INSTITUTE OF ACTUARIES OF INDIA

EXAMINATIONS

CP1A - Actuarial Practice

May 2025

INDICATIVE SOLUTION

Introduction

The indicative solution has been written by the Examiners with the aim of helping candidates. The solutions given are only indicative. It is realized that there could be other points as valid answers and examiner have given credit for any alternative approach or interpretation which they consider to be reasonable.

Q. 1) **a)**

1. Identification of risks (underwriting, market, credit, operational, etc.)
2. Measurement and assessment of risks using actuarial models
3. Risk mitigation (reinsurance, diversification, hedging, etc.)
4. Monitoring and reviewing risk exposure regularly
5. Regulatory compliance and capital adequacy maintenance (2)

b) The reasons for calculating the provisions needed by a provider include the following:

1. to determine the liabilities to be shown in the provider's published accounts and reports
2. If separate accounts and reports are prepared for the purpose of supervision of solvency, to determine the liabilities to be shown in those accounts
3. to determine the liabilities to be shown in internal management accounts and reports of the provider
4. to value the provider for merger or acquisition
5. to determine the excess of assets over liabilities and whether any discretionary benefits can be awarded
6. to set future contributions to a benefit scheme
7. to value benefit improvements for a benefit scheme
8. to calculate discontinuance/surrender benefits
9. to influence investment strategy
10. to provide disclosure information for beneficiaries. (5)

[7 Marks]

Q. 2) To assess the impact of a guaranteed-return product on capital, the following **principles and factors** would be considered:

1. **Capital Requirements and Solvency Impact**
   - Evaluate how the product affects **regulatory capital** and **solvency ratios** (e.g. through increased reserve requirements or risk-based capital charges due to investment guarantees).
   - Long-term guarantees increase **market and interest rate risk**, requiring higher capital buffers
2. **Risk Appetite and Target Solvency Levels**
   - Assess whether offering such guarantees aligns with the company's **risk appetite** and existing capital strategy.
   - If it pushes solvency below internal targets, risk mitigation or capital raising may be needed.
3. **Product Profitability and Capital Strain**
   - Consider the **initial new business strain**, i.e., the upfront cost vs. timing of profit emergence.
   - Analyze whether the product generates **sufficient return on capital** to justify the risk.
4. **Use of Reinsurance or Capital Optimization Tools**
   - Explore whether **reinsurance, hedging**, or **financial reinsurance** can reduce capital strain or risk exposure.
5. **Investment Strategy Alignment**
   - Ensure that available assets can support the **duration and return profile**

of the guarantee, minimizing mismatch risk.

[5 Marks]

Q. 3) **a)** A deterministic model is one where the parameter values are fixed at the outset of running the model and the result of running the model is a single outcome. Sensitivity analysis and scenario testing can then be carried out to assess the potential variability of the results.

A stochastic model is a model where one or more of the inputs are random variables. A stochastic model estimates at least one of the parameters by assigning it a probability distribution. The model is run a large number of times, with the values of stochastic parameters being selected from their distributions on each run. The outcome is a range of values, giving an understanding of the likely distribution of outcomes. (2)

b) Characteristics of deterministic models:
1. A deterministic model is more readily explicable to a non-technical audience, since the concept of variables as probability distributions is not easy to understand.
2. It is clearer what economic scenarios have been tested.
3. The model is usually cheaper and easier to design, and quicker to run.
4. Users can get 'blinded by science' by complex models, assuming they must be working correctly, but without verifying or testing this.

Characteristics of stochastic models:
1. A stochastic model tests a wider range of economic scenarios.
2. The programming is more complex and the run time longer, but the benefit is in the quality of the result.
3. Stochastic models are particularly important in assessing the impact of financial guarantees or to allow for investment mismatching risks. (4)

c)
1. **Understanding Assumptions:**
   - Users must understand the assumptions behind the model to assess whether they are appropriate for the context.
2. **Data Quality:**
   - The accuracy of model output depends heavily on the quality and relevance of the input data.
3. **Model Limitations:**
   - All models are simplifications of reality and may not capture all risks or behaviours, especially in extreme scenarios.
4. **Interpretation of Results:**
   - Outputs must be interpreted with judgment, not blindly relied upon, as the model may not reflect real-world nuances.
5. **Validation and Testing:**
   - Models need to be regularly validated, stress-tested, and back-tested to ensure they remain fit for purpose.
6. **Changes in External Environment:**
   - Shifts in market conditions, regulations, or policyholder behaviour can render previously reliable models inappropriate.
7. **Over-Reliance Risk:**
   - Blind trust in model output can lead to poor decision-making, especially if risks are misunderstood or understated.
8. **Professional Responsibility:**
   - Actuaries have a duty to communicate model limitations, ensure transparency, and apply professional judgment. (4)

[10 Mark]

Q. 4) **a)** Possible reasons for higher lapses than expected

1. **Market Volatility and performance:** Poor investment performance may have led to dissatisfaction and early surrender of policies.
2. **Misalignment of Expectations:** Policyholders may have misunderstood the product benefits or expected guaranteed returns.
3. **Poor After-Sales Service:** Lack of engagement or follow-up from agents or service staff post-sale can reduce persistency
4. **Affordability Issues:** Economic stress or personal financial constraints may have led to inability to pay premiums. Especially given the poor market performance in last few months
5. **Competitor Offerings:** Better products or incentives from competitors may attract existing policyholders to lapse
6. **Inadequate Advisor Explanation:** Complex product features may not have been explained clearly at the point of sale.
7. **High Charges in Early Years:** Front-loaded charges may reduce fund value early on, creating a perception of poor value.
8. **Lack of Perceived Protection Benefit:** Customers may not see clear protection or savings value compared to traditional products.
9. **Limited Flexibility:** Lack of premium holidays or partial withdrawal options may push policyholders to exit.
10. **Negative servicing or Claims experience:**
    a. Poor experience during servicing (e.g. delays in fund switch, premium redirection, or queries) or during claims can lead to **distrust** and early exits.
    b. This erodes brand value and increases **policyholder attrition**, especially if word-of-mouth or social proof is strong. (5)

b) 1. Customer Education and Onboarding: Clear communication of product benefits, risks, and investment horizon through marketing materials and advertisements.

2. Need based selling: Ensure products are sold to customers whose risk profile and financial goals align.

3. Simplify Product Design: Reduce complexity to increase transparency and ease of understanding.

4. Loyalty Additions and Persistency Bonuses: Introduce incentives for staying invested longer without compromising profitability

5. Improved policyholder servicing – Faster response times, clear communication, and easy access to policy details improve customer satisfaction

6. Proactive lapse prevention strategies – E.g., reminders for premium payments or policy reviews before lapses.

7. Flexible Features: Offer premium holidays, top-ups, and partial withdrawals to accommodate financial variability.

8. Advisor Monitoring and Training: Improve quality of advice and post-sale engagement through advisor KPIs and support

9. Align benefits to Life Goals: Encourage policyholders to stay invested by linking policy to life goals such as retirement, marriage, education, etc.

10. Monitor and respond to fund performance – Ensure fund choices remain relevant and appropriate to customer risk profiles (5)

c) Key morbidity-related factors to assess and their influence on product design and financial viability:

1. **Incidence Rates of Critical Illnesses**
   - Assess expected **morbidity incidence rates** by age, gender, and geography (based on population or insurer data).
   - Underestimating incidence rates can lead to **underpricing** and future losses.
2. **Definition and Scope of Illnesses Covered**
   - Broader definitions or a large list of covered conditions can **increase claim probability**.
   - Need to balance customer appeal with pricing sustainability.
3. **Underwriting Strategy**
   - Determine whether to use **medical underwriting**, simplified underwriting, or offer to all ULIP customers.
   - Less stringent underwriting can lead to **anti-selection** risk, especially in protection gaps.
4. **Waiting Periods and Survival Clauses**
   - Features such as **waiting period** and **survival clause** help manage early claims and reduce pricing pressure.
   - These terms may also affect customer perception and acceptance.
5. **Claim Experience and Lapse Assumptions**
   - Model **expected claims outgo** using morbidity assumptions and policyholder behaviour
   - Consider **lapse-supported pricing** carefully, especially since ULIPs already experience higher lapses.
6. **Interaction with the Unit-Linked Nature**
   - Must ensure that the CI benefit does not **distort the investment-linked structure**, e.g., by requiring morbidity charges that reduce fund value.
   - Evaluate **fund value depletion risk** if high rider charges are deducted.

(6)

[16 Marks]

Q. 5) a)

1. Identify the Root Cause:
   - Perform a detailed claims investigation to isolate the new risk factor and understand how it was missed.

2. **Review Pricing Assumptions**

- Reassess original pricing assumptions, especially those relating to frequency, severity, and exposure to the new risk.

3. **Revise Rating Models**
    - Update models to include this risk factor or a proxy variable that can effectively capture it going forward.
4. **Adjust Underwriting Guidelines**
    - Modify underwriting rules to assess this risk more accurately at the proposal stage.
5. **Segment the Portfolio**
    - Identify which customer segments or geographies are most affected and take corrective pricing or acceptance actions.
6. **Introducing Loadings or Exclusions**
    - Introduce risk loadings or policy exclusions where appropriate, particularly for high-risk segments.
7. **Communicate with Key Stakeholders**
    - Inform underwriters, sales teams, and possibly reinsurers about the discovery and proposed actions.
8. **Reassess Reinsurance Coverage**
    - Evaluate whether the current reinsurance treaty offers sufficient protection for the emerging risk.
9. **Update Reserving Assumptions**
    - Reflect the updated risk profile in outstanding claims and IBNR reserves.
10. **Monitor Emerging Experience**
    - Set up a dedicated tracking process to monitor future claims experience related to the risk factor.

(5)

b)

1. **Define the Problem Clearly**
    - The control cycle begins with identifying and defining the pricing issue: a new unpriced risk.
2. **Assess Data Adequacy**
    - Evaluate the quality and relevance of historical data to model this new risk appropriately.
3. **Develop Revised Pricing Models**
    - Use updated assumptions and actuarial techniques to incorporate the new risk factor. Check the impact on premiums with regards to financial viability of the product
4. **Validate the Model**
    - Back-test the revised model against recent experience and other comparable datasets.
5. **Implement Changes**
    - Introduce the updated pricing model into product development and underwriting frameworks.
6. **Communicate with Stakeholders**
    - Explain pricing rationale and expected impacts to distribution channels, underwriting, management, and possibly regulators.
7. **Monitor Actual vs. Expected**
    - Continuously track claims experience to ensure the new model is performing as expected.
8. **Adjust Assumptions if Needed**
    - If actual experience deviates again, loop back and refine the assumptions and methods.
9. **Ensure Fit-for-Purpose**
    - The control cycle ensures pricing reflects current risk realities and is sustainable for the business.

10. **Support Strategic Decision-Making**
    - Insights from the cycle can inform broader decisions, such as entering/exiting lines of business or revising risk appetite.

(5)
[10 Marks]

Q. 6) **1. Product Strategy & Design**

1. **Evaluate Product Mix Profitability**
    - Identify which products (term, savings, annuities, group) are contributing to or dragging profitability.
    - Dig deeper into those products to assess which business mix is leading to higher profits or losses
2. **Assess New Business Strain**
    - Savings or group products may have high upfront strain — assess strain vs. emergence of surplus. Some products can be more capital intensive than the other
3. **Review Guarantees in Savings/Annuities**
    - Ensure guaranteed rates and benefit structures are still viable under current economic conditions.
4. **Simplify Product Range**
    - Streamline overlapping products to reduce admin overheads and improve focus.

2. Pricing Adequacy

5. **Check Pricing Assumptions**
    - Validate whether assumptions (e.g. mortality, morbidity, lapse, expenses, investment returns) remain accurate and in line with changing risks, demography, economic conditions.
6. **Incorporate Margin for Adverse Deviations**
    - Ensure risk margins are not being eroded under competitive pressure.
7. **Benchmark Against Competition**
    - Is the company underpricing to stay competitive at the expense of profitability? Competition benchmarking can help assess this
8. **Reprice Underperforming Products**
    - Revise pricing of those products where claims or persistency deviate from expected assumptions.

3. Valuation and Experience Analysis

9. **Analyse Profit by Source**
    - Use Analysis of Surplus to break down profits into mortality, lapses, expenses, investments to the drivers of profits for each line of business

10. **Experience Monitoring**
    - Regularly analyse actual vs. expected experience for each product line.
11. **Strengthen Reserving Basis if Needed**
12. **Refine Actuarial Models**
    - Ensure models are up to date and sensitive to new risks (e.g. macroeconomic shocks).

4. Capital and Risk Management

13. **Assess Capital Efficiency**
    - Examine whether current capital is being allocated optimally across product lines.
14. **Reinsurance Strategy**
    - Use reinsurance to reduce capital strain, claims volatility, especially for group and term products, where the total sum assured covered can be quite high.
    - The company can also have in place a Catastrophe excess of loss cover for retained risk
15. **Stress Testing and Scenario Analysis**
    - Evaluate profitability under adverse non-economic (demographic assumptions) and economic scenarios (e.g. interest rate spikes, inflation) to stress test the expected future profits
16. **Asset-Liability Management (ALM)**
    - Ensure investment strategies match liabilities — especially critical for annuities.

5. External & Strategic Environment

17. **Respond to Regulatory Change**
    - Assess if compliance costs have increased; explore simplification or automation to manage these.
18. **Engage in Strategic Dialogue**
    - Work with senior leadership to refine growth strategy, pricing philosophy, and product priorities considering external pressures.

[10 Marks]

Q. 7) **a) Risk Profile of the Existing Insurance Portfolio**

1. **Trade Credit Insurance:**
    - Increased risk of defaults as buyers and sellers experience cash flow pressures.
    - Increased correlation of defaults due to country specific risk
    - SMEs in affected sectors (automotive, apparel, solar) may go bankrupt.

- Cancellation of orders can lead to claims on unshipped but produced goods
- Policyholders facing financial pressure may be more likely to submit exaggerated or fraudulent claims.
- Tariff escalation could lead to politically motivated disruptions or expropriations in foreign jurisdictions.

2. **Property & Casualty Insurance:**
   - Higher risk of business interruption claims if factories or supply chains are disrupted.
   - Potential for product liability or delayed delivery lawsuits linked to supply chain bottlenecks.
   - Potential to lead to labor strikes as a result of layoffs or unpaid wages resulting in damages to building or material
   - Shift in Risk Concentrations could lead to certain sectors (e.g., solar panels) become much riskier than general commercial portfolios.
   - Different business lines (trade credit, P&C) may become more correlated, increasing systemic risk.
3. **Investment Linked Products:**
   - Volatility in the financial market makes hedging of guarantees more expensive
   - Higher slippage costs in transactions
   - Volatility across all financial products can also scare potential new policyholders away from investment oriented products increasing business cost
   - It could also lead to surrenders by existing policy holders and result in adverse selection as an outcome

(5)

b) Pricing and Reserving Assumptions

1. **Revision of Default Probability Assumptions:**
   - Trade credit insurance rates must reflect higher default risks.
2. **Increase in Risk Margins:**
   - Margins for adverse deviation may need to be raised, reflecting greater uncertainty.
3. **Higher Expected Claims Costs:**
   - Property and casualty pricing to reflect higher expected loss ratios.
4. **Adjustment for Sector-Specific Risks:**
   - Tariff-affected industries may require additional loadings or exclusions.
5. **Shortened Policy Terms:**
   - Insurers may prefer offering shorter policy terms to manage changing risk

dynamics.

6. **Reassessment of Reserving Bases:**
    - Claims development patterns may be affected; IBNR and outstanding claims reserves may need strengthening.
7. **Potential Increase in Legal/Defense Costs:**
    - Higher claims disputes could require reserving for legal expenses.
8. **Impact on Lapse/Surrender Rates:**
    - Economic slowdown could affect investment-linked policyholder behavior assumptions.
9. **More Frequent Experience Monitoring:**
    - Need for accelerated feedback loops on claims and exposures to adjust pricing faster.

(Max 5)

c) Investment Strategy and Asset Valuation

1. **Sector Exposure Review:**
    - Reassess investments in affected sectors (automotive, apparel, renewable energy).
2. **Equity Market Volatility:**
    - Tariffs may trigger stock market declines, affecting valuation of equity investments.
3. **Credit Quality Deterioration:**
    - Corporates facing margin pressures could experience bond downgrades.
4. **Currency Risk Increase:**
    - Tariff tensions can lead to foreign exchange volatility, impacting investments held in foreign currencies.
5. **Shift Toward Defensive Assets:**
    - May prefer government bonds, utilities, healthcare over cyclical sectors.
6. **Real Asset Valuation Risks:**
    - Property valuations could fluctuate if supply chain disruptions impact commercial real estate markets.
7. **Inflation Considerations:**
    - Tariffs may fuel inflation; causing impact on real returns and requiring adjustments to investment strategies.
8. **Diversification Review:**
    - Ensure asset portfolio remains sufficiently diversified geographically and across sectors
9. **Liquidity Management:**

- Need for higher liquidity buffers if claims frequency rises.

(Max 5)

d) Role of Scenario Analysis

1. **Quantify Adverse Impact:**
   - Model financial impact under prolonged trade war scenarios.
2. **Stress Default Rates:**
   - Stress scenarios where trade credit default rates spike by X%.
3. **Evaluate Property Exposure:**
   - Simulate increased property insurance claims due to business closures or interruptions.
4. **Simulate Asset Shocks:**
   - Assess portfolio losses under sharp equity and bond market declines.
5. **Liquidity Stress Testing:**
   - Simulate cash flow needs under high claims plus investment losses.
6. **Correlation Shocks:**
   - Model increases in correlation across lines of business and asset classes.
7. **Impact on Capital Adequacy:**
   - Assess solvency ratio drops under adverse macro conditions.
8. **Reinsurance Protection Testing:**
   - Evaluate how existing treaties would respond under increased claim frequency.
9. **Management Action Planning:**
   - Scenario testing guides planning on pricing revisions, investment reallocation, or underwriting tightening.

(Max 5)

[20 Marks]

Q. 8)

Aspects of Product design to be considered

1. Clarify Product Objectives and Target Market

- Understand the **needs of the target segment**: protection-focused, wealth-building, or both?
- Ensure the product remains **affordable and comprehensible** for the intended demography

2. Structure of Benefits

- Clearly define how **multiple CI payouts** will be structured (e.g. staging, intervals, illness groups).
- Specify whether **CI payouts are additional or accelerated** in nature
- Set a cap on total payouts (e.g. 500% of SA) and clarify interaction between death

and CI payouts

3. CI Definition and Underwriting

- Use **standardised CI definitions** to reduce ambiguity and disputes.
- Consider **stricter underwriting** or risk classification for high-morbidity lives

4. Participating Nature of the Product

- Participating benefits are typically designed to **share profits**, and not to hedge adverse risks.
- Inform marketing that **par bonuses may not be used as a claims buffer** from a regulatory point of view
- CI claims should be priced and funded explicitly; **bonuses cannot be a guaranteed fallback**.

5. Premium and Profitability Structure

- Consider **premium sufficiency** given high potential payouts.
- Implement **risk loadings** based on morbidity experience and possible reinsurance support.

6. Reinsurance Strategy (1 mark)

- Explore **multi-pay CI reinsurance** (if available) or use layered excess-of-loss cover.
- Reinsurer can also help with **pricing, definitions, and experience monitoring**

7. Complexity vs. Comprehensibility

- Multi-pay CI and participating structure makes the product complex.
- Must ensure it remains **understandable to policyholders and distributors**.

8. Regulatory and Reserving Considerations

- Check if there are any **regulatory constraints** in offering such a product
- Participating policies may require **additional statutory reserves**.

9. Investment and Bonus Strategy (if Par)

- Define bonus structure: **reversionary or terminal or combination of both**, how often declared, and linked to profits.
- Link investment strategy to **asset-liability matching** needs of high payout potential

10. Monitoring and Experience Analysis

- Setup mechanisms to **track CI claims by illness group**, age, gender, underwriting class.

Enable **early corrective action** on pricing, bonus strategy, or underwriting.

[Max 8 Marks]

<u>Investment Objective and Risk Appetite</u>

Q. 9) 1. Alignment to Investment Objectives

- Property investments are generally long **term** in nature while payouts on the liability side are shorter term, typically within 1 year. From a term stand point, it will not be a good fit.
- Property returns are real in **nature** with inflation protection while payouts are nominal. The match from nature perspective is poor.
- **Currency** match can be attained if invested in local property market
- Timing of payout is typically **uncertain** and sometimes correlated. Investment in property will lead to liquidity risks and difficulty in selling them quickly if needed for claims
- Property **valuations** can be subjective and volatile, affecting balance sheet stability.
- 30% allocation may breach prudent **diversification** standards, exposing the portfolio to sector-specific downturns.
- The company already underwrites property risks — investing heavily in property increases **correlation** risk (underwriting and asset exposure).
- Property insurance can face large catastrophic claims (e.g., floods, earthquakes), requiring **liquid** assets, not tied-up real estate.
- The "property boom" may represent a late-stage **cycle risk**; investing after major appreciation may expose the company to price corrections.
- While property is often seen as an inflation hedge, **returns are not guaranteed,** and costs (e.g., taxes, maintenance) can be high, eroding gains.
- Property investments will typically attract a significantly higher **solvency capital charges,** impacting regulatory ratios and hence profit margins on the core business
- Recommend running stress and scenario tests to assess the portfolio impact under adverse property market conditions on **probability of bankruptcy** of the insurer.

<u>What can be done instead?</u>

- Stick to core principles of investment management
  - Core of investment management is to select assets that match nature, term, currency, uncertainity of liabilities as closely as possible. Once that level of matching is done, assets should be selected in a way that maximize return for a given level of risk or minimize risk for a given level of return
  - Only excess assets should be invested in speculative or non-matching instruments
  - If investing, recommend diversified property assets (e.g., REITs, property company shares) to mitigate concentration risk.
  - If any increase is approved, suggest a gradual/phased allocation rather than an immediate 30% shift.

[Max 7 Marks]

Q. 10) **Key external environmental factors to assess and their impact:**

1. **Regulatory Framework**
   - Understand the local insurance regulations (e.g. licensing, capital requirements, product approvals, tax on profits).
   - A complex or restrictive regulatory environment may delay product launch or increase compliance costs.
2. **Economic Environment**
   - Inflation, interest rates, GDP growth, unemployment etc., all impact demand for insurance and pricing assumptions.
   - High inflation may erode real returns or increase claim costs, affecting profitability.
3. **Legal System and Contract Enforcement**
   - Availability of legal recourse for disputes and claims settlement.
   - Weak enforcement may lead to higher claim fraud or reputational risk.
4. **Political Stability**
   - Political risk (e.g., nationalization, changes in tax laws, civil unrest) can affect long-term business planning and solvency.
   - Companies may need to adjust product guarantees or reinsurance strategy in volatile regions.
5. **Socio-Cultural Factors**
   - Cultural perceptions of insurance, literacy levels, religious beliefs, and financial inclusion.
   - Affects product design, marketing approach, and policyholder behaviour (e.g., persistency, ability to pay for premiums).
6. **Technological Infrastructure**
   - Availability of digital payment systems, underwriting data, mobile connectivity, etc.
   - Determines whether digital distribution and servicing are viable.
7. **Competitive Landscape**
   - Number and strength of local players, pricing practices, and innovation levels.
   - This helps positioning products competitively and managing risk selection.

[Max 7 Marks]

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