

Institute of Actuaries of India

Subject SP7 – General Insurance Reserving and Capital Modeling

December 2022 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:

i)

U/w (Cession pattern)			
EAR Policy for Total Sum Insured of INR 2450 crs.			
PML @ 35% = INR 857.5 crs.			
Cession pattern		Cession on PML basis	U/W Cession
Obligatory	5%	INR 42.875 crs.	5.00%
Net Retention	INR 200 crs. (PML)	INR 200 crs.	23.32%
IGT	INR 240 crs. (PML)	INR 240 crs.	27.99%
Surplus Treaty	INR 300 crs. (PML)	INR 300 crs.	34.99%
Facultative	Balance	INR 74.625 crs.	8.70%
Total	100%	INR 857.5 crs.	100.00%

[1 mark each for the relevant cession, **Max 5**]

ii), iii) & iv)

Claim apportionment & Recovery from RI protection		
Recovery pattern	Apportionment of Claim 1 of INR 62 crs.	Apportionment of Claim 2 of INR 890 crs.
Obligatory	INR 3.1 crs.	INR 44.5 crs.
Net Retention	INR 14.4 crs.	INR 200 crs.
IGT	INR 17.4 crs.	INR 240 crs.
Surplus Treaty	INR 21.7 crs.	INR 300 crs.
Facultative	INR 5.4 crs.	INR 74.625 crs.
Total	INR 62 crs.	INR 859.125 crs.
Recovery from XL & Surplus Treaty	INR 21.7 crs.	INR 300 crs.
Net to Insurer	INR 14.4 crs.	INR 230.875 crs.

[3.5 and 3.5 marks for each claim upto Facultative, **Max 7**][1.5 mark for each claim for Surplus recovery, **Max 3**][1 mark for each claim for Net to Insurer, **Max 2**]**[17 Marks]****Solution 2:**

Revenue Account		
	FY 2021-22	FY 2022-23
Written Premium	200	200
Earned Premium	200	200
Incurred claim	130	220
PDR	0	10
Expenses and Commission	40	40
Underwriting result	30	-70
Investment income	40	40

Insurance Result	70	-30

[1 mark for each of the item, Max 8 marks]

Retained profit is difference between shareholders' funds at the start and end of the year. This leaves asset as balancing item for FY 2022-23

Balance Sheet		
	FY 2021-22	FY 2022-23
Assets	400	380
UPR	100	110
Outstanding	200	200
Shareholder fund	100	70

Assumptions:

- Outstanding claims is inclusive of IBNR
- PDR created for each year is minimum of zero

[Max 5 marks]

[13 Marks]

Solution 3:

i) The principal aims of regulation are to:

- correct market inefficiencies and promote efficient and orderly markets
- protect consumers of financial products
- maintain confidence in the financial system
- help reduce financial crime.

[0.5 marks for each point, **Max 2]**

ii) prescriptive rules

+ it should be less open to abuse than the alternatives and may command a higher degree of public confidence.

- outsiders may impose rules that are unnecessarily costly and may not achieve the desired aim.
- Existing regulatory structures are often slow to adapt to changing societal and economic circumstances.
- Many national regulatory systems are complex and fragmented, with various responsible agencies exercising overlapping authority.
- regulators struggle to keep up with the rapidly growing technology
- It is difficult for regulators to keep pace with fintech and other innovations in the industry
- Rapid adaptation to emerging technology, therefore, poses significant hurdles, where change occurs at a rapid rate.
- regulations provide criteria or checklists, making it easier for regulators to follow and reduce their accountability later on.

[0.5 marks for each relevant point, Max 4]

principles- based approach

- + may be a more effective way to foster innovation.
- + the reduced cost of regulation
- + the focus of regulation shifts from inputs to outcomes, the way government intervenes in markets changes. This shift can create operational efficiencies for regulators and greater freedom for innovators.
- + Gives insurers significant flexibility to quickly react to current events and meet their business objectives, while delivering the outcomes required by regulators.

- + Consumers benefit from a more innovative insurance industry that can rapidly respond as standards of care change and technology advances over time.
- + Regulators and state governments benefit from innovative solutions that reduce the financial strain of underinsured populations, and mitigate consumer risk.
- + Potential to help insurers and regulators widen the reach of insurance services to protect the health and livelihoods of under-served, low-- income populations.
- + Rather than using traditional producers for sales, products might be sold by mobile network operators, pawnbrokers, churches, retailers, and other entities that are easily accessible for uninsured or underinsured populations.
- Principles-based regulation can be ambiguous and open to interpretation, which can create uncertainty for insurers as to whether they are complying with the law.
- bad actors might take advantage of the flexibility for their own personal gain.
- Senior management will be responsible for self-policing and will be held accountable by regulators if consumers are harmed by actions taken by the insurer or its agents. This approach will require even more self-policing to protect consumers and the company's reputation.

[0.5 marks for each relevant point, Max 6 marks]

[12 Marks]

Solution 4:

Analysis need to be done separately for OD and TP

- Segment wise – Private car, passenger carrying wise, two-wheeler & Commercial Vehicle [1 mark]

Business mix, one way, two way and multivariate experience analysis need to be done with following factors:

Private Car - Sedan, Sport, mini, Hatchback

Passenger Carrying - Seating Capacity

Goods Carrying – Gross Vehicle Weight

[1 mark]

Experience analysis of Common Rating Factors which are generally captured: Company might be charging same rate without differentiating but they behave differently

- Retail Vs Tie Up business
- New Vs Renewal
- Renewal of policy with Claim Vs No claim
- Diesel and Petrol
- Distribution network wise – Agent, broker, aggregator, online and direct
- Sum Insured
- Different Zone
- Rural Vs Urban
- Year of Manufacture
- Make and Model
- Standalone Vs Package policies
- Cashless Vs Reimbursement claims

[0.5 marks for each, Max 3 marks]

Other Analysis

Competitor Analysis – Premium rate comparison, type and area in which business written, their declined business list

Frequency & Severity trend quarterly and if possible, comparison with competitors

Add- on available with company and in Market and their experience analysis

Fraud, Anti Selection

Claim process and management

Underwriting Matrix

Underwriting and other discount Matrix

[0.5 marks for each, Max 3 marks]

[8 Marks]

Solution 5:**i) Impact on different lines of business (**

Motor-

- rising global temperatures leading to severe storms, floods and increasing losses esp since high populated country. Large losses on motor fleet, commercial and private motor vehicles
- claims due to damage including total loss of vehicles, death or injury of driver [Max 2 marks]

Liability-

- Unexpected climatic conditions leading to widespread claims for
 - employer's liability-liability due to injury or death of employer due to destruction of workplace
 - motor third party liability- liability arising due to destruction of motor vehicles
 - marine and aviation liability- legal liability to compensate third parties for damage arising due to destruction of vessel or aircraft. [Max 2 marks]

Business interruption-

- storms, floods, fires will affect turnover. financial consequences due to loss of premises, hit of production lines, income loss from customers
- compensate for rebuilding premises, restarting production facilities, building the required turnover, loss of profit, additional temporary costs. [Max 2 marks]

Trade credit-

- economy as a whole impacted hence the risk that debtors will not pay their obligations
- claim payments of lump sum including the interest payments to be made by the company

Correlations b/w different classes leading to larger claims.

[Max 2 marks]

[8 Marks]

ii) Challenges faced

- climate risk and its impact not well-understood.
- Existing model or new model to be used.
- Data and assumptions needed for this- level of detail required
- Whether the expertise to build a model is available
- How results will be checked [0.5 marks for each relevant point, **Max 2**]

iii) Stages involved in building capital model for climate risk (15)

Design

- Apt to purpose – modelling the capital required for climate risk
- Allow for constraints- eg imposed by regulator
- Consider the intended use of the model [Max 1 mark]

Build

While building new model, consider:

- Collection of required data- right balance of relevance and credibility
- Type of scenarios to develop and model- eg- impact of different lines of business
- Decide which variables to include and inter-relationships
- Purpose of model
- Accuracy
- No. of times model to be used
- Desired flexibility
- Cost of building and running the model

- Time needed/available for model to run
- Time needed/available to review and test model

[0.5 marks for each point, Max 4 marks]

Test

Testing the model to ensure it is fit for the purpose it is being used for [1 mark]

Parameterisation

Parameters and assumptions apt to:

- Business being modelled- the different classes written by company
- Risk appetite of insurer
- External environment of Country A in which insurer is based
- Time period to which capital model applies [0.5 marks for each point, Max 2 marks]

Documentation

- Depending on intended use. Eg- requirements of the regulator
- Key impacts identified and modelled aptly
- Key assumptions and approximations made are understood and can be communicated, so that it can be run by other members of the staff and improvements introduced over time.

[Max 2 marks]

Validation

- To give confidence that results are correct, helpful to compare results with alternative method of risk and capital assessment, such as deterministic stress and scenario tests on key assumptions
- Important to check the results such that they make sense in the real world to ensure that the model is not giving spurious accuracy [Max 2 marks]

Recalibration

If any part of validation stage highlighted any issue, address by altering parameters, distribution functions or even model structure. [Max 1 marks]

Monitoring

- Monitor actual experience regularly and compare with assumptions used to ensure understanding of any material deviations so that model/assumptions can be improved as required [Max 1 marks]

Development

- Process should be a cycle of cont. improvement and enhancement to ensure model keeps pace with business needs, regulatory reqts., industry best practice. [Max 1 marks]

[15 Marks]

[25 Marks]

Solution 6:

i) After applying liner interpolation, triangle obtained is- [7 marks]

u/w year	Cumulative claims paid as at				
	1	2	3	4	5

2017	2108	2926	3789	3942	4070
2018	1807	3187	3749	4789	
2019	1789	4189	4980		
2020	2431	3789			
2021	2890				

Dev factors

[3 marks]

df	1.73	1.22	1.16	1.03	1.00
Cumulative df	2.52	1.45	1.20	1.03	1.00

u/w yr	ultimate	Future
2017	4,070	-
2018	4,945	156
2019	5,955	975
2020	5,506	1,717
2021	7,274	4,384
Total		7232

Diagnostics and Revaluation

[3 marks]

u/w year	1-2	2-3	3-4	4-5
2017	1.388046	1.294942	1.04038	1.032471
2018	1.763697	1.176341	1.277407	
2019	2.341532	1.188828		
2020	1.558618			

The 1-2 factor for u/w year 2019 seems on a higher side and one-off factor. The dev factors are recalculated after removing it.

Dev factors

df	1.56	1.22	1.16	1.03	1.00
Cumulative df	2.27	1.45	1.20	1.03	1.00

u/w yr	ultimate	Future
2017	4,070	-
2018	4,945	156
2019	5,955	975
2020	5,506	1,717
2021	6,553	3,663
Total		6,510

Assumptions

[2 marks]

- Linear interpolation used as best way to adjust for missing data
- No tail factor used. 1.03 is small, which might suggest evidence of small tail factor/no tail factor to be used

[15 marks]**ii) Changes to data and approach**

- Data issues- data quality enhancement so that it is available at every qtr or at date where analysis is being carried out. Quantity of data to be increased to allow for better estimation
- Claim dev period- better data quality can allow for quarterly triangles. Seasonal effect considered for lines of business where there can be possible impact
- Type of claims data- projection using both paid and incurred data should be used. Paid data can be sparse as some claims take longer to settle, volatile if in one year no payments made. Incurred allows for case reserving.
- Type of cohort- projections using both u/w and accident period cohorts. Accident period cohorts can be better to understand seasonality, same exposure thus same risk environment. Aligned easily to a/c period.
- Separate treatment of attritional, large and cat claims
- Tail factor to be estimated for lines where available data not enough to project ultimate claims
- Inflation adjusted CLM can be used.

[1 mark for each relevant point, **Max 5**]**iii)**

- Accounting rules may influence the basis, such as the level of prudence and detail required for filing.
- Timescales required for reporting results may influence the trade-off between rigour and time taken.
- Auditors- level of scrutiny (e.g. by auditors) may influence the level of rigour, such as the number of cross-checks using different estimation methods.
- Trading conditions in relevant industries may influence the level of IBNR in anticipation of changes in claims activity.
- Market rates of return will affect the discount rate.
- Tax rules may impact the extent of discounting and margins or prudence.
- Regulations for demonstrating solvency may prescribe a basis and method.
- Professional guidance is likely to influence the methods and documentation used. Some methods such as BF may make allowance for position in underwriting cycle
- Competition - for consistent comparison
- Trends in data because of the recession/propensity to claim

- Reinsurance - type of reinsurance and the conditions prevailing

[0.5 mark for each relevant point, **Max 5]**

[25 Marks]
