ILA LP Model Solutions
Fall 2017

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.

(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.

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

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

Commentary on Question:
This question was testing the candidates' knowledge on Equity Indexed Annuities (EIAs) including different indexing methods, calculating a Surrender Value, describing some of the risks of EIAs and calculating a put option premium. Overall candidates did very well on this question especially parts (a), (b) and (d).

Solution:
(a) Compare and contrast the following methods for computing Index-Based Interest:
  • Point-to-point
  • Averaging
  • Ratcheting

Commentary on Question:
Overall candidates did well on part (a). To receive full credit candidates needed to define each method as well as compare and contrast to the other methods. Most candidates were able to correctly define each method but not all specified the similarities and differences to the other methods.

1.   Continued

Point-to-Point Index Growth calculation is the closing index level divided by the beginning index level over a specified period of time. All interim index levels are ignored which is different than the Averaging method. There is the potential for the closing level of the index to be less than the beginning level can which can cause the growth rate to be negative.

Average Index Growth calculations are based on the average closing level of the index over a period of time, usually one year, could be daily as well. In general, Averaging will produce 55-60% of an unaveraged calculation and is generally less expensive than point-to-point methods. Averaging has a tendency to tame the volatility of the index levels, making the Average Index Growth less volatile than the point-to-point method.

Ratcheting compares the index level at the end of the contract year to the index level at the beginning of the contract year. Any resulting decreases are ignored and the gain is locked in each year, so returns cannot be countered by poor index performance in the future. This method is typically more expensive than the point-to-point and averaging methods.

(b)   Calculate the surrender value at the end of each period. Show all work.

Commentary on Question:
For part (b) to receive full credit, the candidate needed to, for three years, correctly calculate the index growth percentage, apply the participation rate, cap and margin, calculate the indexed account value and the GMAV then recognize the surrender value is the maximum of the IAV and the GMAV. Most candidates were able to correctly calculate the surrender value. A common mistake was to incorrectly apply a floor of 0% to the index growth percentage.

Index Growth % (IG%)
IG%(1) = 850/980-1 = -13.27%
IG%(2) = 930/850-1 = 9.41%
IG%(3) = 1200/930-1 = 29.03%

Apply Participation Rate:
100% so no change to the index growth %

Apply Margin
IG%(1) = -13.27% - 1% = -14.27%
IG%(2) = 9.41% -1% = 8.41%
IG%(3) = 29.03% -1% = 28.03%

1.   Continued

Apply Cap
IG%(1) = -14.27%
IG%(2) = 8.41%
IG%(3) = 10%

Index Account Value (IAV)
IAV(1) = 1200*(1+(-14.27%)) = 1028.76
IAV(2) = 1028.76*(1+8.41%) = 1115.28
IAV(3) = 1115.28*(1+10%) = 1226.81

Guaranteed Minimum Account Value (GMAV):
GMAV(1) = 90%*1200*(1.02)^1 = 1101.60
GMAV(2) = 90%*1200*(1.02)^2 = 1123.63
GMAV(3) = 90%*1200*(1.02)^3 = 1146.10

SV(1) = 1028.76 < GMAV, so SV = **1101.60**
SV(2) = 1028.76*(1+8.41%) = 1115.28 < GMAV, so SV = **1123.63**
SV(3) = 1115.28*(1+10%) = 1226.81 > GMAV so SV = **1226.81**

Also gave full credit if the cap was applied before the margin. The Index Account Value and the Surrender Value would change to the following:

Index AV (IAV)
IAV(1) = 1200*(1+(-14.27%)) = 1028.76
IAV(2) = 1028.76*(1+8.41%) = 1115.28
IAV(3) = 1115.28*(1+9%) = 1215.66

Surrender Value (SV)
SV(1) = 1028.76 < GMAV, so SV = **1101.60**
SV(2) = 1028.76*(1+8.41%) = 1115.28 < GMAV, so SV = **1123.63**
SV(3) = 1115.28*(1+9%) = 1215.66 > GMAV so SV = **1215.66**

(c)

(i)   Describe each of the following risks as it applies to the EIA:
- Low interest rate environment
- High equity volatility

(ii)   Recommend EIA product design changes to mitigate each of these risks. Justify your answer.

1. Continued

Commentary on Question:
For part (i) candidates needed to describe the specific risks as it applies to the EIA. Many candidates were able to describe the risks. However, several candidates just listed general risks or would not relate the risk back to the EIA.

For part (ii) candidates needed to recommend product design changes to mitigate each of the risks. Many candidates just listed design changes without going into detail of why or how they would mitigate the risk. Two well written recommendations would receive full points.

(i)   A low interest rate environment could cause the Guaranteed Minimum Account Value (GMAV) funding to be expensive so products with lower GMAVs have more attractive features in low interest rate environments. Also, lower GMAVs leave more money to fund hedge costs.

High equity volatility causes the call option costs to increase which puts pressure on multi-year guarantees. So EIAs with shorter guarantees are more marketable in periods of high volatility. High call option costs also negatively impact pricing and profitability of the EIA.

(ii)   Possible product design changes include but are not limited to (do not need to have to receive full credit):
Annual Reset EIAs: with high equity volatility potential, the most attractive EIAs have Index-Based Interest components that are guaranteed for shorter periods of time, usually one year. With short-term guarantees, insurers avoid the need to lock in long-term volatility for the entire Index Period. Although short-term volatility can swing to high levels, the annual cost of the Index-Based Interest can be managed by setting the crediting components at levels driven by the volatility at each reset point.

Flexible Premium EIAs: Flexible premium designs allowed EIA writers to reduce the GMAV from 90% of premium accumulated at 3% to as low as 65% of initial premium accumulated at 3%. Many flexible premium designs have a 75% of initial premium guarantee with an 87.5% of additional premium guarantee, accumulated at 3%.

1. **Continued**

Lower GMAV Interest Rates: The 3% minimum credited rate specified in the Standard Nonforfeiture Law (SNFL) for Deferred Annuities has been recognized by the National Association of Insurance Commissioners (NAIC) as being unrealistic and problematic in today's environment. While the task force was meeting to design the new regulation, many states adopted temporary relief by replacing the 3.00% minimum requirement in their laws by 1.50%. The Index SNFL allows interest rates as low as 1% (indexed between 1% and 3%) as well as allowing 87.5% of the premium in the GMAV calculation.

Index Growth Measurement: several designs have emerged as cost reduction tools for managing option costs, which goes hand-in-hand with providing the most attractive benefit for a given cost and aids in marketing EIAs to customers. These designs include averaging and innovative return methods (binary returns & high water).

Other product design changes used to reduce the return to the client, including lowering the participation rate, increasing the margin or lowering the cap.

(d)   Calculate the price of the put option using the following additional information:
- Assume put-call parity
- Call option price = 10
- Risk-free rate = 10% and T = 2 year
- Current index = 980 and Strike price = 1200

Show all work.

Commentary on Question:
Most candidates were able to correctly apply the put-call parity and solve for the put option premium.

Using the Put-Call Parity:
$P + S = C + Ke^{-r(T-t)}$
$P + 980 = 10 + 1200e^{-.1(2)}$
$P = 12.48$

Also accepted using the Put-Call Parity assuming the Risk-free rate is an annual effective interest rate.
$P + S = C + K\frac{1}{(1+r)^t}$
$P + 980 = 10 + 1200\frac{1}{(1.1)^2}$
$P = 21.7355$

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:
(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.

(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-132-15, Lapse Based Insurance, Gootlieb & Smetters, Apr 2014, pp. 1 - 24 plus Appendix A (pp. 29 - 30)

LP-107-07: Experience Assumptions for Individual Life Insurance and Annuities Atkinson & Dallas, Life Insurance Products and Finance, Chapters 10, 11, 13

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

SOA, Report on the Lapse and Mortality Experience of Post-Level Premium Period Term Plans)

Commentary on Question:
Commentary listed underneath question component.

Solution:
(a)   An experience study was conducted in year 7 and the future expected lapse rate was revised to 2% per year beginning in year 8.

        (i)   Calculate the change in the present value of future profits at the end of year 7 using the revised lapse assumption. Show all work.

        (ii)   Describe two possible reasons for lower actual lapse experience.

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2. **Continued**

Commentary on Question:
Part (a) tested candidates' ability to calculate a basic expected value of future profits for a life insurance product, showing that in some circumstances, lower lapse rates can be more detrimental to the company than higher lapse rates.

Candidates generally did well in setting up the profitability calculation correctly. Common mistakes included not discounting the death benefit to the beginning of the year, and including the company's expenses as a revenue item instead of an expense item.

Many candidates identified valid reasons why lapse experience may turn out to be lower than expected. Some candidates gave incorrect answers that were not applicable to a term product, such as credited interest rates being lower than expected or inadequate growth in cash values.

Part (i):

Calculation with 10% lapse rate:

Year	Premium Per Policy	Insurance Amount	Pols In Force BOY	Expenses Per Policy	Actual Deaths	Actual Lapses	Pols In Force EOY	Premiums (BOY)	Expenses (BOY)	Claims (EOY)	Profit (Disc to BOY)	Discount Factor
8	1,000	100,000	461	25	4.6	45.6	410.8	461,000	11,525	461,000	1,902	1.00
9	1,000	100,000	411	25	4.5	40.6	365.6	410,751	10,269	451,826	- 38,184	0.97
10	1,000	100,000	366	25	4.4	36.1	325.1	365,609	9,140	438,731	- 69,484	0.94
										PV Profit	- 100,664	

Calculation with 2% lapse rate:

Year	Premium Per Policy	Insurance Amount	Pols In Force BOY	Expenses Per Policy	Actual Deaths	Actual Lapses	Pols In Force EOY	Premiums (BOY)	Expenses (BOY)	Claims (EOY)	Profit (Disc to BOY)	Discount Factor
8	1,000	100,000	461	25	4.6	9.1	447.3	461,000	11,525	461,000	1,902	1.00
9	1,000	100,000	447	25	4.9	8.8	433.5	447,262	11,182	491,988	- 41,578	0.97
10	1,000	100,000	433	25	5.2	8.6	419.7	433,495	10,837	520,195	- 82,385	0.94
										PV Profit	- 116,121	
										Difference	- 15,456	

2. Continued

Part (ii):

Lapse rates may be lower than was originally assumed in pricing because the distribution of policy sales by marketing method was different from what was assumed in pricing. This policy may have been more attractive in the career agent marketing channel than the brokerage marketing channel, and because policy owners who buy through career agents have less of a tendency to shop around for rates, they lapse their policies at a lower frequency.

Lapse rates may also have come in lower than expected due to changes in the economic environment. The company's original lapse assumptions may have been set assuming a less favorable economic environment. Because many customers may lose their jobs or feel other economic pressure in an economic downturn, customers are more likely to lapse their policy in such environment.

(b) You are developing a new 10-year term life insurance product and are evaluating different product designs:

- Design A: Level face amount with attained age premium
- Design B: Decreasing face amount with a level premium

(i) Describe the challenges presented by each of these product designs.

(ii) Recommend changes to each product design to address these challenges. Justify your answer.

Commentary on Question:
Part (b) tested candidates' understanding of the implications of variations on a standard level term policy contract. Many candidates accurately identified challenges presented by the proposed product designs, which included difficulties in pricing a competitive product as well as lapse experience that might emerge.

Although many candidates were successful in identifying changes to the product design that would address the challenges, many candidates also gave answers that would not apply to this product structure, such as offering a persistency bonus or increasing interest crediting rates.

For part (ii), candidates also received full credit for recommending other possible changes including offering limited payment decreasing term, decreasing premium scales, etc.

2. **Continued**

Part (i):

Design A: It is very difficult to develop an attained age scale sufficiently competitive for a wide range of issue ages, as premiums can become high, especially in relation to newly issued policies for the same age. Some companies limit this problem by offering coverage only for a short period of time (e.g., seven years).

Design B: A level premium may become very high in relationship to the death benefit in later policy years, leading to little motivation for the insured to keep the policy in force. Because of this, counting on low lapse rates to provide a healthy stream of future profits is very dangerous.

Part (ii):

One approach to address the challenges is to levelize the death benefit in the later policy years at a minimum level, such as 20% of the initial death benefit. By doing this, the company avoids the value of the policy becoming too low relative to the premium, and provides some incentive to keep the policy in force which should lead to better persistency experience.

(c) You are considering adding a guaranteed renewal option with attained age premiums to your current 10-year term product.

Evaluate the impact to the mortality assumption after the initial 10-year term. Justify your answer.

Commentary on Question:
Part (c) tested candidates' understanding of the mortality implications of guaranteed post-level term renewal options. Most candidates correctly identified the correct mortality pattern that results from this product design, although not all candidates gave an adequate justification for their answer.

When adding a guaranteed renewal option after the 10-year term period, the company should expect that duration 11 mortality will be substantially higher than duration-10 mortality. Because healthier customers will be able to qualify for a new 10-year term product with new underwriting, those customers will tend to lapse rather than pay the higher duration-11 premium, and the more unhealthy customers will tend to persist. A higher jump in premium from duration 10 to duration 11 should be expected to result in greater lapses and therefore higher anti-selective mortality.

2. **Continued**

After duration 11, the company should continue to assume that shock lapses will occur each year as the premium continues to increase, and so anti-selective mortality will continue to increase. As the policy continues to age, the effect of shock-lapse-based anti-selection will diminish, since it is likely that most customers who continue to persist are uninsurable and therefore will keep their existing policies as long as possible.

3.   **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:
SOA LIMRA Research 2014 – Variable Annuity Guaranteed Living Benefits Utilization, Executive Summary only (pp. 19 – 32)

Proposed ASOP on Setting Assumptions, Dec 2016

SOA – Society of Actuaries, Modelling of Policyholder Behavior for Life and Annuity Products, 2014, pp. 9 – 16, 23- 33, 45 – 67

Commentary on Question:
Commentary listed underneath question component.

Solution:
(a)   Explain how the problem of information asymmetry can result in a gap between expected GLWB withdrawal utilization and actual policyholder behavior.

   Commentary on Question:
   Many candidates provided examples of information asymmetry from either the policyholder or the company perspective, but not both. Many candidates would fail to explain how those examples could result in a gap between expected GLWB withdrawal utilization and actual policyholder behavior.

   In addition to the response below, candidates could earn partial credit by describing the information asymmetry that can result from data challenges (lack of credible data, lack of causal linkages around data, and data aggregation or loss due to the way information is (or is not) captured by underwriting or administrative systems.

   Information asymmetry exists when the policyholder and insurer have information that is unknown to the other party.

   The policyholder has information on their own financial situation and when the timing of retirement or income needs may result in the utilization of the guaranteed withdrawals. The optimal timing from a policyholder's perspective takes into account their tax situation, other income sources, and other considerations not known to the actuary setting the utilization assumption.

3. Continued

On the other hand, the company's actuaries are very aware of the specific details of the rider and can determine the withdrawal timing that would result in the greatest actuarial present value of guaranteed benefits to be paid out. It is difficult to "un-know" this information and is easy to set the utilization assumption such that more policyholders will begin withdrawals at the "optimal" time than will actually occur.

(b)   Critique the memo based on:

    (i)   How the assumptions compare to the SOA/LIMRA experience study.

    (ii)   How the communication in the memo follows the proposed ASOP on setting assumptions.

Commentary on Question:
In part (i), candidates did fairly well critiquing the surrender rate assumption but most candidates did not understand the misinterpretation of the withdrawal benefit utilization study results.

In part (ii), candidates often listed items from the proposed ASOP, but failed to make a critique of the memo with regards to those items.

    (i)   Surrender Rates: The SOA/LIMRA study clearly noted that the presence of a GLWB rider resulted in lower surrender rates, especially when withdrawals are being taken. Using company experience for a product without a GLWB rider will result in full surrender rates that are too high. Surrender rates vary based on age and the relationship of withdrawal amount to the maximum benefit available.

        Withdrawal Benefit Utilization: This assumption is based on a misuse of the experience study. The 23% represents the percentage of contracts currently taking withdrawal benefits. Because there can be a delay of years between the purchase of a contract and the withdrawal benefit utilization, it is not appropriate to use the percentage of contracts utilizing at one point in time as an assumption for utilization over the life of a contract.

    (ii)   - The actuary should have disclosed who the "responsible actuary" was instead of signing the memo from the department. This is known from section 4.1.e, where the proposed ASOP states that there should be a disclosure of the aspect of work for which the actuary is taking responsibility or from ASOP 41, which is referenced in the proposed ASOP section 4.2.b.

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3. Continued

- According to section 4.1.a, the material assumptions should be described in sufficient detail to permit another qualified actuary to assess the reasonableness of the assumptions. This has not been done for the differences in withdrawal utilization for qualified and non-qualified contracts. Just knowing that one is higher and one is lower is not enough. How much higher/lower?

- The full surrender assumption was set by an actuary or actuaries in another department. The author should have assessed the reasonableness of the assumption or disclaims responsibility for the assumption as set forth in section 3.5. The presence of the rider would appear to be a material change in conditions as described in section 3.1.5 that may cause the assumption to no longer be appropriate.

- Given this is a new rider, it would have been appropriate to discuss alternative assumptions or sensitivities that were considered (section 3.2).

- Given the time difference between the information date of the SOA/LIMRA study and the date of the memo, the author should have provided some sort of disclosure about subsequent events or any other change in circumstances that might be known (section 4.1.c).

4. **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 Internal Revenue Code Sections 7702 and 7702A, 2nd Edition, Ch. 1-3, 6, 7

Commentary on Question:
Commentary listed underneath question component.

Solution:
(a) List the future benefits included in the calculation under IRC 7702.

> **Commentary on Question**:
> *This question required the candidate to list the future benefits included in the IRC 7702 calculations.*
>
> *To receive full credit, the candidates must list all three benefits. Most candidates received either full credit or partial credit by listing at least one of the benefits.*

> Death Benefit
> Endowment/Maturity Benefit
> Qualified Additional Benefit (QAB) charges

(b) Identify the errors in the following statement associated with the calculation of the guideline premium limits under IRC 7702:

> "*For a 100,000 level death benefit Variable Universal Life (VUL) policy, the Guideline Single Premium (GSP) can be calculated to provide an endowment benefit of 125,000 at maturity age 90*".

4. Continued

Commentary on Question:
This question tested the candidate's knowledge of the guideline premium limits.

To receive full credit, the candidate must identify that there are two errors and ensure it is clear why they are errors by referencing IRC 7702 rules. For example, "endowment benefit should be 100,000 or an endowment benefit of 125,000 is too high" would earn partial credit. Full credit is earned if the candidate outlines that the maximum endowment can not exceed the face amount on this policy. Most candidates received full or partial credit, while those who received little to no credit either did not identify the errors or give confidence as to why they were errors.

Error #1: Maturity age of 90 is too low.
Maturity age cannot be earlier than 95 per IRC 7702 rules.

Error#2: Endowment benefit of 125,000 is too high.
Endowment benefit must be no greater than the amount payable on death per IRC 7702 rules, which in this case is the face amount of 100,000.

(c)   Assess whether the following benefits will increase the guideline premium limits under IRC 7702:

    (i)   Disability waiver of premium benefit with no explicit charge.

    (ii)   Optional long-term care rider with an additional charge.

Justify your answer.

Commentary on Question:
This question tested how well candidates understand the role of QABs in the determining guideline premium limits.

To receive full credit, the candidate must state whether the guideline premium limit will increase, and provide sufficient justification. The most common reason where candidates received little to no credit was because they provided a "yes" or "no" answer with limited to no justification.

    (i)   This will not increase the guideline premium limits because there is no explicit charge. Disability waiver is a qualified additional benefit and as such, any charges are included in the future benefit and increase the limit. However, there are no charges and therefore no increase.

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4. **Continued**

        (ii)   This will not increase the guideline premium limits. Long-term care rider is not a qualified additional benefit under 7702 and as such, the charges will not be included in the guideline premiums.

(d)   Calculate:

        (iii)   The initial guideline level premium

        (iv)   The 7-pay premium

    Show all work.

Commentary on Question:
This question required the candidate to understand how to apply QABs within the initial guideline level premium and 7-pay premium calculations.

To receive full credit, the candidate must include the formula and reach the correct answer. Partial credit was given if the correct annuity factors were used, if the implication of the QAB was understood, or if a partially correct formula was displayed and used.

Full credit was also given if the Term Rider Annual Charge was discounted using an annuity factor as that solution is also acceptable.

Candidates most often received partial credit for not properly applying the term rider charges in the premium calculations.

        (i)   GLP = (DB x A50:45) / a50:45 + Term Rider Annual Charge
              GLP = (100,000 x 0.45)/19 + 500
              GLP = 2,868.42

        (ii)   7-Pay Premium = (DB x A50:45 + Term DB x A50:10) / a50:7
              7-Pay = (100,000 x 0.45 + 25,000 x 0.15) / 6.2
              7-Pay = 7,862.90

(e)   Determine the interest rate to be used in calculating the guideline single premium on a VUL policy with a 0.25% separate account administration fee and a 0.50% charge for mortality and expense.

Commentary on Question:
Most candidates were able to identify that 6% is to be used in calculating the GSP limit. Very few candidates understood which charges could and could not be deducted from the 6%.

4.   **Continued**

5.5% which is determined as follows:

6.00% is the required rate to be used in determining the GSP limit minus 0.50% for the mortality and expense charge.   No further deduction can be made for the 0.25% charge since it relates to the separate account administration fee and is not a permitted deduction.

5. **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.

(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.

Sources:
LP-132-15: Lapse-Based Insurance

The Response of Life Insurance Pricing to Life Settlements, Product Matters!, September 2006

LP-133-15 Empirical Investigation of Life Settlements: The Secondary Market for Life Insurance Policies

Commentary on Question:
This question tested candidates' understanding of the life settlement market, the potential effect it might have on product pricing, and required them to calculate a simple example of a life settlement transaction.

Solution:
(a) Define a "lapse-supported" product.

Commentary on Question:
Most candidates were able to correctly provide this definition. The most common mistake was identifying that lapse assumptions were an important driver of profitability, but not mentioning whether higher or lower lapses were beneficial.

5. Continued

A lapse supported product is a product where there would be a material decrease in profitability if, in the pricing calculation, the ultimate lapse rates were set to zero.

(b) Assess whether a secondary life settlement transaction has a positive or negative impact on each of the parties typically involved. Justify your answer.

Commentary on Question:
Candidates generally did well on this question. Some candidates who did not receive full credit did not identify the insurance company as a stakeholder or did not provide sufficient explanation for whether the transaction was positive or negative.

Insurer: Negative
- leads to lower lapse rates and higher mortality rates
- results in lower profitability

Policyholder: Positive **OR** Negative [full credit given for either if answer justified]
> Positive:
> o provides flexibility enabling them to respond to changes in life situations more effectively
> o ability to realize the market value of their policy, which could be significantly higher than the CSV
> Negative:
> o life settlement value is often less than the intrinsic economic value of their policy

Investor: Positive
- opportunity to gain exposure to longevity risk which is uncorrelated with other financial markets
- high expected IRR
- expected returns highly depend on life expectancy estimates

(c) The policyholder is considering selling his life insurance policy to a secondary life settlement company.

    (i) Discuss considerations this policyholder should take into account when deciding to sell his life insurance policy to a secondary life settlement company.

    (ii) Calculate the maximum price the secondary life settlement company should offer to achieve an internal hurdle rate of 10%. Show all work.

5. **Continued**

Commentary on Question:
i)   *Candidates received full credit for this question if they provided reasonable considerations the policyholder should take into account, even if not from the source material.*
ii)   *Most candidates were able to correctly solve the maximum price. Common errors included adding the CSV into the calculation, or not discounting the cash flows.*

(i)

- Consider the offer from the settlement company and how it relates to the insurance company cash value.
- Consider the legal implication of assigning the policy to the life settlement company as they will have a financial interest in the insured's life until death.
- Consider any potential tax consequences to cashing in the policy, taking a policy loan (with the life insurer) vs. selling the policy to the settlement company.
- On the surface, if the policyholder is looking to liquidate their policy it would be more beneficial to sell it than to surrender the policy with the life insurer if the offer is significantly higher than the CSV but other considerations must be evaluated based on circumstances.

(ii)

PV of cash flows = -(Maximum Price +15,000) - 15,000/(1.1) - 15,000/(1.1)^2 - 15,000/(1.1)^3 + 1,000,000/(1.1)^4 = 0
Maximum Price = -15,000 - 15,000/(1.1) - 15,000/(1.1)^2 - 15,000/(1.1)^3 + 1,000,000/(1.1)^4
Maximum Price = 630,711
Offering any price below this is good for the life settlement company.

(d)   Assess the impact on the life insurance company if many policyholders take an offer from a secondary life settlement company.

Commentary on Question:
To achieve full credit for this part, candidates needed to identify impacts to lapse and mortality assumptions. Credit was given for other reasonable impacts if properly explained.

5. **Continued**

Many policyholders considering offers and taking offers can be a challenge to an insurance company

- requests for policy illustrations
- policyholder inquiries, questions, quotes (more administration work and expenses)
- impact on pricing assumptions
  - better than expected persistency will impact pricing assumptions and financials
  - if unhealthy lives are offered life settlements, mortality assumptions may deteriorate (anti-selection)

(e)   Propose strategies life insurance companies can use to limit their exposure to the secondary life settlement market.

Commentary on Question:
Candidates received full credit for this question if they identified and explained at least two strategies.

Make life harder for settlement providers through their response to requests for inforce illustrations

- eg. Limiting the number and speed of responses, or by taking extra caution and time to process assignments

Public Pronouncements and Lobbyists

- Eg one industry analysis was produced demonstrating that life settlements provide a poor return to policyholders
  - American Council of Life Insurance, representing 300 large life insurance companies, released a statement asking policymakers to ban the securitization of life settlement contracts.

"If you can't beat 'em, join 'em."

- At least one insurer has a significant settlement portfolio (that includes policies from other insurers). Such a portfolio might act as a hedge against adverse mortality experienced by their in-force life insurance.

Find some legal manner in which to make individual offers to surrendering policyholders based on updated underwriting information.

- Policyholders may be more amenable to making this transaction with the insurer rather than have some third-party investor waiting for them to mature (die), perhaps to the point of accepting a lower offer.

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:
(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.

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

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

Commentary on Question:
Commentary listed underneath question component.

Solution:
(a)   Explain why hedging may not completely mitigate the shortfall risk on this product.

Commentary on Question:
Candidates received full credit for this question if they correctly identified the two categories of risks within the shortfall risk and gave a brief definition of each of these two categories. Most candidates did well on this section.

Shortfall risk has two categories:
Asset risk
• The risk that the performance of underlying assets is insufficient to cover the guarantees
• This risk can mostly be mitigated through hedging
Biometric risk
• The risk that persistency and longevity are different than expected
• This risk cannot be mitigated through hedging

(b)   GFE is evaluating alternatives to using a static hedge.

(i)   Describe three risk management techniques that GFE could use as an alternative.

(ii)   Outline the advantages and disadvantages of each technique.

6. Continued

Commentary on Question:
Candidates did reasonably well on this part of the question. Candidates received full credit if they correctly listed three risk management techniques and for each technique gave a brief description of the technique and correctly identified at least one advantage and identified at least one disadvantage when using the technique.

Possible answers are:

Naked/No risk management
Use management's view to set capital aside to cover losses
    Advantages
- Less expensive
- Easy to understand and explain results

    Disadvantages
- Large exposure
- Capital may not be sufficient to cover liabilities

Semi-static hedge
Dynamically adjusting hedge periodically to allow for deviations from expected experience
    Advantages
- Rebalancing allows hedges to reflect emerging experience

    Disadvantages
- Needs to be refreshed with the addition of new business

Dynamic hedging
Replicates the liabilities by dynamically matching the sensitivities (Greeks)
    Advantages
- More flexibility
- Can lower costs as buying over-the-counter options

    Disadvantages
- Need to rebalance the hedge as markets move
- Potential for high transaction costs due to continuous rebalancing
- Requires significant infrastructure and expertise

Reinsurance
Cede part or all of the risk to a third party
    Advantages
- Can mitigate all capital market risks, basis risks, and actuarial risks
- Can use expertise of the reinsurer

    Disadvantages
- Coverage depends on the reinsurance treaty
- Introduces counter party risk
- Profits must be shared with reinsurer

6. Continued

Actuarial approach
Use stochastic simulation to project the liabilities
  Advantages
  • Easy to understand and explain results
  Disadvantages
  • Can be complex and time consuming
  • Dependent on adequate scenarios generated

Ad hoc approach
Use actuarial judgement
  Advantages
  • Simple
  • Less expensive
  Disadvantages
  • Dependent on expertise

(c)   Describe four factors that could affect the lapse experience on this product.

Commentary on Question:
Few candidates were able to identify more than two factors. Candidates received full credit if they correctly identified four factors and for each factor gave a brief explanation.

Possible answers are:

• In-the-moneyness (ITM) – If the GMDB is in-the-money, policyholders are not likely to lapse.
• Policyholder – Better alternative investments and products would encourage policyholders to lapse.
• Product Design – Products with high surrender charges or with longer surrender charges periods would encourage better persistency.
• Distribution Channel – Products sold through career agents are likely to experience better persistency than products sold through brokers.
• Commission Rate - Higher or heaped commission can experience higher lapse rates.

(d)   Recommend whether a one-sided or two-sided factor approach for dynamic modeling of lapses is more appropriate for this product. Justify your answer.

6. **Continued**

> **Commentary on Question**:
> *Candidates struggled with this question. When recommending one approach over another, both approaches should be adequately described to compare what the recommended approach has that the other one does not. Most candidates did not mention the non-recommended approach. Furthermore, when justifying their recommendations, most candidates did not incorporate the facts of this case. There are reasons for recommending either approach. Candidates received full credit if they described the one-sided approach, described the two-sided approach, made a recommendation, and adequately justified the recommendation.*

A two-sided approach for dynamic modeling of lapses is more appropriate for this product.

A two-sided approach allows projected lapses to increase or decrease based on how much the guarantee is in-the-money.

A one-sided approach will only allow projected lapses to decrease based on how much the guarantee is in-the-money.

Given that current lapses are higher than expected, this is an indication that the original pricing assumption may be too conservative. Thus, allowing the projected lapse assumption to increase as well as decrease would produce a more accurate projection. However, this should be done with caution and frequent reviews should be performed.

OR

A one-sided approach for dynamic modeling of lapses is more appropriate for this product.

A two-sided approach allows projected lapses to increase or decrease based on how much the guarantee is in-the-money.

A one-sided approach will only allow projected lapses to decrease based on how much the guarantee is in-the-money.

The GMDB is currently in-the-money. Generally, lapses are lower when the guarantee is in-the-money. A one-sided approach is conservative and will not under-estimate the cost or the reserve by assuming higher ultimate lapse rates.

6. Continued

(e)   Senior management plans to increase sales of this product by offering a wider range of investment options.

Evaluate the impact of management's plan on the cost of the GMDB.

Commentary on Question:
Few candidates received full credit for this part of the question. Candidates received full credit if they correctly explained the impact of offering a wider range of investment options.

- Policyholders are more likely to make sub-optimal investment choices which will increase the volatility of the portfolio
- More policies are likely to be in-the-money
- This will increase the cost of any hedge and the cost of the GMDB

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

(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.

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

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

LP-141-16: Introduction to Reinsurance, World Bank, April 2009, excluding appendices

Commentary on Question:
Commentary listed underneath question component.

Solution:
(a)
(i) Calculate the ROE for each of the first three years. Show all work.

(ii) Calculate the EV. Show all work.

(iii) Assess whether ABC should launch the product based on these results. Justify your answer.

7. Continued

Question (a) was intended to test candidates' ability of developing and evaluating a product's performance, capital requirements, tax and regulatory requirements, and risk profile through return on equity and embedded value calculations.

For part (i), many candidates failed to fully capture the relationships, e.g. the deferral tax liability impact to the stockholder earning and as well as equity. Majority of the candidates performed poorly on this section.

For parts (ii) and (iii), generally candidates did well to list the EV calculation formula based on the after-tax solvency earnings. Candidates will get full credits regardless the present values for year 4 and later are discounted at hurdle rate or not.

(i)   Application of the formulas to arrive the calculated ROE results in the table below.

$$PreTaxStockholderEarnings(t) = PTSE(t)$$
$$= PreTaxSolvEarn(t) + [SolvRes(t) - SolvRes(t-1)]$$
$$- [EarnRes(t) - EarnRes(t-1)] + InvIncRC(t)$$

$$AccruedTax(t) = AccTax(t) = PTSE(t) \times TaxRate$$

$$AfterTaxStockholderEarnings(t) = ATSE(t) = PTSE(t) - AccTax(t)$$

$$DefTaxProv(t) = AccTax(t) - TaxRate \times [PreTaxSolvEarn(t) + InvIncRC(t)]$$

$$DefTaxLiab(t) = \begin{cases} DefTaxProv(1), & t = 1 \\ DefTaxLiab(t-1) + DefTaxProv(t), & t > 1 \end{cases}$$

$$Equity(t) = SolvRes(t) + ReqCap(t) - EarnRes(t) - DefTaxLiab(t)$$

$$MeanEquity(t) = \begin{cases} \dfrac{Equity(1)}{2}, & t = 1 \\ \dfrac{Equity(t) + Equity(t-1)}{2}, & t > 1 \end{cases}$$

$$ROE(t) = \frac{ATSE(t)}{MeanEquity(t)}$$

t	PTSE	AccTax	ATSE	DefTaxProv	DefTaxLiab	Equity	MeanEquity	ROE
1	82	29	53	60	60	1,151	575	9.3%
2	125	44	81	-48	12	972	1,061	7.7%
3	-6	-2	-4	-54	-42	762	867	-0.4%

7. **Continued**

    (ii)   Application of the EV formula to arrive at the EV result below.

$$EV(n) = PV(Profit, n) = \sum_{t=1}^{n} \frac{AfterTaxSolvEarn(t)}{(1 + HurdleRate)^t}$$

$$EV = \sum_{t=1}^{3} \frac{AfterTaxSolvEarn(t)}{(1 + HurdleRate)^t} = -\frac{96}{(1.08)^1} + \frac{124}{(1.08)^2} + \frac{64}{(1.08)^3} + \frac{400(1 - 0.35)}{(1.08)^4}$$

$$= 259.04$$

    (iii)   Since the embedded value of the product is positive, ABC should launch the product.

(b)   Describe the effect of reinsurance on this product's ROE and EV measures.

Commentary on Question:
The objective of Question (b) was to test candidates' understanding of the reinsurance effects on product management and financials.

For question (b), many candidates did well explaining the impact of reinsurance on EV and ROE. However, only a few candidates mentioned the reinsurance benefit on the first year business strain. Candidates that described any two of the following effects received full credit:

- Reinsurance can be used to finance new business by alleviating first year strain, especially if the reinsurer agrees to advance the future expected profits of the business in the form of reinsurance commission. This will greatly reduce the negative earnings in the first year.

- Ceding commission partially reimburses the cedant's acquisition costs and expenses, which increases earnings - this increases both the ROE and EV.

- Registered reinsurance will alleviate required capital. This increases ROE as well as EV (which using the distributed earnings method).

(c)   ABC's pricing consultant suggested using distributable earnings to calculate EV.

    (i)   Explain which EV calculation methodology is more appropriate for ABC. Justify your answer.

    (ii)   Assess whether ABC should launch the product based on the pricing consultant's EV measure. Show all work.

7. Continued

Commentary on Question:
Question (c) requires candidates to demonstrate the ability to assess and critique performance and risk measures for appropriate product management recommendations.
Many candidates did well by recommending the distributable earning as the preferred EV method. Majority of the candidates were able to capture the required capital component but unable to call out the key point of "free cash flow" distributable to shareholders.
For part (ii), generally candidates did well but some were unable to apply the tax to the investment income on required capital. And full credits will be given regardless the present values for year 4 and later are discounted at hurdle rate or not.

(i)   Distributable earnings better reflects the owners' expected cash flows and are therefore preferable, this is because:

- After-tax solvency earnings reflect only cash flow, reserves, and tax
- After-tax solvency earnings ignore the initial capital of 100 set up in the product
- Distributable earnings reflect everything after-tax solvency earnings does but also reflects capital
- Distributable earnings can be interpreted as the "free cash flow" left over to remit to shareholders after cash, reserves, and capital
- EV = 0 means shareholders have borrowed at the same rate they have invested in; this interpretation is only valid when considering distributable earnings.

(ii)   Application of the formulas below to arrive the EV results based on distributable earnings.

$$DistrEarn(t) = PreTaxSolvEarn(t) \times (1 - TaxRate) - ReqCapIncr + InvIncRC \times (1 - TaxRate)$$

$$DistrEarn(1) = -96 - (1{,}040 - 0) + 60 \times (1 - 35\%) = -1{,}097$$
$$DistrEarn(2) = 124 - (950 - 1{,}040) + 70 \times (1 - 35\%) = 260$$
$$DistrEarn(3) = 64 - (840 - 950) + 50 \times (1 - 35\%) = 206$$
$$DistrEarn(4+) = 260 - (-350) + 190 \times (1 - 35\%) = 734$$

$$EV = \sum_{t=1}^{3} \frac{DistrEarn(t)}{(1 + HurdleRate)^t} = -\frac{1{,}097}{(1.08)^1} + \frac{260}{(1.08)^2} + \frac{206}{(1.08)^3} + \frac{734}{(1.08)^4} = -90.49$$

Using distributable earnings would cause the EV to be negative. An assessment based on this EV value would result in a suggestion to not proceed with the launch of the product.

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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.

(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.

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

ASOP # 2, Nonguaranteed Charges or Benefits for Life Insurance Policies and Annuity Contracts

ASOP #23 Data Quality (excluding Transmittal Memo and Appendices)

"Term Mortality and Lapses", Product Matters, August (62) 2005,

Commentary on Question:
Commentary listed underneath question component.

8. Continued

Solution:
(a)   Critique the following excerpts from the most recent mortality study:

- ***Mortality improvement****:*
  Trends in mortality improvement due to medical advances were ignored to increase the conservatism of the mortality assumptions.
- ***Policy class definition:***
  Due to the lack of credible data, all products were combined into the same policy class.
- ***Data disclosure:***
  Data was provided and reviewed exclusively by a third party administrator.

Commentary on Part (a)
Generally reasonably well done – most people got part marks. Where marks were dropped it was due to:
-not understanding what would be conservative in Mortality improvement
-missing the underwriting criteria in Policy class definition
-making a blanket disapproval of the Data disclosure statement

Solution (a)
 Mortality improvement – potentially appropriate
   -need to consider trends
      -will they continue
   - might be correct to ignore if doing so is conservative
      -or required by regulation

 Policy class definition – inappropriate
    -should not combine data from full and simplified underwriting
    -whole life/UL/joint policies likely to have dissimilar mortality experience
    -combining over different time periods – UL block is closed – others still open

 Data disclosure – appropriate
     -ASOP 23 does not specifically require review by the actuary
     -but if not reviewed requires disclosure of any resulting limitations

(b)   Describe adjustments that should be made to the most recent mortality experience in order to develop mortality assumptions for the new term product.

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8. Continued

Solution (b)

Genetic testing – no longer allowed – will need to adjust expected mortality higher
-may have to adjust for anti-selection
Joint life policy data – probably should not use this data
-or find some way of adjusting to apply to single life policies
UL block – is closed block – mortality has the potential to be quite different
New product – has full underwriting – mortality should be better than simplified
New product conversion feature – need to allow for anti-selection at time of conversion

(c)   Assuming a calendar year study:

(i)   (*1 point*) Calculate q_{40}.

(ii)   (*3 points*) Determine whether 53 claims out of 10,000 policies for males age 40 using a 95% confidence interval is reasonable.

Show all work.

Solution (c-i)

$$q_{40} = \frac{D}{A + (1 - r)N - (1 - s)W}$$

$$= \frac{40}{8000 + \left(1 - \frac{6}{12}\right)2000 - \left(1 - \frac{6}{12}\right)160 - \left(1 - \frac{9}{12}\right)30}$$

$= .004488$

8. **Continued**

Solution (c-ii)

95% interval $= E \pm 1.96\sigma$

$E = Nq = 10000 \times .004488 = 44.88$

$\sigma^2 = nq(1-q) = 10000 \times .004488 \times (1-.004488) = 48.58099$

$\sigma = 6.97$

95% interval $= (44.88-1.96 \times 6.97, 44.88+1.96 \times 6.97) = (31.22, 58.54)$

53 claims is within the interval – consequently it's reasonable.

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:
(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.

(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:
The Art and Science of Life Insurance Distribution

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

LP-130-14: Life Insurance Underwriting in the US-Yesterday, Today and Tomorrow

LP-134-15: Digital Distribution in Insurance: A Quiet Revolution, Swiss Re, 2014 (Newly added LOB1)

LP-114-09: CIA Research Paper, Life Insurance Costing and Risk Analysis, June 2008 (Remove LOB reading)

Commentary on Question:
This question tested the candidates' understanding of the impact on sales, speed to market, cost, and mortality resulting from distribution and underwriting changes. The candidate should also understand the meaning of Breakeven Year and New Business Strain, and how different characteristics of distribution channels impact each. The question was answered reasonably well by candidates, although many candidates struggled in part b in the application of determining the impact on Breakeven Year and New Business Strain.

9. Continued

Solution:

(a)   Assess each of the proposed changes for their impact on each of the following:

     (i)   Sales

     (ii)   Expenses

     (iii)   Mortality experience

Commentary on Question:
To receive full credit for this question, candidates were required to state the impact and provide justification of introducing internet marketing, changing the underwriting method, and applying Big Data analytics on Sales, Expense, and Mortality experience. A common mistake made by candidates was stating that initial expenses for Internet Marketing would be higher due to upfront costs, but not further mentioning that it would lead to lower maintenance expenses. Some candidates thought simplified issue underwriting was stricter than non-medical underwriting and this affected their answer to sales, expenses and mortality experience for the underwriting part of the question. In addition to the responses shown below, credit would also be given for other reasonable explanations. Some impacts are considered 'uncertain', for which candidates should demonstrate knowledge of the differing factors.

Internet Marketing

Sales: Increase
Term products sell well online, Internet is a growing channel attractive to millennials, aggregators are common so there is a high degree of price sensitivity in this channel and therefore opportunity for sales

Expenses: Decrease
Significant upfront expenses to enter the channel and gain expertise, but maintenance expenses on internet channel are very low - lower than direct. If sales emerge as expected, per policy expenses will decrease for the company in the long run.

Mortality Experience: Uncertain
Product can be more 'bought than sold' in this channel, or purchased if needed via an aggregator and may attract unhealthy policyholders, who may be likely to lapse if a cheaper product later becomes available on the same aggregator.

This can be offset by the potential for a demographic skewed towards younger lives given the technological component which could improve mortality

9. **Continued**

Underwriting Method

Sales: Increase
The simpler process will attract policyholders. Less strict underwriting will improve sales driven by anti-selection, allowing policyholders to purchase the product who wouldn't have been eligible under the previous underwriting process. The simplified underwriting process will lead to faster application processing, which will also drive sales. Expense savings may allow lower premium to drive sales further.

Expenses: Decrease
Less strict and simplified underwriting process will reduce expenses, but this can be partially offset by increased claims related expenses after accounting for anti-selection

Mortality Experience: Worsen
Anti-selection as more people are able to purchase the product who would otherwise be turned down. Less information overall is gathered about policyholders through the simplified underwriting process compared to non-medical

Big Data

Sales: Increase
Allows micro market segmentation and targeted marketing towards favorable segments. Degree of success will depend on how effective current marketing strategies are. Given that this is combined with entering a new channel, there is significant opportunity for sales growth.

Expenses: Uncertain
Significant initial expense to set up big data infrastructure and increased maintenance expenses to hire staff/develop expertise. But cost savings will be generated by this in the long run (more effective marketing, underwriting, etc…)

Mortality Experience: Improve
Given micro market segmentation and improved ability to monitor risk, the company will be able to mitigate underlying risk components of the product including mortality.

9. Continued

b) The CFO is concerned about the impact of the poor recent sales on the MJB's projected financials, particularly the breakeven year and new business strain.

   (i) Define breakeven year and new business strain.

   (ii) Compare breakeven year and new business strain for the following distribution channels:

   - Internet
   - Direct mail
   - Independent agents

Commentary on Question:
Most candidates were able to accurately define Breakeven Year and New Business Strain. In general, many candidates struggled with understanding and explaining the impact of different distribution channels on the profit metrics.

   (i) Breakeven Year: First year when the accumulated cash flows exceed the reserve or cash surrender value and subsequently remain greater. An alternate definition is the first policy year where accumulated profits turn positive and remain positive thereafter.
   New Business Strain: First year distributable earnings divided by first year premium. An alternate definition is ratio of first year loss, including earnings on required capital to the annualized premium.

   (ii) Breakeven Year:
   Increasingly, consumers can purchase directly from insurers without relying on brokers or agents and thereby reducing acquisition expenses (no commissions, etc). Expenses for internet distribution are expected to be lower than direct mail which in turn is lower than Agents. Also, premiums are expected to be higher for internet than direct mail but could be higher or lower than for agents.
   Breakeven year is the shortest for Internet due to lowest expenses and higher premiums (vs Direct Mail).

   Therefore, shortest to longest Breakeven Year would be Internet, Direct Mail, then Agents

9. Continued

New Business Strain
Having poor initial sales could lead to less distributable earnings which increases the New Business strain. Internet sales will have higher distributable earnings due to lower expenses compared to the direct mail and agent channels.
The size of the premium / sales may influence the result for New Business strain. e.g. higher premiums for agent sold business that isn't fully commissionable could lower New Business strain.
Agent commissions add significant New Business strain for the agent channel. If the costs of setting up the Internet channel are included in the analysis, Internet strain may be worse than direct, but would still be better than agent

For similar rationale for Breakeven Year, the lowest to highest New Business strain would be Internet, Direct Mail, then Agents.

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

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

(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.

Sources:
LP-135-15: IIPRC2014 - Update on the Interstate Insurance Concept

Life Insurance and Modified Endowments Under IRC Sec. 7702, 2nd Ed.

LP-145-16: Actuarial Guideline 49: A Closer Look

LP-146-16: Actuarial Guideline 49 Post Standards Update

LP-125-13: NAIC Life Insurance Illustrations Model Regulation

LP-128-13: CLHIA - Guideline Illustrations

10. Continued

Commentary on Question:
Demonstrate knowledge of Universal Life product regulations specifically related to product filing in the US, IRC sections 7702 and 7702A in the US and regulations & guidelines for illustrations in the US and Canada.

Solution:
(a)   Describe the advantages of submitting life insurance forms for review through the Interstate Insurance Product Regulation Commission (IIPRC).

Commentary on Question:
Candidates generally did well on this part of the question. Full marks were awarded if 4 advantages were listed.

- Improved speed to market
- Less filing preparation
- Consistency across markets
- Lower cost

(b)   You have been asked to evaluate an inforce Indexed Universal Life (IUL) policy with the following characteristics at issue:

Face Amount	100,000
Death Benefit Option	Level
Cumulative Premiums Paid	22,000
Guideline Single Premium	20,000
Guideline Level Premium	2,000
7-Pay Premium	4,000

Construct an example of a premium payment pattern under Internal Revenue Code sections 7702 and 7702A for each of the items below:

(i)   IUL qualifies as life insurance and is a Modified Endowment Contract (MEC).

(ii)   IUL qualifies as life insurance and is not a MEC.

(iii)   IUL does not qualify under the definition of life insurance.

Commentary on Question:
Candidates generally did well on this part of the question. An example of a premium pattern appropriate for i, ii and iii was required for full marks, partial credit for less than the three examples or if an example was not clear or complete. A common mistake was to identify an example that satisfied the 7702 and 7702A tests but the cumulative premium did not sum to 22,000.

10. Continued

Many examples exist, one is included under each of (i) (ii) and (iii) to demonstrate the concept and what would earn full credit:

(i)

Year	1	2	3	4	5	6	7	8	9	10
Premium	$5,000	$5,000	$3,000	$2,000	$2,000	$1,000	$1,000	$1,000	$1,000	$1,000

(ii)

Year	1	2	3	4	5	6	7	8	9	10	11
Premium	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000

(iii)

Year	1
Premium	$22,000

(c)

    (i)   Describe the illustration regulations and/or guidelines for the non-guaranteed elements for policies issued in US and Canada.

    (ii)   Describe the illustration regulations and/or guidelines on interest rates linked to market performance for policies issued in US and Canada.

    (iii)   Identify which illustration regulations or guidelines apply to each of the following four policies:

        A. Universal life with non-guaranteed elements issued in the US.
        B. Indexed universal life with non-guaranteed elements issued in the US.
        C. Indexed universal life with non-guaranteed values and features issued in Canada.
        D. Fully guaranteed non-participating whole life issued in Canada.

Commentary on Question part (c):
Most candidates did not do well on this part of the question. The descriptions provided were not adequate for full marks so many candidates received partial credit when relevant explanations were provided. Many candidates did not differentiate their answers for (c)-i and (c)-ii and therefore did not make it clear as to the different requirements for non-guaranteed elements vs interest rates linked to market performance. Candidates generally described what is required in an illustration rather than focusing on non-guaranteed elements and interest rates linked to market performance. However, many candidates answering most or all of (c)-i and (c)-ii were able to answer (c)-iii.

10. Continued

(c)(i) The NAIC provides life insurance illustrations model regulations for policies issued in the US. Any illustration of non-guaranteed elements shall be accompanied by a statement indicating that:

a) The benefits and values are not guaranteed;
b) The assumptions on which they are based are subject to change by the insurer; and
c) Actual results may be more or less favorable.

If the illustration shows that the premium payer may have the option to allow policy charges to be paid using non-guaranteed values, the illustrations must clearly disclose that a charge continues to be required and that, depending on actual results, premium payments may need to continue or resume.

AG49 provides guidance for policies with index-based interest. The basic illustration should include the following:

A. A ledger using the Alternate Scale shall be shown alongside the ledger using the illustrated scale with equal prominence.
B. A table showing the minimum and maximum of the geometric average annual credited rates calculated for each applicable Benchmark Index Account.
C. For each Index Account illustrated, a table showing actual historical index changes and corresponding hypothetical interest rates using current index parameters for the most recent 20-year period.

CLHIA Guideline G6 sets out practices for the preparation and distribution of illustrations. An illustration should clarify which values or features in the policy are guaranteed and which are not guaranteed and show how the non-guaranteed values or features may change.

(c)(ii) For interest rates linked to market performance, G6 stipulates that the primary scenario should generally reflect reasonable assumptions as to the long-term performance of the market to which the interest rate is linked. The illustration should identify all applicable fees affecting performance and indicate where additional information is available.

AG49 defines the maximum credited rates for the illustrated scale as the arithmetic mean of the geometric average annual credited rates for each applicable Benchmark Index Account (BIA).

10. **Continued**

The BIA has the following features:
i.   The interest calculation is based on the percent change in S&P 500 Index over a one-year period
ii. An annual cap is used in the interest calculation.
iii. The annual floor used in the interest calculation shall be 0%.
iv. The participation rate used in the interest calculation shall be 100%.

(c) (iii)
A. NAIC Life Insurance Illustrations Regulations
B. AG49 and NAIC Life Insurance Illustrations Regulations
C. CLHIA Guideline G6
D. CLHIA Guideline G6