

INSTITUTE OF ACTUARIES OF INDIA

EXAMINATIONS

22nd May 2014

Subject ST7 – General Insurance: Reserving & Capital Modeling

Time allowed: Three Hours (14.45* – 18.00 Hrs)

Total Marks: 100

INSTRUCTIONS TO THE CANDIDATES

1. *Please read the instructions on the front page of answer booklet and instructions to examinees sent along with hall ticket carefully and follow without exception.*
2. ** You have 15 minutes at the start of the examination in which you are required to read the questions. You are strongly encouraged to use this time for reading only, but notes may be made. You have then three hours to complete the paper.*
3. *You must not start writing your answers in the answer sheet unless instructed to do so by the supervisor.*
4. *The answers are not expected to be any country or jurisdiction specific. However, if Examples/illustrations are required for any answer, the country or jurisdiction from which they are drawn should be mentioned.*
5. *Attempt all questions, beginning your answer to each question on a separate sheet.*
6. *Mark allocations are shown in brackets.*
7. *Please check if you have received complete Question paper and no page is missing. If so, kindly get a new set of Question paper from the Invigilator.*

AT THE END OF THE EXAMINATION

Please return your answer book and this question paper to the supervisor separately.

Q. 1) Give reasons for correlations between different lines of business and describe how allowance can be made for correlations within a stochastic model. [6]

Q. 2) You are the consulting actuary of a large consulting company and have been engaged to advise a medium size insurer on its reinsurance programme. The CEO of the company has raised the following concerns to you:

- i) Underwriting results are less predictable than what the CEO would like
- ii) Rapid growth of company has caused the premium to surplus ratio to become too high
- iii) Company is writing higher policy limits than it has in past
- iv) Company has begun writing a new product that could produce very volatile loss ratios

Outline the reinsurance program you would recommend to address each concern identifying the type of reinsurance used, its advantages & disadvantages, and how or why it would address CEO's concerns. [8]

Q. 3) A catastrophic event triggers the following losses under an insurer's commercial multi-peril policies (CMP) policies (all amounts in INR million):

CMP Liability			CMP Property	
Loss No.	Policy Limit	Loss Amount	Loss No.	Loss Amount
1	10	10	1	60
2	45	22.5	2	300
3	150	75	3	75
			All Others	3,000

All others are CMP property losses less than INR 100 million per loss.

Three RI programmes are in place:

- A two line surplus treaty covering CMP liability with a minimum line of INR 30 million
- A property per occurrence XL treaty covering CMP property for INR 300 million excess INR 100 million per loss
- A CAT treaty covering CMP for INR 3,000 million XS 100 million per CAT with a 10% coinsurance clause.

Assuming the surplus treaty and property per occurrence XOL treaties pay before CAT treaty triggers, calculate the loss retained by primary insurer. [5]

Q. 4) You have joined an insurance company specializing in warranty insurance as an actuary. Your company has just issued a four year warranty policy for a premium of Rs. 300,000 on 1st April 2013. The manufacturer of the product covered by warranty has some data that indicates that the chance of product failure each year is 100% higher than the previous year.

- i) Estimate the unearned premium reserve from this contract as at 31st March 2014 applying the principles of premium earning for uneven risk spread. (2)

- ii) Describe the purpose of AURR, also known as Premium Deficiency Reserve in India? (1)
- iii) From a similar contract of another manufactures of similar products, the company had a loss ratio of 97.5%. The marginal expenses of the company related to run off of UPR is estimated at 10% of UPR and the fixed and general overhead expense ratio of the company is 27.5%. There was a claim reported under the policy on 31st Dec 2013 for an amount of Rs. 50,000 which is unpaid. Calculate the Premium Deficiency reserve of the company as at 31st March 2014. (3)

[6]

Q. 5) You are given the following data for a line of business of an insurance company:

Accident Year	Cumulative Incurred Losses (Amounts in '000)				
	Age of Development in Months				
	12	24	36	48	60
2008-09	18,330	20,170	22,000	22,500	22,500
2009-10	20,170	22,180	24,230	24,760	
2010-11	22,180	24,400	26,620		
2011-12	26,840	28,310			
2012-13	29,540				

Accident Year	Case Reserves (Amounts in '000)				
	Age of Development in Months				
	12	24	36	48	60
2008-09	7,330	4,170	4,000	3,000	-
2009-10	8,070	4,580	4,420	3,300	
2010-11	8,870	5,040	4,840		
2011-12	12,200	7,010			
2012-13	13,430				

Accident Year	Cumulative Reported Claims				
	Age of Development in Months				
	12	24	36	48	60
2008-09	130	160	163	163	163
2009-10	130	160	163	163	
2010-11	130	160	163		
2011-12	130	160			
2012-13	130				

Accident Year	Cumulative Closed Claims				
	Age of Development in Months				
	12	24	36	48	60
2008-09	100	140	153	160	163
2009-10	100	140	153	160	
2010-11	100	140	153		
2011-12	100	140			
2012-13	100				

- i) Calculate the total IBNR for the company as of 31st March 2013. (2)
- ii) Using the calculations in (a) above, calculate the expected IBNR emergence for accident year 2012-13 case incurred loss during calendar year 2013-14 (1)
- iii) Explain why the IBNR estimate in part (a) above may not be appropriate? Justify your answer using the diagnostics calculated from the data provided (5)

[8]

Q. 6) Following information is provided about a direct insurance company as at 31st March 2014:

<i>Amounts in INR Million</i>	
Gross Written Premium(GWP)	10000
GWP last year	8000
Retention (both years)	60%
# Risks written	1500000
# Risks written last year	1200000
Claim freq	20%
Claims Severity	0.02
Increase in priors years' claims liability	500
Commission Paid Ratio	15%
Reinsurance Ceding commission	25%
Management exp	15% of GWP
Investment income	1,000
Tax provision @	30% of profit

Assume the following:

- DAC is not allowed by local regulations
- Claims frequency and severity are for the accident year 2013-14 and are gross of reinsurance
- Risks are written uniformly through the year

- i) Prepare the company's P&L statement for the year 2013-14. (5)
- ii) Calculate company's:
- a) Net Loss ratio
- b) Combined Operating ratio (2)

Clearly state any assumptions you make. [7]

- Q. 7)** i) Assume that the unpaid liabilities and the claims from future premiums are normally distributed. The mean for unpaid liabilities is 100 and the mean for liabilities from future business is 50. The coefficient of variation for unpaid liabilities is 20% and it is 10% for future liabilities. The correlation between unpaid liabilities and future liabilities is 0.30. The z-value for 95th percentile of standard normal distribution is 1.65.

What is the capital requirement at 95% level for reserving risk and underwriting risk combined? (3)

- ii) A company has recently completed 5 years of operation with consistently high growth rates in business during this period. The company predominantly writes motor insurance. How could the correlation between reserving risk and underwriting risk vary between Third-Party Liability and Own Damage section? (4)

[7]

Q. 8) You have recently joined a medium sized direct general insurance company as an investment actuary. CEO of the company has mandated you to invest *all* funds of the company to optimize investment returns.

- i) Discuss which funds of the company could be non-investible. Also discuss what factors could influence the size of such non-investible funds for the company (3)

- ii) Discuss how regulatory constraints and external factors can influence the company's investment strategy? (6)

[9]

Q. 9) The traditional actuarial view of reserve risk looks at the uncertainty in the outstanding liabilities over their lifetime (the 'Ultimate View'). Under the 'One-Year View' of reserve risk, the uncertainty in the outstanding over the one year time horizon is considered.

- i) In the following example, calculate the coefficient of variation of unpaid liabilities at the end of Year 0 from both 'One-Year View' and 'Ultimate View': (4)

Scenario	Probability	Initial Case OS	Initial IBNR	Paid during Year 1	Case OS at end of Year 1	IBNR at end of Year 1
1	1/9	40	42	9	35	42
2	1/9	40	50	10	40	40
3	1/9	40	58	11	45	38
4	1/9	40	52	18	42	36
5	1/9	40	60	20	40	40
6	1/9	40	68	22	45	37
7	1/9	40	60	27	45	33
8	1/9	40	70	30	48	32
9	1/9	40	80	33	50	32

- ii) Briefly describe how the estimation of one-year reserve risk differs from the estimation of reserve risk as per the ultimate view. (3)

- iii) How could the impact on capital for reserve risk vary between short-tailed and long-tailed lines when moving from the 'Ultimate View' to 'One-Year View'? (3)

[10]

- Q. 10)** A company wants to perform a comprehensive analysis to model the claims severity for its Motor Own Damage business.
- i) List down the details of the data required for this exercise. (3)
 - ii) Explain briefly the methodology of the exercise after the required data is obtained. (4)
 - iii) How could the claims severities possibly vary by NCB level, every other attribute remaining the same? Ignore any possible differences due to varying depreciation levels. (2)
- [9]**
- Q. 11)** Weather Index based Crop Insurance responds to an objective parameter at a defined weather station during an agreed time period. The underlying index is designed to be a sound proxy for loss based upon an objective measure (for example, rainfall, wind speed, temperature) that exhibits a strong correlation with the crop yield. Typical features are:
- A specific meteorological station is named as the reference station.
 - A trigger weather measurement is set (e.g. cumulative millimetres [mm] of rainfall), at which the contract starts to pay out.
 - A lump sum or an incremental payment is made (e.g. a specified amount per mm of rainfall above or below the trigger).
 - A limit of the measured parameter is set (e.g. cumulative rainfall), at which a maximum payment is made.
 - The period of insurance is stated in the contract and coincides with the crop growth period; it may be divided into phases (typically three), with each phase having its own trigger, increment and limit.
- i) Briefly describe any five major advantages of this product. (5)
 - ii) Describe briefly the types of basis risk within this product. (4)
 - iii) Discuss briefly any other major disadvantages of this product apart from basis risk. (4)
- [13]**
- Q. 12)**
- i) Describe briefly an 'Underwriting Cycle'. (3)
 - ii) Describe briefly how could a simplistic capital regime, in which the capital required to write business depends on the premiums, fail to achieve its desired objective during:
 - a) Hard-market period of an UW cycle, and
 - b) Soft-market period of an UW cycle. (3)
 - iii) In the above scenario, explain how the effectiveness of the capital regime could improve if the capital requirements can be modified if the claims were very high in the prior years? (3)
 - iv) Describe briefly the three main considerations in taking Underwriting Cycle into account, with respect to modelling of Reserving Risk and Underwriting Risk (3)

[12]
