INSTITUTE OF ACTUARIES OF INDIA

CP1 - Actuarial Practice (Paper B)

November 2025 Examination

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.

Solution 1:

a) **Catastrophe Risk** (Max: 2 marks)

The risk of **very large, correlated losses** arising from **low-frequency but high-severity** events that impact many policyholders simultaneously — such as **cyclones, floods, earthquakes, or major hurricanes**.

b) I. **Frequency and Data Availability**

- Attritional risks occur frequently, providing abundant historical data for **experience rating** and statistical estimation.
- Catastrophe risks are **rare**, and past experience is too limited to produce credible frequency or severity estimates.

II. **Statistical Dependence and Tail Behaviour**

- Common general insurance pricing models assume **independent claims** and **thin-tailed loss distributions**.
- Catastrophe events produce **highly correlated losses** and **fat-tailed distributions**, where the extreme tail dominates the expected loss.

III. **Aggregation and Correlation of Losses**

- Attritional and large individual risks are mostly **independent** across policyholders.
- Catastrophe events strike **many insureds simultaneously**, causing severe **accumulation of losses** and portfolio-wide impacts.

IV. **Geographic Concentration**

- Catastrophic events often affect **entire regions or countries**, and the insured exposure in the affected area can **dwarf normal portfolio sizes**.

V. **Modeling Requirements**

- Catastrophe risks require **specialized catastrophe models**, simulating thousands of scenarios using data on hazard intensity, geographic exposure, vulnerability, and secondary effects (e.g., infrastructure failure, economic disruption).

VI. **Reinsurance and Capital Implications**

- Insurers rely heavily on **catastrophe reinsurance** to limit exposure; these protections are expensive and must be factored into premiums.
- Firms must hold **larger capital reserves** to ensure solvency after extreme events, further increasing required premiums.

VII. **Pricing Uncertainty and Regulatory Oversight**

- Because catastrophe losses are less predictable, **premium estimates must include wide uncertainty margins**.
- Regulators often impose **additional solvency or stress-testing requirements**, leading to more **conservative pricing** for catastrophe risks.

(Max 4 marks)

c) **I. High Geographic Concentration of Risk**

- Small islands have **highly concentrated insurance portfolios**, with almost all risks located in the **same hazard zone** and no natural regional diversification.
- A **single cyclone or flood** can impact nearly every insured property, vehicle, and business

simultaneously.

- Exposure to a single peril (e.g. cyclone, flood, earthquake) means the **entire market depends on one dominant catastrophe driver**.

II. Economic Exposure and Systemic Impact

- Insured assets (property, vehicles, infrastructure) often represent a **large share of national GDP**, amplifying the macroeconomic impact of catastrophes.
- **Tourism and agriculture**, the island's key industries, are **highly climate-sensitive**; a major disaster disrupts employment, GDP, and future insurance demand.
- A **single event** can cause losses far exceeding the **insurance sector's capital base**, threatening both the insurer and the broader economy.

III. Market Structure and Capacity Constraints

- In this case, **IslandProtect dominates the market**, so its financial distress would **destabilise the entire insurance sector and the national economy**.
- As a **domestic insurer**, it cannot diversify geographically like multinational insurers, leaving it **fully exposed to local catastrophe risk**.
- The domestic **capital base is small**, reflecting a developing economy dependent on agriculture and tourism, making **post-event capital raising extremely difficult**.

IV. Dependence on Reinsurance and Government Support

- The local market relies **heavily on reinsurance**, which provides vital risk transfer capacity but exposes insurers to **recovery delays and counterparty risk**.
- If catastrophe risk is **underestimated or mispriced**, widespread **underinsurance or insurer insolvency** could cripple economic recovery efforts.
- The **government's fiscal position** is also vulnerable, as it may need to step in to support the insurance system or fund reconstruction.

V. Emerging Risks and External Pressures

- **Climate change** is increasing the **frequency and severity** of tropical cyclones, worsening loss potential.
- Heavy dependence on **tourism and foreign exchange** introduces additional volatility from global economic or geopolitical shocks, further pressuring solvency.

(max 8 marks)

d)

- **Limits exposure to catastrophic losses**, ensuring the insurer's net liability is capped.
- **Enables underwriting of high-risk or large-scale policies** that IslandProtect could not retain independently.
- **Enhances financial stability** by providing capital relief, supporting regulatory solvency requirements.
- **Diversifies risk globally**, with reinsurers absorbing correlated, island-wide exposures.
- **Accelerates post-disaster recovery**, provided reinsurance claims are settled promptly.
- **Stabilizes financial performance** by smoothing the insurer's loss experience over time.
- **Expands underwriting capacity**, allowing the company to write more business confidently.
- **Provides access to specialized data, analytics, and expertise**, improving risk assessment and pricing.

(max 4 marks)

e) **i) Motor – Accidental Damage** (Max: 2 marks)

- Typically involves **low severity but high frequency** claims.
- The portfolio is likely to consist of **homogeneous risks**.
- **Proportional treaties** such as **Quota Share (QS)** and **Surplus Share** are suitable to manage frequent, predictable losses.

ii) Motor – Third Party (TP) Liability (Max: 2 marks)

- Claims range from **low to moderate severity**, but can escalate significantly depending on the **extent of injury to third parties**.
- **Court awards** introduce **greater severity and unpredictability** in claim outcomes.
- **Risk-based Excess of Loss (XoL)** reinsurance is appropriate to manage **high individual claims**.

iii) Property Insurance (Max: 4 marks)

- **Residential properties** (e.g., apartments, single-family homes) are generally **small and homogeneous**, making them suitable for **Quota Share treaties**.
- **Commercial and industrial risks** are **heterogeneous and large-scale**, requiring **Facultative reinsurance** for tailored coverage.
- **Facultative arrangements** allow for **customized protection** on a case-by-case basis.
- **Examples** include large cinema complexes, shopping malls, chemical plants, or electronics warehouses, which demand **specific coverage terms**.
- Property portfolios are vulnerable to **natural catastrophes** (e.g., earthquakes, floods, storms).
- In small island nations, a **single catastrophic event** can impact a large number of properties simultaneously. **Catastrophe Excess of Loss (Cat XoL)** is essential to manage such aggregate risks.
- Cat XoL treaties are **critical for maintaining solvency**, especially when a single insurer dominates the market.

iv) Group Accident Insurance (Max: 2 marks)

- For **small, homogeneous portfolios**, **Quota Share or Surplus Share treaties** provide effective **capital relief**.
- For **catastrophic risks**, **non-proportional arrangements** such as **Cat XoL** are necessary.

v) Crop Insurance (Max: 2 marks)

- **Proportional reinsurance** (e.g., QS and Surplus Share) is suitable due to the **high frequency and low-to-moderate severity** of claims.
- Numerous **small claims** are better managed under a proportional structure.
- **Parametric crop insurance products** align well with proportional reinsurance, given their **frequent, capped payouts**.

f) **i) Underwriting Results** (Max: 5 marks)

- **Surge in claims** across multiple lines of business — property, motor, and accident.
- **Significant spike in loss ratios**, reflecting deteriorated underwriting performance.
- **Coverage disputes**, especially around ambiguous events like storm surge or flooding under motor policies.
- **Increase in operating expenses** due to claims handling, external adjusters, and legal costs.
- **Higher combined ratio**, indicating reduced profitability.
- **Potential for fraud or moral hazard** in the aftermath of the catastrophe.
- **Claim accumulation across lines**, amplifying the overall impact on the insurer.

ii) Reserving Challenges (Max: 5 marks)

- **IBNR (Incurred But Not Reported) uncertainty** due to delayed claim reporting post-

catastrophe.

- **Long-tailed bodily injury claims** from accident lines increase reserve estimation complexity.
- **Inflated costs of labor and materials** during reconstruction complicate case reserve adequacy.
- **Prolonged settlement disputes** extend the tail of liabilities.
- **Risk of under-reserving** due to limited historical data on similar events.
- **Magnitude of the event necessitates additional reserve strengthening**.
- **Distortion of reserving triangles**, requiring alternative actuarial methods for projections.

iii) Solvency Position (Max: 5 marks)

- **Capital erosion** from underwriting losses weakens the insurer's financial base.
- **Reserve strengthening** further reduces available surplus.
- **Asset-side strain**, including potential liquidation at depressed values, leading to investment losses.
- **Liquidity pressure** due to immediate and large-scale claim payouts.
- **Risk of breaching regulatory solvency margins**, triggering supervisory intervention.
- **Credit rating downgrades**, resulting in costlier reinsurance and capital access.
- **Systemic risk** in a small island economy where the insurer plays a dominant role.
- **Higher cost and difficulty in raising capital** post-event due to weakened financial position.

g) I. Coverage Limitations and Gaps

- **Policy wording exclusions** may lead to coverage gaps — e.g., storm surge, business interruption, or contingent business losses.
- **Treaty limits may be exceeded** in the case of very severe events.
- **Aggregate covers may be exhausted** if multiple catastrophic events occur within the same year.
- **Treaty misalignment** with actual exposures — disputes over event definitions can hinder recovery.

II. Liquidity and Payment Delays

- **Reinsurer payment delays** can create significant **liquidity gaps** for IslandProtect, affecting timely claims settlement.
- **Global reinsurer strain** due to multiple catastrophes may result in **delayed payments or defaults**.
- **Regulatory approval delays** or complex documentation requirements may **slow down reinsurance recoveries**.

III. Financial and Economic Mismatches

- **Currency mismatch risk** between insurance payouts and reinsurance recoveries can lead to financial strain.
- **Post-catastrophe reconstruction surge** in costs may outpace fixed nominal treaty limits, reducing real coverage.

IV. Cost and Affordability

- **Higher reinsurance premiums** following a catastrophe may **strain affordability**, especially for smaller insurers.

(5)

h) <u>Insurer Actions Post-Catastrophe</u>

I. Risk Management and Reinsurance Strategy

- Review and recalibrate **catastrophe models** to reflect updated hazard and exposure data.

(0.5 mark)

- Strengthen the **reinsurance programme** — increase limits, consider multi-year contracts, and add aggregate covers.
- Explore **alternative risk transfer mechanisms** such as catastrophe bonds and parametric reinsurance.

II. Financial Preparedness

- Improve **liquidity management** through credit lines, catastrophe reserves, and contingent capital arrangements.
- Diversify the **insurance portfolio** across products (e.g., health, accident) or geographies, where feasible.

III. Operational Efficiency

- Strengthen **claims management** and enhance **fraud detection** capabilities.
- Prioritize **quick claim settlement** to support customer recovery.
- Deploy **additional adjusters** from regional partners or reinsurers to expedite loss assessment.

IV. Governance and Communication

- Enhance **Enterprise Risk Management (ERM)** and ensure **board-level oversight** of catastrophe risk.
- Provide **clear communication** on future coverage limitations to manage policyholder expectations.

<u>Government / Systemic Actions</u>

I. Risk Pooling and Financial Support

- Establish a **national catastrophe pool** to share risks across insurers.
- Participate in **regional risk pools**, such as CCRIF-style mechanisms.
- Purchase **sovereign catastrophe insurance** to support fiscal resilience.
- Provide **temporary liquidity support or guarantees** to insurers for faster claims settlement.
- Create a **shared insurance fund** between government and private insurers for extreme loss layers.
- Act as a **reinsurer of last resort** for systemic catastrophic layers.

II. Resilience and Risk Reduction

- Strengthen **building codes and resilience standards** to reduce vulnerability.
- Improve **disaster response coordination** to minimize insured losses.
- Invest in and promote **local development of advanced climate models**.

III. Public Engagement and Strategy

- Provide **public education** on insurance coverage and disaster resilience.
- Develop a **national disaster risk financing strategy**, aligning public and private sector efforts.
- Issue **regular public updates** to maintain trust and confidence in insurers and system stability.
- Utilize **sovereign catastrophe bonds or parametric insurance** for government infrastructure and fiscal protection.

(10)
[60 Marks]

Solution 2:

a) Advantages of Tailored / Flexible Pension Products

1. **Better Member Engagement**
    - Products designed around individuals' needs can improve understanding, ownership, and engagement in retirement planning.
2. **Targeted Offerings for Specific Groups**
    - **Women-specific plans:** Address longevity and career break patterns (e.g., flexible withdrawals, longer payout phases).
    - **Gig and informal sector workers:** Allow flexible or irregular contributions, expanding coverage to under-served groups.
3. **Improved Risk–Return Alignment**
    - Investment strategies can be matched to life stages — e.g., higher equity exposure for younger members, shifting to bonds closer to retirement.
4. **Potential for Higher Retirement Incomes**
    - Optimised, personalised investment choices may enhance overall returns and post-retirement income levels.
5. **Greater Product Choice and Innovation**
    - Members may select among features such as guarantees, drawdown vs annuity, or flexible benefit structures, supporting varied preferences.
6. **Enhanced Financial Inclusion**
    - Broader choice and innovation can attract individuals currently outside formal pension systems, promoting inclusivity and savings culture.

Disadvantages / Risks of Greater Flexibility and Customisation

1. **Complexity and Member Understanding**
    - Increased choice may overwhelm or confuse less financially literate members, leading to suboptimal decisions.
2. **Mis-selling and High Fees**
    - Incentives for agents may lead to mis-selling of complex or higher-fee products.
    - Higher fees over time can significantly erode long-term returns.
3. **Reduced Risk Pooling**
    - Customisation weakens collective risk sharing, leading to more volatile and uncertain outcomes for individuals.
4. **Equity Concerns**
    - Wealthier or financially literate members benefit more from flexibility; poorer members may be left behind or exposed to greater risks.
5. **Unclear Guarantees and Risk Exposure**
    - Members may not fully understand investment risks or lack adequate protection if guarantees are reduced.
6. **Longevity Risk Not Well Managed**
    - If members choose drawdown over annuitisation, they bear the risk of outliving their assets.

7. **Behavioural Risks**
    - Members may chase recent investment performance or frequently switch funds, harming long-term returns.
8. **Reduced Comparability and Transparency**
    - Highly individualised products make it difficult to benchmark performance or assess value for money.

(10)

b) **i) Product Design** (Max: 5 marks)

1. **Increased Product Complexity**
    - Multiple product variants are required to meet diverse needs (e.g., women, gig workers), increasing design and testing workload.
2. **Customised Retirement Parameters**
    - Products must accommodate different **retirement ages** and **lifecycle needs**, requiring more detailed modelling and projection.
3. **Gender-Specific Longevity Modelling**
    - Annuitisation options need to reflect gender-based longevity differences to ensure fair pricing and sustainability.
4. **Complex Fee Structures**
    - Use of tiered or performance-based fees increases the risk of **cross-subsidies** and makes transparency more challenging.
5. **Adverse Selection Risk**
    - Members with higher risk tolerance may disproportionately choose aggressive or guarantee-heavy plans, affecting portfolio balance.
6. **Enhanced Disclosure Requirements**
    - New, clear disclosure templates are needed so members can understand differences across customised products.
7. **Guarantee Sustainability Testing**
    - Any offered guarantees must be carefully stress-tested to avoid **mispricing or long-term solvency strain**.

ii) Operational Aspects (Max: 5 marks)

1. **System and Administration Complexity**
    - Administrative systems must handle **multiple plan rules, fees, and investment allocations**, increasing operational demands.
2. **Enhanced Data and Reporting Requirements**
    - Granular data collection and reporting are required to monitor member groups and product variants accurately.
3. **Training and Distribution Capability**
    - Sales and advisory staff need comprehensive training to accurately explain the range of customised options.
4. **Technology Upgrades**
    - Significant IT investment needed in **member portals** and back-office systems to

enable personalised product information and self-service functionality.

5. **Compliance and Regulatory Costs**
    - Each product variant must meet disclosure and reporting standards, raising compliance costs.
6. **Operational Error Risk**
    - Increased product complexity raises the likelihood of **errors** such as incorrect fee application or contribution allocation.

iii) Risk Management (Max: 5 marks)

1. **Investment Risk**
    - Broader investment options increase portfolio monitoring requirements and the potential for **asset–liability mismatches**.
2. **Operational Risk**
    - Complexity in product design and sales processes heightens the risk of **mis-selling** or **administrative errors**.
3. **Liquidity Risk**
    - Flexible withdrawal options and custom drawdown features may create **liquidity strain**, especially under stressed conditions.
4. **Reputational Risk**
    - Poor outcomes or losses in one product group could **damage public confidence**, reducing participation in the broader system.
5. **Capital and Solvency Requirements**
    - Guarantees or risk-based product features may necessitate **higher capital buffers** and closer solvency monitoring.
6. **Regulatory and Supervisory Risk**
    - Increased complexity and risk exposure could attract **greater regulatory scrutiny** and potential penalties for inadequate controls.

c) Structured Personalisation

Investment design should provide **controlled flexibility** — allowing members to align portfolios with their individual goals and risk tolerance, while operating within **defined regulatory and risk parameters**. Oversight mechanisms must prevent **mis-selling, excessive risk-taking, or unsuitable allocations**.

Possible Approaches

1. **Member Risk Profiling**
    - Classify members into **risk categories** (e.g., conservative, balanced, aggressive) based on age, income, and investment horizon.
2. **Pre-Approved Model Portfolios**
    - Offer a **limited set of diversified portfolios** combining equities, bonds, and alternative assets to maintain consistency and ease of supervision.
3. **Defined Risk Parameters**
    - Each model portfolio should have **specified volatility bands** and **Value-at-Risk (VaR)**

limits, ensuring transparent and measurable risk control.

4. **Portfolio Resilience Testing**
    - Conduct regular **stress testing and scenario analysis** to assess how portfolios perform under adverse market conditions and macroeconomic shocks.
5. **Controlled Customisation**
    - Fund managers may **adjust asset weights** within predefined regulatory boundaries to enhance returns while preventing excessive dispersion of outcomes.
6. **Default Investment Options**
    - Maintain robust **default funds** for members who are unwilling or unable to make an active investment choice, ensuring suitable participation.
7. **Lifestyling / Age-Based Glide Paths**
    - Implement **automatic de-risking** strategies that gradually shift exposure from equities to bonds or cash as members approach retirement, reducing the risk of a market downturn near retirement.
8. **Strategic and Tactical Asset Allocation**
    - Asset selection should reflect long-term strategic objectives, liability matching, and factors such as **longevity and mortality trends**, while allowing tactical adjustments for market conditions.

(max 5 marks)

d) 1. Protecting Members and Promoting Fair Outcomes

- **Consumer Protection Priority**
  Safeguarding member interests should remain a core regulatory objective.
- **Prevention of Mis-Selling**
  Regulators must ensure members are not sold **complex or high-fee products** that do not suit their needs.
- **Support for Financially Unsophisticated Members**
  Investor protection mechanisms are vital for members with **limited financial literacy** or low engagement.
- **Fair Access for All Groups**
  Particular care should be taken to ensure **women, gig workers, and informal sector participants** receive fair outcomes, rather than being targeted with superficially attractive but costly products.

2. Disclosure and Transparency Standards

- **Clear and Comparable Disclosures**
  Customised plans require **transparent, standardised disclosure** of fees, risks, and expected outcomes to enable informed comparison.
- **Simplification to Avoid Information Overload**
  Disclosures must be concise and comprehensible to avoid **confusing members with excessive technical detail**.
- **Comparability and Benchmarking**
  Greater product customisation can reduce **comparability across funds**, making it harder for both members and supervisors to assess relative performance.

3. Pricing and Fee Regulation

- **Fee Controls**
  Allowing higher or performance-based fees could lead to **excessive charges**, undermining retirement adequacy. Regulators should set **reasonable fee caps or disclosure-based limits**.
- **Balancing Innovation and Protection**
  Regulation must strike a balance between **encouraging innovation** and ensuring **adequate member protection** against high costs and poor value.

4. Supervisory and Systemic Oversight

- **Monitoring Complexity**
  Increased product variants complicate supervision of **solvency, investment practices, and governance** across pension providers.
- **Reputational and Systemic Risk**
  Mis-selling scandals or poor member outcomes could **damage trust** in the pension system. If many funds adopt aggressive, equity-heavy portfolios, this could heighten **systemic vulnerability** during market downturns.
- **Market Fragmentation**
  Excessive product customisation may **fragment the market**, reduce **risk pooling efficiency**, and complicate regulation.

5. Strengthening Regulatory Capability and Policy Alignment

- **Capacity Building**
  Regulators may need **new analytical tools, skilled staff, and advanced data systems** to supervise personalised products effectively.
- **Policy Consistency**
  Pension reforms introducing customised schemes must align with **national retirement adequacy objectives** and existing **social security frameworks**, avoiding overlapping or conflicting provisions.
- **Transition Management**
  Moving from standardised to custom plans requires careful **management of legacy members** to prevent operational disruption and inequitable treatment.

(max 10 marks)
[40 Marks]

****