

INSTITUTE OF ACTUARIES OF INDIA

Subject SP8 - General Insurance: Pricing

May 2026 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 examiners have given credit for any alternative approach or interpretation which they consider to be reasonable.

Solution 1:**i)**

1. Claims Outstanding reserve
2. IBNR & IBNER {Incurred but not (enough) reported claims reserves}
3. Re-opening claims reserve
4. Claims Handling expenses
5. UPR (Unexpired premium reserves)
6. PDR (Premium deficiency reserves)
7. CAT event reserves
8. Claim equalization reserves

[2]**ii)**

Sources of Funds: Initial Capital provided by promoters/shareholders (Shareholders Funds) and Premium Income (Policyholders Funds)

The capital gets used for Investments and Dividends (if any)

Premium Income gets used for paying claims, commission to intermediaries, operational expenses, reinsurance cost and for Investments (Unearned premium reserves) and dividends (if any)

Claims related reserve may further lead to generate investments income.

[6]
[8 Marks]

Solution 2:**i)**

- Redundancy of manual work as process get automated
- Increased risk of cyber security
- Risk of over-automation as models may not be trained for all scenarios (especially events not occurred in past)
- Risk of modeling or data errors
- Increased reputational risk
- Risk of increased cost as trained professionals are lesser, so operational risk

[4]**ii) Liability products-**

- Professional Indemnity - for modellers who train the machines
- Motor Third Party Liability - as cars become driver-less
- Public Liability - for any machine or modelling error

Speciality products-

- Cyber risk - for every information & transaction move to digital
- Obsolete risk - as many businesses may go bust like research report creating companies, etc.

Property products-

- Fire & other physical damage risk - to protect the infrastructure protecting the software

Financial loss-

- Unemployment insurance - As procedural jobs may be replaced by machines
- Payment protection - as more cashless transactions occur

[4]
[8 Marks]

Solution 3:**i) Regulatory framework:**

- Capital structure and holding
- Products, pricing and business risk
- Expense limits
- Reinsurance requirements
- Investments
- Customer service requirements
- Fraud Management Regulatory requirements
- Technology factors
- Corporate governance framework

Economic factors:

- Underwriting cycle
- Level of inflation
- Investment opportunities
- Currency movements
- Legal & political scenario
- Climate and environmental factors

[5]**ii)**

Proportional - Quota Share, Surplus
 Non-Proportional - Excess of Loss, Stop Loss
 Financial reinsurance
 Run - off reinsurance

[2]**iii)**

1. Capital gearing reinsurance arrangements may not be seen as insurance risk transfer mechanism.
2. Regulator may want to promote minimum level of risk sharing and added responsibility for the direct insurer.
3. Also, this is to avoid fronting business to reinsurers.

[3]**iv)**

- a) Run-off reinsurance provides ways for an insurer to transfer its future liability or volatility to a reinsurer.

There are 2 popular methods –

Adverse Development cover - where the future volatility is transferred but reserves or portfolio remains with insurer.

Loss portfolio transfer - where from a particular date complete portfolio and future liability is transferred.

- b) Motor Third Party liability or another long-tailed liability lines of business e.g. Professional indemnity, medical malpractice covers.
- c) It depends! If the expected ultimate liability of the insurer is expected to fall outside the risk appetite of the insurer, they may decide to choose this method. This can help insurer to focus on newer years of business or lines of products. Considering provided figures, adverse development cover may be more appropriate.

[6]
[16 Marks]

Solution 4:

i)

- Fair Claims Adjudication
- Fraud management
- Financial Reports preparation and Audit trail availability by system
- Various policy and claims reports to regulator e.g. claim approval TAT etc, UW decision TAT
- Seamless customer service
- Portfolio monitoring and analysis

[2]

ii) Structure:

- Different input or User Interfaces for various parts of journey like customer acquisition, channel management, policy issuance, claims management, reinsurance, etc.
- List of fields to be captured
- Unique key for each row of each table, to facilitate meaningful joins. Eg: to calculate loss ratio using premium and claims tables
- Description of each row like will single policy have a separate row or each endorsement will have a separate row

Data Quality:

- Length of each field
- Data format of each field
- Standardization masters for common fields like product name etc.
- Presence or absence of blanks
- Minimum, maximum and negative and/or positive for numeric fields
- Conditions at data input stage like can Males cant register a maternity claim

Validation and Checks:

- Data quality is being met or not
- Summary of values being transferred from 1 system to another
- Count of rows being transferred in case of multiple systems being involved

Frequency of update:

Which dataset will be refreshed real-time like new policy sold reflecting in claims system and which will be later

Compatibility with external sources of data:

- Reinsurer's system
- Vendor's systems like Network hospital or Network Garages
- Underwriting vendor like for Pre-policy check up or Risk engineers etc.

All above will be subject to cost and structural constraints

[6]
[8 Marks]

Solution 5: Creating enough size of pool for identical and independent risk along with appropriate assessment and quantification of each risk are common underwriting risk which is faced by an insurance company across all its products. Other product specific risks are as below:

1. Motor Third Party business: Court and social inflation, rates are governed by regulator/government.
2. Retail Health Indemnity Products: Medical inflation, Limited scope of underwriting on renewal, restriction on price increase e.g. for senior citizen
3. Drone Insurance: Data risk leading to pricing risk, Fraud risk as there may not exist enough specialized operators to adjudicate claims, non-availability of right reinsurance program
4. Specialized insurance: Reinsurance availability and reinsurance credit risk
5. State Crop Scheme: Regulatory risk, political risk, weather risk

[5 Marks]

Solution 6 :

- Business risk -
 - if any business is being sourced offshore, increased frequency risk or currency conversion risk
 - awareness increases in need for business, pushing up sales
 - demand for new global geographical coverage products
 - demand for including war like perils
 - higher claims expected from global risks like Marine insurance
 - increase in local inflation due to global uncertainty
 - increased exposure to aviation claims
 - high risk of Business interruption claims
 - reduced capacity available from foreign reinsurers
 - inflation pressures can be high
- Currency risk-
 - to manage global risk coverage products
 - in-case of liquidation of cross border investments
- Credit risk-
 - of cross border reinsurer or investment houses
- Investment risk-
 - local or global markets may crash
 - some investments may become illiquid

[7 Marks]

Solution 7:

i)

- Class of business
- Availability of data- Quality and Quantum
- Market condition and practices
- Regulatory conditions - constraints and pricing related regulations
- Perils covered
- Risk and Rating factors

[2]

ii)

Policy Year	Premium	Claims	Claims adj. inflation 26-27	Exposure
2022-23	100	100	146	200
2023-24	200	160	213	500
2024-25	300	300	363	800
2025-26	400	450	495	1500
Total	1,000	1,010	1,217	3,000

Loss ratio till date = till date claims / premium = 101%

Average claim per unit of exposure = total adj. claims / total exposure = $1,217/3,000 = 0.405$

Claims expected for Policy year 2026-27 = $2000 \times 0.405 = 811.33$

Premium to be charged = $811.33 / (1 - 7.5\% - 0\%) = 877.11$

[6]

iii) Yes. By ceding out 50% risk, loss ratio will be 101% and considering a direct business total variable outgo will continue to be 101% only. However, the Company will earn 5% RI Commission on 50% business i.e. 2.5% on overall business. Hence, Net Loss ratio will be 98.5%.

[4]

[12 Marks]

Solution 8:

i) Experience rating is used in portfolios where enough reliable volumes of detailed data is available, and portfolio experience is relatively stable. Though exposure-based pricing is more suitable to heterogenous risk, relatively low frequency risk and high cat-exposed properties.

[2]

ii)

- To meet business objectives of increasing market share in property product
- Some emerging risks are difficult to quantify
- The Company wants to retain certain renewal customers
- Despite lowering property premiums, at a client level the Company is still profitable via selling other products
- Reduction in premium is balanced by reducing Commission and other expenses
- Tax reduction benefits are being passed on to the customers
- Changing covers at the time of renewal business
- Cheaper reinsurance capacity available

[6]

iii)

- Applicability of the curve - type and size of risk
- Reliability of the curve - based on partially or fully credible data
- Level of development of claims used while creating these curves, adjustment of IBNR, if any
- Treatment of deductibles in the policy
- Large or Catastrophe claims adjustment use
- Reinsurance structure applicable in past years who's data is used while curve formation

[4]

[12 Marks]

Solution 9: Catastrophe models are generally stochastic model sets used to model rare low frequency and high severity perils.

Perils that can be modelled:

- Hurricane
- Tornado
- Earthquake
- Hailstorm
- Windstorm
- Floods (River or Ocean)
- Tsunami
- Pandemic
- Terrorism

Structure of Catastrophe models:

Event: Modelling probability of the peril event by using geo sciences

Hazard: Overall impact of the event, if occurred

Inventory: Study of overall exposure book of the Company

Vulnerability: Evaluation of portion of book that may be impacted by any event

Financial Analysis: Financial loss expected from that event to the Company's exposed portfolio

[6 Marks]

Solution 10: To optimize its risk appetite and use of available capital, the Company may:

Retain : all small and medium, less risky policies, where pricing is strong

Use **Non-proportionate reinsurance**: Medium or large risks where risk is moderate or high

Use **Proportionate reinsurance**: all large policies (for capacity), all high risks or all policies where pricing is weak (to share losses and diversify)

For large policies with high risk, the Company may use both proportional and non-proportional reinsurance to protect its net retained part, against large losses. In this case, its proportional treaty will be **insuring** into its non-proportional treaty like all

Each policy ceded into its proportional reinsurance will have a monetary **deductible** which will be retained by the insurer. Further, for the non-proportional treaty to trigger there will be an **Aggregate deductible** limit.

These policies may get expensive considering the large size of the insurer. So, it may be cheaper to add a **usage clause or re-instatement** clause in the treaty. The Company may purchase a smaller cover in the beginning with a re-instatement clause which will trigger once the earlier layer of cover will get utilized.

In high inflation environment for long tail policies like liability, there may be **indexation clauses** added to the treaty limits to ensure adequate cover is in place. For example: a claim in current year may give the Company 50% recovery if settled in current year but may only give 25% if settled after 5 years; but with indexation clause both deductible and limits may be indexed to ensure same cover irrespective of year of settlement

For contracts where the level of volatility basis is high, the reinsurer may protect itself by requiring a minimum level of profitability. For example: if the Company has hired a new Underwriting policy, whose credibility in the market is unknown, the reinsurer may like to protect itself by entering into a **swing-rated contract** i.e. if the loss ratio is between 90 to 120%, the RI commission paid will be 10%; if lower than flat 15% and if higher than that then 0%

Lastly, all contracts may be loss ratio caps i.e. overall the property portfolio will be protected only till its overall loss ratio is 110% and if higher, cover of all reinsurance treaties may cease.

[10 Marks]

Solution 11:

- i) Classification models & Regression models are the 2 types of Supervised Machine Learning models.
 Classification models can be used when variables are binary or discrete in nature like Gender etc.
 Regression models can be used when variables are continuous in form like relation of Height & weight.

[3]

- ii) Using all the above data, burn cost for each risk cohort is as below:

Risk cohort	Frequency = Base frequency * Claim count relativity	Severity = Base severity * Claim amount relativity	Burning cost = Frequency * Severity
Sedan upto 5 yrs	=25%*1.00 = 25%	=35,000*0.9 = 31,500	=25%*31,500=7,875
SUV upto 5 yrs	26.25%	35,000	9,187.5
Sedan 6-10 yrs	30%	42,000	12,600
SUV 6-10 yrs	32.5%	52,500	17,062.5

[5]

[8 Marks]
