

INSTITUTE OF ACTUARIES OF INDIA

CP1 - Actuarial Practice (Paper A)

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:**
- **Company's own historical CI claims experience** (if available), to reflect actual insured population characteristics.
 - **Company's general claims data** on related morbidity or medical conditions, even if not specifically CI.
 - **Reinsurer experience data** – often provided as part of pricing support, especially for CI where insurer experience may be limited.
 - **Industry tables / published CI experience studies** from actuarial bodies or industry associations.
 - **Population-level medical or health statistics** (e.g., cancer registries, heart disease incidence data) to derive base rates.
 - **Government health data** – national disease incidence and prevalence data, often published by health ministries or public health bodies.
 - **CI experience from other products within the company** (e.g., standalone CI policies) to calibrate rider assumptions.
 - **Experience from similar markets** – using international CI tables or data from countries with similar demographics and healthcare environments, with adjustments.
 - **Reinsurer-provided standard incidence tables** adjusted for local population characteristics.
 - **Medical research literature** and academic studies on disease incidence trends.
 - **Underwriting and claims expert judgement** – to supplement data gaps, especially for rare conditions or new cover definitions.
 - **Adjustments for expected future trends** – e.g., improving detection rates, lifestyle changes, medical advances, which may affect incidence over the policy term.

(6 marks)

Solution 2:

a) **Investment strategy & asset-liability matching**

- **Scarcity of long-dated risk-free assets** — fewer long government bonds makes it harder to find risk-free instruments to match long liabilities; duration matching becomes more difficult. (1 mark)
- **Potential change in long-term yields / curve shape** — reduced supply can push prices up (yields down) if demand remains; but if demand is waning, yields may rise elsewhere → need to monitor yield curve shifts and base ALM decisions on observed moves.
- **Increased reliance on non-government debt** — insurers may have to use corporate bonds or supranationals for duration; this increases credit risk and requires stronger credit assessment and limits.
- **Greater use of derivatives (swaps, futures)** — to achieve duration matching insurers may hedge using interest rate swaps or OIS rather than buying physical long bonds; introducing counterparty/operational risk.
- **Liquidity management implications** — long government bonds are typically liquid; replacing them with less liquid assets raises liquidity risk for claim/annuity cashflows and may require larger liquidity buffers.
- **Impact on matching adjustment / hedging cost** — cost and availability of hedges may change, raising the cost of economically hedging guarantees.
- **Portfolio re-optimization** — review strategic asset allocation: consider increasing credit, inflation-linked, infrastructure or alternative assets that offer long duration, while controlling concentration and liquidity risk.
- **Reinsurance / longevity hedging** — consider reinsurance or transfer of some longevity/guarantee risk to reduce reliance on perfect ALM via long government bonds.
- **Operational changes** — enhance monitoring, expand approved asset lists, formalize

counterparty limits for derivatives and repos used to obtain duration.

(8)

b) Pricing and capital management for long-term liabilities

- **Revisit discounting & valuation assumptions** — if market yields for suitable instruments change, update discount rates used in pricing and reserving (and reflect in policy liabilities). (1 mark)
- **Higher cost of guarantees** — if hedging or matching becomes costlier, the implied cost of providing guaranteed annuity rates rises; pricing must reflect higher economic cost.
- **Increase in capital for interest-rate/market risk** — reduced ability to hold risk-free long assets and higher asset risk increases economic and regulatory capital needs. (1 mark)
- **Stricter product design** — consider reducing guaranteed elements, introducing product design features (bonus smoothing, market-linked crediting) to share risk with policyholders.
- **Repricing / sales strategy** — new business pricing should include higher risk margins or restrict guaranteed product sales until funding/hedging strategy is secured.
- **Impact on participating bonuses** — availability of surplus used for reversionary/terminal bonuses may reduce; set more conservative bonus expectations and clearly communicate to policyholders.
- **Capital planning & contingency** — run capital projections and consider contingent capital, capital raising or retention of profits to meet increased solvency strain.
- **Regulatory and reporting considerations** — inform regulators if asset strategy materially changes; ensure reserving and solvency calculations reflect changed asset/liability mix (and disclose assumptions).

(8)

(16 Marks)

- Solution 3:**
- (i) Risk Transfer:** Transfers part of the insurer's risk to the reinsurer, reducing exposure to large individual or aggregate losses.
 - (ii) Capacity Enhancement:** Enables the insurer to **underwrite larger sums assured** or more business than its own capital would allow.
 - (iii) Stabilization of Results:** Helps **smooth claims experience** over time, reducing volatility in profit and loss.
 - (iv) Catastrophe Protection:** Protects against **large, infrequent losses** (e.g., natural disasters) through excess-of-loss or catastrophe covers.
 - (v) Capital Relief / Regulatory Benefits:** May reduce **required capital** under solvency regimes, improving solvency ratios and capital efficiency.
 - (vi) Access to Expertise:** Reinsurers often provide **underwriting, claims, or pricing support**, improving the insurer's technical capabilities.
 - (vii) New Market Entry Support:** Reinsurance can help manage uncertainty when entering new **lines of business** or **geographies**, by sharing early-stage risk.
 - (viii) Protection Against Accumulations:** Helps limit exposure to **accumulation risks** (e.g., concentration by geography, peril, or industry).
 - (ix) Cash Flow and Liquidity Management:** Some reinsurance treaties provide **cash flow relief**, helping manage liquidity when claims spike.
 - (x) Product Development Support:** Reinsurers may assist with product design, pricing, or sharing development risk for innovative products.
 - (xi) Reputation and Creditworthiness:** Having strong reinsurance backing can **enhance the insurer's credibility** with regulators, customers, and investors.
 - (xii) Strategic Flexibility:** Reinsurance can be used tactically (e.g., temporary covers, stop-loss) to manage **short-term financial strain** or during restructuring.

(6 marks)

Solution 4: Bonus Philosophy & Policyholder Expectations

1. **Consistency with declared bonus philosophy** – Check whether an immediate large terminal bonus aligns with the stated long-term bonus strategy.
2. **Policyholder reasonable expectations (PRE)** – Sudden bonus changes could breach or distort policyholder expectations developed over time.

Smoothing and Stability

1. **Bonus smoothing principle** – With-profits typically aim to smooth investment returns over time; distributing all surplus now may undermine this.
2. **Future investment uncertainty** – Retaining some estate helps absorb future adverse experience and maintain stable bonuses.

Estate Management & Solvency

1. **Regulatory capital requirements** – The estate acts as a buffer for solvency; assess post-distribution solvency coverage.
2. **Long-term financial strength** – Distributing most of the estate could weaken the company's ability to fund future guarantees or withstand shocks.
3. **Support for future bonus declarations** – The estate may be needed to maintain reversionary bonuses in years of poor returns.

Fairness Considerations

1. **Fair treatment across generations** – Large immediate terminal bonuses may favour current exiting policyholders at the expense of past and future policyholders.
2. **Consistency between different product cohorts** – Ensure distribution does not disproportionately benefit one block of business.

Regulatory and Governance

1. **Regulatory expectations** – Regulators usually expect prudent estate management; large distributions may require approval or notification.
2. **Board & With-Profits Committee input** – Such decisions typically require formal governance processes and actuarial justification.
3. **Support Capital Requirement** – Estate can support solvency capital requirement of Participating business. Further, if the estate is depleted, the shareholders may have to infuse money to support the minimum bonus to maintain PRE which may not be recouped given regulatory restrictions besides providing solvency capital.

Practical Implementation

1. **Timing and communication** – Consider timing of distribution, clarity of communication, and impact on policyholder behaviour (e.g., surrenders, lapses).
2. **Impact on new business** – Maintaining a strong estate can support competitive bonus rates and future sales; reducing it may hurt competitiveness.
3. **Modelling of alternative scenarios** – Perform projections under different investment conditions to assess sustainability of reduced estate levels.

(7 marks)**Solution 5:**

- Historical expense analysis
- Allocation of expenses between product lines
- Fixed vs. variable expense split
- Acquisition vs. maintenance expenses
- Expected future inflation
- Anticipated business volumes and expense overruns

- Planned operational or system changes
 - One-off or exceptional expenses
 - Expense projections and budgeting information
 - Regulatory or tax changes impacting expense levels
 - The above factors are applicable for both pricing and valuation purpose, however for Valuation purpose the insurer would need to factor in margin for adverse deviation/prudence
- (5 marks)**

Solution 6: Data Integrity & Migration

- **Data accuracy and completeness** – ensure data migrated from the old system is fully reconciled with financial and actuarial records.
- **Testing of migrated data** – parallel runs and validation to avoid mismatches between old and new systems.

Model & Valuation Implications

- **Impact on valuation processes** – ensure actuarial models can read from the new system without errors.
- **Consistency of assumptions** – verify that product features, calculations, and parameters remain consistent post-migration.

Operational & Business Risks

- **System downtime risk** – assess the impact of potential delays or failures on policy servicing and new business.
- **Regulatory reporting** – ensure the new system supports all statutory, regulatory, and internal reporting needs.
- **Change management and training** – staff and distribution must be trained to use the new platform efficiently.
- **Contingency planning** – ensure fallback mechanisms are in place if migration fails or is delayed.

Pricing & Expense Assumptions

- **Expense impact** – reflect temporary dual running costs or implementation costs in expense assumptions.
- **Operational efficiencies** – potential long-term expense savings may influence future pricing assumptions.

Governance & Communication

- **Stakeholder communication** – involve IT, actuarial, risk, operations, and regulators early.
 - **Independent validation** – actuarial sign-off on data and calculation accuracy before go-live
- (8 marks)**

Solution 7: Pricing & Underwriting Adjustments

- **Revisit pricing assumptions** – adjust premium rates to reflect higher expected frequency and severity of events.
- **Refine underwriting criteria** – stricter risk selection, building standards, elevation requirements, or zoning restrictions.
- **Introduce higher deductibles / co-insurance** – to control claims cost and align incentives.

Strategic & Regulatory Response

- **Engage with regulators and industry bodies** – on pricing adequacy, coverage availability, and climate adaptation measures (1 mark)

Reinsurance Strategy

- **Enhance catastrophe reinsurance cover** – increase limits, reduce retentions, or consider multi-year programs.
- **Model-based reinsurance structure** – use updated cat models to structure XoL and aggregate covers effectively.

Capital Management & Risk Modelling

- **Update catastrophe models** – incorporate latest climate data into internal models for capital and solvency projections.
- **Stress and scenario testing** – evaluate solvency impact under more extreme weather scenarios.

Product Design & Customer Engagement

- **Develop innovative products** – e.g., parametric covers for cyclones, or risk prevention discounts.
- **Promote risk mitigation** – incentivise policyholders for preventive measures like cyclone-proofing buildings.

(7 marks)**Solution 8:**

- a) Tracking error
- b) Money weighted rate of return
- c) Structural risk
- d) Corporate governance
- e) Liability hedging
- f) Securitization
- g) Return on investments supporting solvency margin and free assets (0.5 mark can be given if only one of the two is mentioned)
- h) Strategic risk
- i) Discontinuance valuation
- j) Inflation & inflation risk premium

(1 mark each)
(10 marks)

Solution 9:

- Identify emerging trends early (e.g., worsening mortality, lapse spikes, expense overruns).
- Detect data or operational errors that may affect valuations or pricing.
- Improve accuracy of future assumptions through regular feedback loops.
- Support profitability analysis by understanding deviations from expected results.
- Enable timely management actions to address adverse experience.
- Ensure regulatory and internal reporting accuracy by validating key metrics.
- Enhance pricing and reserving basis by incorporating actual experience.
- Monitor the effectiveness of reinsurance or hedging strategies.
- Provide early warning of solvency or capital issues arising from adverse experience.
- Promote good governance and control as part of the actuarial control cycle.

(5 marks)**Solution 10:**

- **Clarity** – Advice should be communicated in a clear and understandable way for the intended audience.
- **Relevance** – Advice should be tailored to the specific problem and objectives of the user.
- **Materiality** – The actuary should focus attention on aspects that are material to the user's decisions and avoid overcomplicating or obscuring key issues.

- **Transparency of assumptions** – All key assumptions and methodologies used should be clearly stated.
- **Disclosure of limitations and uncertainties** – The actuary should outline the scope and any limitations of the advice.
- **Professional objectivity** – Advice should be unbiased and not influenced by conflicts of interest.
- **Appropriate for the audience** – Technical content should be adapted to the recipient's level of expertise.
- **Consistency with standards and regulations** – Comply with relevant professional guidance and legal requirements.
- **Documentation** – Maintain adequate records of data, methods, and reasoning.
- **Timeliness** – Advice should be delivered in time to support decision-making.
- **Ongoing review** – Advice should be reviewed periodically to ensure it remains appropriate as circumstances evolve.
- **Communication of uncertainty** – The actuary should clearly convey the degree of uncertainty or potential variability in outcomes to enable informed decision-making.

(5 marks)

Solution 11:

a)

1. Market efficiency

- ensuring sufficient liquidity in the market place, e.g. by having market makers
- the provision of settlement systems (to ensure that trades are carried out in an efficient and orderly way)
- imposing stock exchange requirements on listed companies

2. Consumer protection

- disclosure of information and product literature (to ensure that customers understand what they are buying)
- cooling off periods
- the initial authorisation of the main players in a particular market
- schemes to compensate investors for breaches of the regulations
- legislation preventing the use of unfair contract terms
- legislation on treating customers fairly

3. Confidence

- checking ongoing solvency (capital adequacy) of authorised providers
- enforcing strict accounting information requirements
- ensuring the competence and integrity of financial practitioners

4. Financial crime reduction

- vetting (investigating and approving) the firms authorised to conduct certain activities
- vetting the individuals authorised to conduct certain activities
- enforcing regulations
- investigating suspected breaches of regulation
- imposing sanctions if regulations have not been met

(8)

b)

- Setting benchmark for treating customers fairly
- Compensation to affected investors
- Audit review of models to see if discrimination was deliberate
- Control & disclosure of parameters to be fed into models

- Evaluation of competence of personnel involved in building the company's models
- Disclosure to stock exchange if listed company
- Educating investors about models and how they function
- Removal of unfair features of the contract

(5)

(13 marks)

- Solution 12:**
- **State modelling objectives** — clearly document aim of the model: accurate pricing, assessment of capital needs, hedging strategy, profit emergence, and sensitivities.
 - **Define output requirements** — list required outputs (e.g., best estimate PVs, risk margins, scenario P&L, capital metrics, cash-flow projections).
 - **Choose modelling approach (stochastic vs deterministic)** — use stochastic interest-rate models to capture volatility for valuation of guarantees; deterministic for baseline checks.
 - **Select appropriate stochastic model(s)** — e.g., multi-factor short-rate or market models (Hull-White, LMM) consistent with traded instruments and calibration needs.
 - **Data requirements and quality checks** — assemble and validate yield curves, historical volatilities, mortality/longevity tables, lapse and expense data; perform reconciliations.
 - **Calibration of models** — calibrate interest-rate models to market instruments (swap rates, caps/floors) and ensure goodness-of-fit; document calibration period and limitations.
 - **Projection framework** — define scenario generation, projection horizon, time step, correlation between economic drivers (rates, inflation, equities) and between market and underwriting risks.
 - **Assumptions for non-market risks** — set mortality, morbidity (if relevant), lapses, expenses, and management actions; justify levels and prudence.
 - **Discounting & valuation basis** — decide market consistent vs best-estimate discounting for different purposes (pricing vs statutory valuation) and be consistent with accounting/regulatory guidance.
 - **Treatment of guarantees & options** — model embedded options (e.g., guaranteed annuity rates, surrender options) explicitly; value with risk-neutral pricing where appropriate.
 - **Reserving and capital metrics** — define methods to derive provisions (e.g., deterministic best estimate plus margin) and capital (Pillar 1/RBC or internal model), reflecting interest-rate risk.
 - **Hedging & ALM considerations** — model hedging strategies (duration matching, swaps, swaptions) within the projection to test effectiveness and residual risks.
 - **Costs, expenses & new business strain** — model acquisition costs and new business strain; consider impacts on short-term solvency and long-term profitability.
 - **Sensitivity & scenario analysis** — run key sensitivity tests (parallel yield shifts, twist, volatility spikes) and adverse scenarios (rapid rate rises/falls) to assess robustness.
 - **Model validation and back-testing** — plan independent validation, back-testing of projections against experience, and benchmarking against simpler models.
 - **Practical constraints & implementation** — consider computational feasibility, run-time, system integration, and how results will be delivered to stakeholders.
 - **Governance, documentation & sign-off** — document model design, assumptions, limitations; obtain appropriate actuarial sign-off and Board/committee approvals.
 - **Monitoring, review & feedback loop** — set up ongoing monitoring of experience vs assumptions, re-calibration triggers and periodic reviews (control cycle: implement → monitor → refine).

(max 12 marks)
