposed to stop the sale of critical illness products because the premium is expensive and LWS also sells disability income insurance.

Critique the CEO's proposal. Justify your answer.

Commentary on Question:

This part of the question required candidates to analyze and respond to the CEO's proposal by critiquing the statement that CI premiums are expensive and by comparing critical illness (CI) and disability income (DI) insurance.

5. Continued

Many candidates misinterpreted the "expensive" rationale as a statement that critical illness was an expensive product for the company to administer, rather than a statement that the premiums were high for the consumer. Many candidates also compared CI to LTC or another product and did not compare CI to DI. Some candidates suggested that the CEO look at profitability metrics or that the CEO did not understand the insurance market. These types of answers received no credit.

An example of a solution which would receive full credit is below. Credit was also given for other reasonable answers.

- Incidence rates for CI are high so claims are likely and the premiums are high (especially compared to term life insurance where mortality rates are lower).
- CI is not a substitute for DI. Only 15-20% of those who have both types of policies could make a claim which qualifies for benefits under both policies. Many DI claims are for mental/nervous conditions or soft tissue injuries, neither of which would qualify for CI benefits.

6. 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:

(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:

Impact of VM-20 on Life Insurance Product Development, SOA Research, Nov 2016

LP-107-07 Experience Assumptions for Individual Life

CIA 2014 - Lapse Experience Study for 10-year Term Insurance, Jan 2014, pp. 6 -32

Commentary on Question:

Commentary listed underneath question component.

Solution:

(a) ABC Life's primary focus is on Term Life insurance and Universal Life insurance with Secondary Guarantees (ULSG).

(i) Explain three different reserve components and their mechanics under VM-20.

(ii) Describe the advantages and disadvantages with delayed adoption of VM-20.

Commentary on Question:

Most of the candidates were able to list the three different reserve components but only few of them could explain them correctly.

The second part of the question asked for the advantages and disadvantages of delayed adoption of VM-20; however, some candidates described the advantages and disadvantages of moving to VM-20 instead.

6. Continued

(i) Net Premium reserve is a seriatim formulaic calculation using specified CSO mortality tables, prescribed lapses and prescribed valuation interest rates.
Deterministic reserve is an aggregate gross premium reserve developed as the present value of pretax liability cash flows at discount rates, using a prescribed scenario.
Stochastic reserve is an aggregate reserve calculation using an asset liability model developed as a starting asset amount plus the greatest present value of accumulated deficiencies over a range of stochastic scenarios, with the SR set at the 70th conditional tail expectation (CTE).

(ii) The advantage with delayed adoption of VM-20 is to allow more time for company to develop complex reserve mechanism for VM-20. Also, there is incentive to delay the adoption of VM-20 to keep the product more competitive due to reserve advantage from financing. However, an early adoption gives company more time to develop new concepts to compete better under VM-20 environment and might bring reserve down by using company's experience.

(b) ABC recently launched a new term life product sold through its brokerage channel. You have been asked to conduct an experience study on the first year lapses.

(i) You are given the following:

- 49 of 784 policies lapsed in the first policy year.
- Expected first year lapse rate is 5%

Determine if the first year lapse assumption is appropriate assuming a 95% confidence interval. Show all work.

(ii) Identify two different methods to enhance credibility in setting the lapse assumption.

(iii) A lapse study shows significant differences from the industry survey.

Explain the possible causes of these differences.

6. Continued

Commentary on Question:
Candidates overall did better on this part of the question than part (a) and had relatively more success with the 95% confidence level calculation in (i) and the explanation in (iii). But many candidates failed to propose the correct method to enhance credibility in setting the lapse assumption in (ii).

(i) Actual lapse rate: 49/784 = 6.25%
Variance of expected lapse: 784*5%*(1-5%) = 37.24
95% confidence interval of expected lapse:
6.25+/- 1.96 * 37.24^0.5 / 784 = 6.25% +/- 1.53%
The confidence interval is (4.72%, 7.78%). 5% lapse rate assumption is appropriate under 95% Confidence Level.

(ii) Combine multiple years of issue age together. It is common to group 5-year or 10-year issue age to group data to get more credible results for each group. The grouped results would then be smoothed to produce the final assumption.
Conduct A/E ratio analysis. This ratio is used to track trends over time and to adjust experience tables for recent experience without creating an entirely new table.

(iii) Brokerage channel have lower retention than captive/career agents. With industry study combining all distribution channels, company experience can be different. Industry study may combine different products in the same line of business. Mass markets tend to have smaller face amount, which resulted in higher lapse rates.

7. **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.

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

Learning Outcomes:

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

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

(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.

(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.

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

Sources:

Life Insurance Products and Finance, Atkinson & Dallas, Chapter 2

LP-121-13: Life Insurance and Annuity Nonforfeiture Practices

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

LP-102-07: Equity Indexed Annuities: Product Design and Pricing Considerations

SOA - Modeling Policyholder Behavior for Life and Annuity Products, 2014 pp. 9-16, 23-33, 45-67

SOA – Transition to a High Interest Rate Environment: Preparing for Uncertainty, SOA Research, July 2015, executive Summary, Sections C, D & E

7. Continued

Commentary on Question:
Commentary listed underneath question component/

Solution:
(a) Describe three reasons why the CEO's strategy may not be successful.

Commentary on Question:
Candidates did reasonably well on this part of the question. Some candidates did not receive full credit because they did not describe or provide an explanation, beyond a single thought or point.

1. Product and company fit
   A core competency of the company is underwriting, which will provide no advantage in the annuity market since it does not use underwriting. The market likely already has competitors with products that will be available to take advantage of the new law more quickly. The current distribution system may have challenges expanding beyond its core western markets.

2. Implementation barriers
   Annuity products have very different administrative processes and procedures than term insurance. Therefore the company will need to invest heavily in new software and training. Doing this quickly risks costly disruptions to the company's existing business. It is also possible that the company does not have the expertise necessary to properly implement the annuity product.

3. Regulatory barriers
   While it appears that the company could get regulatory approval for an annuity product, it may be difficult, expensive, or take longer than desired. This could be due to the company being less familiar with specific filing requirements of this eastern state, or accounting/reserving requirements for annuities. Also the company may need to comply with licensing requirements in order to sell in this state.

7. Continued

(b)

(i) Determine whether the guaranteed cash surrender value at the end of contract year 1 satisfies the prospective (present value) test described in Section 6 of the SNFL.

(ii) Determine whether the guaranteed cash surrender value at the end of contract year 10 satisfies the retrospective (accumulation) test described in Section 4 of the SNFL.

(iii) Contrast these guaranteed cash surrender values to those required in Canada.

Show all work.

Commentary on Question:
Many candidates struggled with part i) of this question, but many candidates also did very well on part ii).
Some candidates incorrectly used a 3% interest rate on part i), or tried to utilize the same formula as in part ii). Partial credit was given for part i) that used 3%.
Some candidates did not state the conclusion of whether or not the test was passed or failed, thus they were only given partial credit.
For part iii), many only stated that Canada had no minimum nonforfeiture law and did not describe the group equity concept.

i) Prospective test - end of contract year 1
Compare present value of maturity value of paid up annuity benefit discounted at a rate not greater than 1% over the guaranteed rate. i.e. the rate to use is 1.5%

Prospective non- forfeiture value = 22,983 = 26,279 x (1.005+.01)^-9
This test is satisfied as cash value of 23,090 is greater than the non-forfeiture value of 22,983.

ii) Retrospective test - end of contract year 10
Accumulate 87.5% of the purchases at the non-forfeiture rate less a $50 annual expense allowance.

Retrospective non-forfeiture value = 28,808= 29,398 - 590 = 87.5% x 25,000 x (1.03)^10-50s_n10

This test fails, as the cash surrender value of 26,279 is less than the minimum non-forfeiture value of 28,808.

7. Continued

iii) Canada has no minimum nonforfeiture law for life insurance. Actuaries in Canada use a concept of "group equity" which means that values from terminating policies may be used to reduce premiums or raise the level of benefits for all policyholders.

(c) Develop a strategy to address pricing considerations for each of the following potential situations:

(i) The options used to fund the indexed-based crediting become unavailable in the market.

(ii) Surrenders are well above expected during periods when competitors have increased the rates offered on new products.

(iii) A period of low or negative nominal interest rates.

Commentary on Question:
Candidates did reasonably well on this part of the question. There are a variety of correct answers for this question. For parts ii) and iii) many candidates took the approach of answering how these problems could be solved with product changes, while others considered how to quantify the risk in pricing. Both types of answers were given credit. To receive full credit, the candidates needed to provide an explanation for their answers beyond a list or statement.

(i) With the options not being available any longer, we could set up a delta hedging program using futures instead. As this is a dynamic hedge rather than a static hedge, this will require frequent rebalancing. As a result, we will not be able to know the cost in advance, but will only know after the fact once all of the rebalancing trades are complete.

(ii) This kind of experience would appear to be consistent with a situation where dynamic policy holder assumptions might be appropriate. In this situation, it would be appropriate to do an experience study comparing the time periods when competitors are offering higher vs. lower rates. Then if we are modelling rates stochastically, implement a dynamic assumption. Alternatively, could run sensitivity tests in the pricing model with lapses in the 2 different behavior scenarios.

Some product features that could address this would be higher surrender charges to discourage lapses, or adding a MVA feature which lowers cash value when interest rates rise.

7. Continued

(iii) Many interest rate generators have trouble modeling rates that are near zero or negative. Special scenarios would need to be tested. Would also want to have a discussion on ALM concerns as minimum guarantees could be difficult to fund for reinvestment, or funding new inflows.

Some product changes would include lowering the guaranteed rate to the minimum allowed rate and lowering the indexed floor to 0%. Hedging costs can be lowered by lowering the index cap, lowering the participation rate and margin.

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.

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.

(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.

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

Sources:

Atkinson & Dallas, Life Insurance Products and Finance, Chapters 11

Impact of VM-20 on Life insurance Product Development, SOA Research, Nov 2016 (exclude appendices)

LP-XXX-16: Evolving Strategies to Improve Inforce Post-Level Term Profitability, Product Matters, Feb 2015, pp. 23-29

8. Continued

Commentary on Question:
Commentary listed underneath question component.

Solution:
(a) Calculate the distributable earnings in year 1. Show all work.

Commentary on Question:
Candidates did well on this part of the question. Common mistakes included not using all the correct product cash flows, not applying the tax rate correctly or assuming a tax rate of zero because the pre-tax income was negative. Candidates received full credit for bothv including/excluding premium tax in the Distributable Earnings calculation. Candidates required to show all steps and formulas for full credit.

The following solution excludes Premium Tax:
Product Cash Flows = Premium - Benefit - Expenses
Product Cash Flows = 5,000 - 321 - 535 – 6,500 – 2,000 - 363 = - 4,719

PreTax Solvency Earnings = Product Cash Flows + Invest Income - Increase In Stat Reserve
PreTax Solvency Earnings = -4,719 + 100 - 450 = - 5,069

AfterTax Solvency Earnings = Pre Tax Solvency Earnings – Tax
Tax = Pre Tax Solvency Earnings * Tax Rate
AfterTax Solvency Earnings = -5,069 – (-5,069 * 0.35) = - 3,294.85

Distributable Earnings = AfterTax Solvency Earnings - Increase In Target Surplus + AfterTax Invest Income On Target Surplus
AfterTax Invest Income On Target Surplus = Target Surplus * Investment return on target surplus * (1 – Tax Rate)
Distributable Earnings = -3,294.85 - 1,200 + (1,200 * 0.1 * (1- 0.35)) = -3,294.85 - 1,200 + 78 = **- 4,416.85**

The following solution includes Premium Tax:
Product Cash Flows = 5,000*(1-.025) - 321 - 535 – 6,500 – 2,000 - 363 = - 4,844
PreTax Solvency Earnings = -4,844 + 100 - 450 = - 5,194
AfterTax Solvency Earnings = -5,194 – (-5,194 * .35) = - 3,376.10
Distributable Earnings = -3,376.1 - 1,200 + (1,200 * 0.1 * (1-.35)) = -3,294.85 - 1,200 + 78 = **- 4,498.10**

8. Continued

(b) PQR's current reserve basis is XXX with AG48 financing of reserves.

(i) Analyze the impact to PQR of the adoption of VM-20

(ii) Recommend actions PQR can take to minimize the impact of VM-20.

Commentary on Question:
For part (i) many candidates struggled to understand the relationship between financing the reserves, the tax benefit and how that would change with the adoption of VM-20. Many were able to identify that VM-20 would change the level of reserves but were unable to articulate that it would decrease the overall profitability.

For part (ii) recommended actions should focus on what the company can do to help increase profitability. Several candidates listed possible actions such as stochastic modeling that are related to VM-20 but did not address minimizing the impact of VM-20.

(i) PQR is currently using AG48 financing of reserves due to the higher reserve requirements of XXX which results in a large tax benefit. If PQR adopts VM-20, the level of stat reserves will most likely decrease, however, PQR will lose the ability to finance reserves and thus will lose the tax advantage. The loss of the tax advantage will decrease the overall profitability of the product.

(ii) To minimize the impact of moving to VM-20 by trying to increase profitability back to the original level, the company could increase premiums or decrease expenses. If PQR is concerned about increasing premiums due to competitiveness they could accept a lower target profitability. Other options include reinsurance.

(c) An inforce block of policies is reaching the end of the initial 10-year term period.

(i) Describe three approaches that would reduce policy lapses after the initial level term.

(ii) Recommend the approach PQR should select. Justify your answer.

Commentary on Question:
Candidates did well on this part of the question and most were able to list and describe the three approaches to reduce policy lapses after the initial level term. However, many candidates did not go into enough detail when describing each approach. Candidates could recommend any of the approaches and earned full credit for giving valid justification for that recommendation.

8. Continued

Simplified Re-underwriting: The company offers insured the option to answer a simplified issue underwriting questionnaire as the post-level term approaches. The carrier uses these answers to determine the insured's risk class. This is a less arbitrary, more fair approach and appealing to customers and regulators. However, the questionnaire may alert the insured of the pending premium jump, possibly causing them to lapse sooner. Also, the implementation could be challenging.

Graded Approach: Post-level term rates increase at much smaller increments until a future anniversary, grading to the original YRT schedule at the end of the graded period. This allows insurers to ease into higher rates that are more attractive to policyowners than those originally illustrated, while retaining the right to increase rates up to the ceiling if need be as experience emerges. By moderating the premium jump, many insureds may be encouraged to retain the current coverage rather than to go through the ordeal of being re-underwritten for a new policy.

Class Continuation Approach: The original class structures continue into the post-level term period, modifying the rate increase based on the insured's select risk class, where rates may or may not converge to an ultimate rate in later durations. All policyowners experience a rate increase and move to a YRT schedule, however the magnitude of jump is dependent on the insured's original risk classification. This approach rewards the best risks by raising their rates the least. However, there is a possibility of the underwriting effect wearing off by the end of the level term period.

Recommendation:
I recommend implementing the Class Continuation Approach as it would decrease the policy lapses after the level-policy term by decreasing the premium-jump ratio for each class. This is less expensive to implement than the Simplified Re-Underwriting approach and it rewards the best risks unlike the Graded Approach.

9. 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.

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

Sources:

LP-102-07: Equity Indexed Annuities: Product Design and Pricing Consideration

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

Commentary on Question:

Commentary listed underneath question component.

Solution:

(a) Critique the Hedging team's report with respect to:

(i) Regulatory concerns

(ii) Expected hedge performance

Commentary on Question:

Overall, candidates did well on this part of the question. A common error when addressing the removal of the 0% floor in Design 2 was relating it to the product's marketability as opposed to regulatory concerns. Another common error related to the expected hedging cost of Design 2 was the reasoning that using only the past one year's experience is not credible enough and should be based on more number of years. This often suggested a lack of understanding of the cost of delta hedging (e.g. not known in advance and driven by market volatilities). Many candidates also agreed with the conclusion that the cost of a delta hedging program should be lower than static hedging.

With respect to regulatory concerns, there are two specific items of note in the Hedging team's report. The suggestion by the Hedging team to remove the 0% floor in Design 2 would pose issues in complying with minimum cash surrender values under the Standard Non-Forfeiture Law.

9. Continued

In Design 3, the "Hedged as Required" criteria under AG35 is only applicable to Type 1 or Book Value Methods. The company can get around this by opting for a Type 2 or Market Value Method of valuation.

With respect to expected hedge performance, there are also two specific items to address in the report. In Design 1, in order to reach the cap of 8%, the index return would need to exceed 10% due to the 80% participation factor. The position in the call spread should be based on a strike price that is 10% out of the money. The current design leaves the amount of index crediting between 6.4% and 8% unhedged.

The assumption that the delta hedging cost in Design 2 is 20% less than the corresponding static hedge is flawed. The cost of delta hedging is not known in advance, but rather depends on the volatility experienced during the period. Higher volatility suggests more frequent rebalancing, which forces you to buy high and sell low. This generally results in higher costs. Therefore, it is inappropriate to base the cost of delta hedging on past experience, which just happened to indicate a lower cost than static hedging over the past year. Presumably it could have been the opposite case if realized volatility had been high enough.

(b) CBT's Modeling team is proposing a stochastic equity scenario generation model for the new EIA product. The proposed model uses geometric Brownian motion to model equity returns and the resulting scenarios are intended to be arbitrage-free. You have been asked to perform a comprehensive peer review of the model.

(i) Identify the primary areas of consideration when conducting a peer review according to *Stochastic Modeling: Theory and Reality from an Actuarial Perspective*.

(ii) Propose a relevant question that you would address in the peer review for each of the areas of consideration.

(iii) Describe the methods you would use to answer each question.

9. Continued

Commentary on Question:
Candidates' performance on this question varied despite the expectation of a wide range of acceptable responses. A good proportion of the candidates were able to identify most, if not all of the four primary areas of consideration when conducting a peer review (formulas, parameters, testing, and validation), and provide a relevant question to address each area of consideration. In terms of describing a method to answer the questions posed, many candidates failed to relate to the specific model (stochastic equity scenario generation model) stated in the question. The majority of candidates provided some high-level, generic methodology that further varied in quality. The answers ranged from a clear demonstration of good practices in a model peer review, to simply restating the proposed question in a statement format.

Full credit is awarded if the candidate demonstrates a comprehensive understanding of the four primary areas of conducting a peer review and is able to relate these concepts specifically to an equity scenario generation model.

The four areas of consideration/categories include formulas, parameters, testing and validation. Credit is given for simply listing the categories where synonyms or similar word substitutions are also acceptable. For instance, if a candidate lists "assumptions" or "data" as a category instead of "parameters", this was accepted. However, if a candidate lists "assumptions" and "data" as two separate categories, credit is only awarded for one category.

The proposed questions in relation to the four categories can vary widely, but they should further demonstrate the candidate's understanding of the categories in relation to the purpose of the peer review process. Illustrative questions for the four categories are:

1) Formula: Have the formulas been reviewed for accuracy?
2) Parameters: How were the model parameters developed and how were they calibrated?
3) Testing: Does the model produce reasonable results?
4) Validation: Does the model validate on both a static of dynamic basis?

When describing the methodology to answer the proposed questions, the key consideration for full credit is the candidate's ability to correctly and concisely apply the concepts to an equity scenario generation model. A less relevant method is awarded partial credit. A repetition of the proposed question with no further insight or details is awarded no credit. An acceptable method to address the above illustrative questions are:

1) Formula: Review the documentation of the model to find the specific stochastic process used (presumably some form of geometric Brownian Motion). Compare the coding of the formulas to the intended process as outlined in a textbook or academic literature.

9. Continued

2) Parameters: The key parameters in an equity scenario generation process are the implied volatilities. A calibrated volatility surface should be calibrated by term structure. Review the volatility surface across difference strike prices to see if it exhibits the expected volatility skew.
3) Testing: Run the model with shocks applied to various parameters. Verify that the modeled cost of an option increases as volatility increases. Verify that the modeled cost of an option decreases as the risk free rate increases.
4) Validation: Run a liability through the model that can also be modelled with a simple replicating portfolio. Compare performance of the replicating portfolio over a recent period against the modeled liability over the same time period.

10. Learning Objectives:

1. The candidate will understand various insurance products, markets, and regulatory regimes.

Learning Outcomes:

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

Sources:

PWC Canadian Life Insurance Taxation Fourth Edition Chapters 10 and 11

Commentary on Question:

Commentary listed underneath question component.

Solution:

(a) Describe for each policy:

(i) A comparison to the exemption test policy (ETP);

(ii) The potential frequency of recurring taxation; and

(iii) The taxation of death proceeds.

Commentary on Question:

Part (a) tested the candidates' ability to determine how different policy designs impact the results of the ETP test. The exempt status for each policy was then to be used to assess the frequency of taxation and taxation on death proceeds.

Candidates generally did well determining that Policy A values would likely exceed the ETP threshold and would therefore be non-exempt from taxation, and that Policy B values would likely not exceed the ETP threshold and therefore be Exempt. To receive full credit, candidates must have identified Policy A as non-exempt and Policy B as exempt.

Partial credit was given if candidates knew the relationship between exempt status and frequency of taxation/death proceeds, but did not attach the statements specifically to Policy A and Policy B. A common mistake was to state that regardless of exempt status, the death benefit was not taxed.

Part (i):

The exempt test policy (ETP) is a 20-pay whole life policy maturing at age 85. In order to qualify for exempt status, a policy's accumulating fund (AF) must be less than or equal to the AF of the ETP at issue and on each anniversary until age 85.

10. Continued

Policy A is paid-up quicker and matures earlier than the ETP, so its AF will grow quicker and exceed the ETP's AF. Thus, policy A will be non-exempt.
Policy B has a longer premium payment period and matures later than the ETP, so its AF will grow slower than the ETP's AF. Thus, policy B will be exempt.

Part (ii):
Policy A: Since this policy is non-exempt, it will be subject to annual accrual taxation.
Policy B: Assuming this policy is exempt, it will not be subject to annual accrual taxation. It could only be taxed if a disposition occurred.

Part (iii):
Policy A: Since this policy is non-exempt, death proceeds will not be tax-free. The gain up to the date of death will be taxed.
Policy B: Assuming this policy is exempt, death proceeds will be tax-free.

(b) Determine whether or not each of the following transactions is a disposition.

(i) An assignment for the purpose of securing a loan (other than a policy loan)

(ii) A surrender

(iii) A lapse which occurred six months prior for non-payment of premium

(iv) Deemed disposition occurring due to no longer qualifying as an exempt policy

(v) A lapsed policy reinstated within 60 days

(vi) Policy sold at arm's length

(vii) The proceeds of a policy loan taken in 1979

(viii) Payments as a disability benefit

Commentary on Question:
In general, candidates did well on this question. A common error was to identify lapses which occurred six months prior for non-payment of premium as a disposition. Also, many candidates did not identify the proceeds of a policy loan taken in 1979 as a disposition. Candidates were not required to justify whether the transaction was/was not a disposition to receive full credit.

10. Continued

(i) Not a disposition
(ii) Is a disposition
(iii) Not a disposition
(iv) Is a disposition
(v) Not a disposition
(vi) Is a disposition
(vii) Is a disposition
(viii) Not a disposition

(c) Compare and contrast the tax treatment of a non-prescribed annuity contract issued to a Canadian policyholder on July 1, 1985 with another issued on July 1, 1995.

Commentary on Question:
Most candidates performed poorly on this section. To receive full credit, candidates were required to identify all of the similarities and differences between the tax treatment of the contracts. Many candidates listed only a small set of the differences and did not identify any similarities. Partial credit was given for each correctly identified similarity or difference.

Similarities:
For both contracts in the accumulation period,

Accrued income = Accumulation Fund – Adjusted Cost Basis (ACB)
Where the Adjusted Cost Basis cannot be negative

For both contracts, the disposition of the contract is taxed on the excess of proceeds of disposition (POD) over ACB

Differences:
July 1, 1995

- Annual reporting is calculated on policy year basis
- In accumulation period, if ACB would have been negative, excess is included in income
- In payout period, Accrued income = Accumulation Fund – Adjusted Cost Basis (ACB) with adjustments for
  - Mortality gains and losses for life annuity contracts
  - And subtracting payments previously paid
  - Accumulation fund = PV expected future payment
- In general, accrued income is highest in early years and decreases in later years

10. Continued

July 1, 1985

- Accrual is applied on a triennial basis unless individual elects annual reporting
- In accumulation period, in the year the final payment is made, calculation produces zero income then the amount that would be negative is included in the income of 3rd anniversary that year
- In payout period,
  - 1st and 2nd year include in income the lesser of
    - Sum of annuity payments received during the year or
    - Sum of accrued income to the end of the year
  - In the 3rd year, all of the income accrued minus amounts included in come over previous 2 years is included in income
- If elected annual reporting, the only difference is that the 1985 contract would be taxed on a calendar year basis instead of policy year basis
- Policyholder cannot pay a premium greater than the premium fixed before 1990 or the excess is considered as buying a new annuity contract and subject to post 1989 rules.