

Institute of Actuaries of India

Subject ST3 – General Insurance

October/November 2007 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.

Q. 1

- (i) premium rating structure does not reflect the correct cost of the insured risk.
- (ii) this may result in adverse selection
- (iii) the office premium may be too low
- (iv) expense allowance may be too lowbusiness volume lower than expected.
- (v) volatile profits due to competition
- (vi) poor policy wording leading to unanticipated claims
- (vii) appropriate measures required to avoid Moral hazard
- (viii) the insured risk profile may not be even over the whole policy duration.
- (ix) the claims cost may be greater than expected - adverse claim fluctuation
- (x) claims cost or the frequency may be different than expected
- (xi) there may be concentration of risk
- (xii) unnecessary accumulation of risk by geography
- (xiii) risk of insolvency - due to under reserving
- (xiv) incorrect recording of data - accurate data is vital for correct calculation of premium and reserves
- (xv) higher inflation than anticipated pose minor risk - for short tailed ; however, it could have a major impact on the long tail business liabilities
- (xvi) poor performing, mismatching or illiquid investment may pose a considerable risk
- (xvii) risk of investment default
- (xviii) Catastrophes represents a considerable area of uncertainty.
- (xix) inappropriate or insufficient level of reinsurance
- (xx) third party default
- (xxi) exposure to risk from political and legal changes/ any precedents

[10]**Q. 2** EML is the expected or estimated maximum loss. ...

- i)** the largest loss expected to arise from a single event in respect of an insured property which may be less than the market value of the property.

This is used as an exposure measure in rating certain classes, including, reinsurance.

- ii)** $R * (1+N)$

- iii)** 100m of the EML is split as follows:

A	B	C
50	20	30

The claim is 90 m.

A will pay an amount equal to 50 m

B will pay an amount equal to $\{ 20/(20+30) \} * [90 - 50] = 16m$

C will pay the balance equal to $90-50-16 = 24m$

iv) Stop Loss cover:

- An aggregate excess of loss reinsurance that provides protection based on the total claims ... from all perils... arising in a class or class over a period.
- The excess point and upper limits are often expressed as a percentage of the cedant's premium income rather than the monetary terms e.g.... the cover might be for a claim ratio in excess of 110% up to a limit of 140%.
- It is common for the cedant to be required to retain a proportion of the risk (called coinsurance proportion) in the reinsured layer, to reduce the moral hazard.

Reinsurance cos. are not often prepared to offer Stop Loss cover because:

- reinsurer has limited control over the underwriting and claims payment made
- historically the business has been loss making.

[10]

Q. 3 Main rating factors that may be used for pricing personal motor insurance:

- i)**
- (i) Excess
 - (ii) Cover
 - (iii) Vehicle use
 - (iv) vehicle age
 - (v) stated miles
 - (vi) driver address
 - (vii) driver occupation
 - (viii) claim record / NCD
 - (ix) years since test passed
 - (x) gender of main driver
 - (xi) marital status
 - (xii) additional drivers
 - (xiii) age of the main driver
 - (xiv) driving restricted to main drivers
 - (xv) make and model of the vehicle
 - (xvi) not in use location - garaged
 - (xvii) parked on or off the street
 - (xviii) security features
 - (xix) any modifications
 - (xx) convictions / endorsement to the license

ii) Four risk factors not normally used in pricing :

#	Risk factors not used	Rating factors used
1	Traffic density at the places where card is driven	Kept location
2	Drivers ability	<ul style="list-style-type: none"> ✓ Claims record ✓ age ✓ sex ✓ occupation
3	Theft risk	<ul style="list-style-type: none"> ✓ Driver's address ✓ not in use location ✓ make and model
4	Actual mileage	Stated mileage

iii) Why the rating factors are used in preference to the corresponding risk factors.

The rating factors are used rather than risk factors as they are capable of being objectively measurable. In the cases in (ii) above the risk factors can not be rating factors as they are not objectively measurable and hence alternative rating factors are used.

[8]

Q. 4 i)

Policy holders advantages	Policy Holder disadvantages
<ul style="list-style-type: none"> ▪ only pay for the cover as needed ▪ potentially lower annual cost ▪ good if drive infrequent long distance 	<ul style="list-style-type: none"> ▪ may not want/ be able to give 24 hr notice ▪ illegally driving without insurance cover if forget to arrange insurance ▪ may not include theft / fire damage when not insured ▪ no other drivers allowed ▪ daily cover may seem expensive ▪ above a certain nos. of days the cost will go above that of a standard policy.
Insurance company advantages	Insurance company disadvantages
<ul style="list-style-type: none"> ▪ potential to penetrate the niche market ▪ could make affinity group deals ▪ gain additional rating data for low mileage drivers ▪ possibility of applying rate changes during the year 	<ul style="list-style-type: none"> ▪ additional cost of administration ▪ high start up cost if used technology like e-mail or text message and lower ongoing cost ▪ computer system may not be able to hold all the data required ▪ possible dispute over cover if crash occurred when not covered ▪ covers runs for 24 hours , so need to record time and date of cover ▪ more fraudulent claims / increased moral hazard ▪ tendency to increase mileage on the days insured.

ii) Issues in rating such a policy:

- none of the data owned by co may be useful, so need to buy data or run a pilot
- no data on the nos. of days low mileage drivers use their cars
- ... so daily rate in not known with certainty
- people identifying themselves as low mileage drivers may be high/medium mileage so current data may not be reliable
- the expenses and the admin cost will not be known with certainty

iii) Four data items collected for this policy, which is usually not collected for standard policy:

- collect individual dates of cover - to collect true exposure period
- If phone data collection then - could ask about planned driving times and location and collect additional data e.g. mileage
- bank detail required - for deducting the daily charges - it could be different from used in past

Passwords etc may be needed - to verify the identity of the caller - this is more important than the standard annual policy as more frequently used.

[14]

Q. 5 i) ways to increase the gross premium

- Charge higher premium for the same exposure
- Take more exposure:
 - By reducing the premium where elasticity of demand is greater than 1.
 - By expanding into new class of business (including inward reinsurance and coinsurance)
 - By expanding into new areas of risk within existing class
 - By writing larger risks into within existing classes
 - By development in new countries
 - By acquiring another insurance companies
- expand into new distribution channel e.g direct marketing, internet
- increasing advertisement, marketing and customer services
- incentive for customers e.g. alarm clock, pen etc.
- increase sales force
- increase commission level offered to agents/ brokers
- increase capital in order to obtain higher credit rating which is more attractive to potential clients.

ii) Constraints:

- Level of free reserves ... if it grow too much it may not have enough capital to support its business
- competition from other insurers ... reduced market share if it increase premiums too much.
- regulatory constraints ... on the
 - Premium it may charge
 - require authorisation ...line of business and in which countries
 - which distribution channel can be used
 - minimum solvency ratio
- may not have expertise to write new classes of business
- it may not have staff/ infrastructure to expand quickly
- acquisition of another company may be too expensive
- expanding into new distribution channel may alienate existing distribution channel
- Brokers may resist reduced premium as it may mean reduced brokerage
- Company's reputation may inhibit growth.
- Cash flow problem
- New sales force may be costly / difficult to recruit

iii) Soft market:

- The soft market caused by over-supply of insurance capacity in certain products.
- It's a term that describe the part of the insurance cycle when the business is less profitable.
- i.e inadequate premium being paid for the amount of risk assumed
- The longevity and the dept of market softness results from the true effects of
 - Claim inflation

- broadening wordings cover
- and increases in exposure
being underestimated at the time of writing the business
- This may persist because premium increases lag behind the claims notifications.

iv) Risks:

- writing larger proportion of unprofitable business than planned leading to overstatement of profit and understatement of reserves
- managers not aware of true financial conditions
- leading to bad business decisions
- risk of writing larger volume of business than planned and not being able to serve it
- there is a risk that the true profitability of business is known for some time
- .. and company write business at less profitable rates than it expects
- This may lead to a significant weakening of the Financial Condition of the company
- When the extent of this position is realized reserve must be increased leading to reduced solvency position
- this would require additional capital support and/or remedial action
- The reduced solvency may directly impact the ability of the company to write the quantity profitable new business
- In some cases this may lead to the insolvency of the company.

[20]

- Q. 6 i)** Gross Loss ratio = The ratio of the cost to claims to premiums, both gross of reinsurance
 Net Loss ratio = The ratio of cost of claims to premium, both net of reinsurance
 can be on earned basis or written basis
 Expense ratio = Ratio of management expenses plus commission to premium
 Combined Ratio = The sum of loss ratio (claim ratio) and expense ratio
 Solvency Ratio = The free reserves divided by the net (of reinsurance) written premium

ii)

	2002	2003	2004	2005	2006	Total
Gross Loss Ratio	44.4%	72.0%	112.1%	150.8%	67.3%	96.9%
Net Loss Ratio	51.9%	38.5%	65.9%	119.3%	93.1%	81.6%
Expense Ratio	23.2%	21.5%	23.5%	26.2%	21.2%	23.2%
Combined Ratio	75.1%	60.0%	89.4%	145.5%	114.3%	104.8%
Solvency Ratio	98.8%	61.5%	108.7%	120.0%	84.3%	95.9%

iii) a) The efficiency of the management in controlling the expenses

	2002	2003	2004	2005	2006
Management Expense ratio	8.1%	5.6%	6.4%	8.5%	5.2%
Expense ratio	23.2%	21.5%	23.5%	26.2%	21.2%

The management expenses increased dramatically as the business expanded in 2004 and 2005. The management expenses were again brought under control in 2006. Similarly expense ratio increased dramatically in 2005.

b) Growth

	2003	2004	2005	2006
GEP Growth	8.1%	162.6%	-11.7%	33.1%
NEP growth	-3.7%	61.5%	11.1%	54.3%

The growth in the Gross earned premium in 2004 is dramatic. Similarly 33% growth in 2006 is big.

Large changes like this may have resulted from an acquisition of another company.

Net premium change is less volatile than the gross premium change.

The large increase in NEP in 2006 is due to reduction in reinsurance purchasing as a percentage of gross income.

c) Reinsurance purchasing

	2002	2003	2004	2005	2006
Premium ceded %	18.2%	26.8%	55.1%	43.6%	34.5%
RI Cost=RI Premium- RI recoveries	11.0	-12.0	-52.0	-66.0	62.0
RI Lost ratio	11%	162%	150%	192%	18%

Reinsurance Loss ratio and the recoveries were low when the company was small.

Ceded Premium have increased significantly with the growth in the gross premium.

Reinsurance spending has been very effective over the period with recoveries exceeding the reinsurance premium paid.

d) Underwriting profitability:

	2002	2003	2004	2005	2006
Net Underwriting profit	16	25	-22	-92	-55

Net UW profits in the last three years have been negative.

Although, negative, the UW profits have improved in 2006.

iv) Comments :

- After a period of rapid growth it would be sensible for the company to consolidate.
- Expenses have been reduced dramatically in the last year and these need to be kept low - in fact reducing them if possible.
- Reinsurance purchasing has been reduced - probably prices have risen due to high level of reinsurance recoveries in middle years.
- A cost benefit analysis of reinsurance spending should be performed.

Efforts should be put into gross and net underwriting profit.

[20]

Q. 7 i) The probability of ruin is approximately given by $\text{Exp}(-RU)$ where

where U = capital required

R = adjustment coefficient = $\alpha - \lambda / c = \alpha \theta / (1 + \theta)$

μ = 1 million

$\alpha = 1 / \mu = 1$

$\theta = 1 / 0.6 - 1 = 0.6667$

$R = 1 * 0.6667 / (1 + 0.6667) = 0.4$

Probability of ruin = $\text{Exp}(-0.4 * U) < 0.5\%$

$0.4 * U < \ln(0.5\%)$

$$0.4 * U < -5.2983$$

$$U > 13.25$$

i.e. the capital required is greater than 13.25 m.

ii) return on capital = $0.2 * 0.6667 / 13.25 = 1\%$

[8]

Q. 8 i) why reported claims at the end of year 2 might exceed the ultimate claims

- ✓ Claims made which end up as nil claims
- ✓ e.g. the claims made which falls outside the coverage of the policies
- ✓ Claim assessment cautious which leads to overstatement of outstanding reserves
- ✓ Reported claims do not allow for salvage or subrogation which reduces the ultimate claims.

- ii) Premium 100
 Initial estimate LR 100%
 Actual LR 120%
 Assumptions: All written premiums become earned
 Claims run off according to the expected pattern

End of Year	1	2	3
Paid	30%	90%	100%
Reported	50%	105%	100%
Dev ratio	2.10	0.952	1.00
Cum f	2.00	0.952	1.00
1- 1/ Cum f	0.5	- 0.05	0
Reported Claims	60	126	120
Claim reserves	50	- 5	0
Estimated UL Claims	110	121	120
Actual Ultimate Claims	120	120	120
Over statement of profit	10		

[2 for correct answer of Claim reserves Ult]

[1 for correct answer of estimated Ult. Claims]

- End of year 1 profit calculated 10 is too big.
- Year 2, Ultimate claims estimates deteriorates by 11 overestimated by 1. (from 110 to 121)
- Year 3, the difference is 0.

[10]
