

INSTITUTE OF ACTUARIES OF INDIA

EXAMINATIONS

28th May, 2012

Subject SA3 – General Insurance

Time allowed: Three hours (9.45* - 13.00 Hours)

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 to read the questions. You are strongly encouraged to use this time for reading only, but notes may be made. You then have three hours to complete the paper.*
3. *You must not start writing your answers in the answer sheet until instructed to do so by the supervisor*
4. *The answers are expected to be India Specific application for the syllabus and corresponding core reading. However, substantially the core reading material is still taken from material supplied by Actuarial Education Company which are meant for UK Fellowship examination. The core reading also contains some material which is India Specific, mostly the IRDA regulation. In view of this, it should be noted that focal point of answers is expected to be India Specific application. However if application specific to any other country is quoted in the answer the same should answer the question with reference to Indian environment.*
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 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)** The product development manager of your company is looking to develop a Property Insurance product covering buildings and contents of large commercial properties. The main perils to be covered under this product include fire, earthquake, flood and cyclone. You have been asked to develop the rating framework for this product.
- a) Outline the rating factors you would use, citing reasons for the same
- You have discussed with the senior underwriters, possible rating techniques for this product.
- One of them has suggested that “experience rating” be used for this product. Another underwriter recommended the use of “exposure rating” referencing rates currently charged for small commercial properties. (6)
- b) Describe the advantages and disadvantages of experience and exposure rating (8)
- c) You have decided to use a credibility weighted approach to rating, blending exposure and experience rating. Briefly detail the approach explaining the basis for arriving at the credibility factor. (2)
- d) You would like to purchase INR 10 million xs 10 million catastrophe XoL cover for Property Insurance. This is intended to protect against catastrophe losses arising from floods alone and will cost INR 0.5 million. Explain the basis of deriving the Cat XoL cost for the new product being developed, assuming a return period of 12 years, no reinstatements, 25% of large commercial properties will be impacted by floods and INR 25 crores is the expected total flood exposure. Based on industry data, you know that the total gross loss amount above INR 10 million is INR 2.2 million. Illustrate if the proposed Cat XoL cover is likely to be good value for money. (6)
- [22]
- Q. 2)** You are the capital modeling actuary of a non-life company writing Property, Engineering, Marine and Motor (Comprehensive cover) insurance. You have calculated the Economic Capital and Statutory Capital requirements for your company as at March 31, 2012 as per IRDA’s stipulations.
- a) State the premium and reserve risk parameters you used for estimating the Economic Capital in respect of each of the above lines of business (3)
- b) Detail IRDA’s investment guidelines by asset class in respect of funds representing the FRSM (funds required for solvency margin). (5)
The Chief Financial Officer of your company wishes to allocate the calculated Economic Capital to each line of business underwritten. Being the capital modeling actuary, you are required to advise the Chief Financial Officer on possible methods of capital allocation.
- c) Outline the fundamental principles to be followed for allocation of capital by line of business (5)

- d) The Chief Financial Officer has suggested that capital may be allocated across lines of business in proportion to either of the following:
- Net written premium
 - Accident year incurred claims including loss adjustment expenses
 - Insurance profit by line of business

Explain the advantages and disadvantages of each basis of allocation.

(17)

[30]

- Q. 3)** a) Outline the general possible reasons that IBNR as determined using paid chain ladder method could differ from IBNR as estimated using incurred chain ladder method (4)

- b) You are an actuary reviewing the reserves of a company that predominantly writes a particular liability line of business. The company does not purchase any reinsurance.

The valuation date is 31/12/2011. The preliminary reserve analysis suggests an IBNR of 15,015 for all the origin years combined. The paid and incurred triangles are given below:

Paid Losses								
Accident	Earned	Evaluation Age in Months						
Year	Premiums	12	24	36	48	60	72	84
2005	4,883	1,121	2,600	3,041	3,299	3,398	3,506	3,575
2006	5,981	1,531	3,306	3,892	4,197	4,337	4,456	
2007	7,588	1,958	4,200	4,892	5,325	5,499		
2008	8,981	2,266	4,872	5,697	6,171			
2009	10,725	2,608	5,618	6,604				
2010	14,171	3,270	7,238					
2011	17,881	4,001						

Incurred Losses								
Accident	Earned	Evaluation Age in Months						
Year	Premiums	12	24	36	48	60	72	84
2005	4,883	2,213	3,484	3,669	3,767	3,843	3,999	4,017
2006	5,981	2,859	4,390	4,645	4,799	5,060	5,083	
2007	7,588	3,524	5,591	5,912	6,316	6,430		
2008	8,981	4,232	6,497	7,197	7,305			
2009	10,725	4,529	8,023	8,293				
2010	14,171	6,794	10,151					
2011	17,881	8,590						

Information regarding the link factors used for incurred chain ladder and paid chain ladder is given below:

Incurred Loss Development							
	Evaluation Interval in Months						
	12-24	24-36	36-48	48-60	60-72	72-84	84+
Select	1.600	1.065	1.035	1.030	1.015	1.015	1.100
Cumulative	2.059	1.287	1.208	1.167	1.133	1.117	1.100

Paid Loss Development							
	Evaluation Interval in Months						
	12-24	24-36	36-48	48-60	60-72	72-84	84+
Select	2.185	1.170	1.085	1.033	1.030	1.020	1.170
Cumulative	3.522	1.612	1.378	1.270	1.229	1.193	1.170

The following table contains the summary of the reserves selected in the preliminary analysis. Incurred chain ladder ultimate was selected for years 2009 and prior. Incurred Bornhuetter-Ferguson ultimate was selected for years 2010 and 2011

Accident Year	Earned Premium	BF IELR	Paid Losses	Incurred Losses	Cumulative LDFs		Est. Ultimate Losses			Selected Ultimate Loss
					Paid CL	Incurred CL	Paid CL	Incurred CL	BF Incurred	
2005	4,883	90.0%	3,575	4,017	1.170	1.100	4,183	4,419	4,417	4,419
2006	5,981	90.0%	4,456	5,083	1.193	1.117	5,318	5,675	5,645	5,675
2007	7,588	90.0%	5,499	6,430	1.229	1.133	6,759	7,287	7,233	7,287
2008	8,981	90.0%	6,171	7,305	1.270	1.167	7,836	8,527	8,463	8,527
2009	10,725	90.0%	6,604	8,293	1.378	1.208	9,098	10,019	9,956	10,019
2010	14,171	90.0%	7,238	10,151	1.612	1.287	11,667	13,061	12,992	12,992
2011	17,881	90.0%	4,001	8,590	3.522	2.059	14,092	17,683	16,865	16,865
Total	79,758		37,544	49,869			58,952	66,670		65,784

The claim count triangles are as follows:

Accident Year	Reported Claim Counts						
	Evaluation Age in Months						
	12	24	36	48	60	72	84
2005	5,223	5,983	6,063	6,109	6,138	6,158	6,171
2006	5,777	6,604	6,696	6,751	6,787	6,809	
2007	6,249	7,282	7,402	7,463	7,505		
2008	6,378	7,324	7,447	7,505			
2009	6,358	7,364	7,482				
2010	7,067	8,149					
2011	7,834						

Accident Year	Closed Claim Counts						
	Evaluation Age in Months						
	12	24	36	48	60	72	84
2005	3,219	5,147	5,522	5,757	5,836	5,917	5,972
2006	3,447	5,644	6,113	6,337	6,439	6,537	
2007	3,901	6,229	6,752	7,023	7,119		
2008	3,943	6,342	6,807	7,049			
2009	3,714	6,355	6,812				
2010	4,087	6,973					
2011	4,672						

Reported Claims Count Development							
Select	1.153	1.015	1.008	1.005	1.003	1.002	
Cumulative	1.311	1.137	1.120	1.111	1.106	1.102	1.100

- i) Berquist-Sherman method techniques address two cases of violation of assumptions of the chain ladder methods. What are these assumptions? Check if any of these is violated in this example. (7)
- ii) List the questions you would ask the claims and underwriting departments to confirm the observations from the diagnostics in part (a) above (5)

- iii) Meeting with the claims team indicates a change in case reserve adequacy in 2010. Adjust the incurred triangle for this.

Perform reserve review using the adjusted incurred triangle and indicate the required reserves in the light of this information. As before, incurred chain ladder method will be selected for AYs 2009 and Incurred BF for AYs 2010 and 2011

(9)

- iv) For the sub-part below, please ignore the Earned Premium information already provided above. Also assume that the following written rate changes happened in the past:

- 10% rate increase in 2009, 5% rate decrease in 2010, 10% rate increase in 2011 and no rate change is planned for 2012

The written rate change is defined as the change in the average premiums charged for a particular year across all accounts to the average premiums charged on comparable accounts in the previous year. Assume that the premiums are earned evenly throughout the year.

The written premiums in 2008, 2009, 2010 and 2011 were 10000, 12500, 17500 and 20000 respectively. The planned written premium for 2012 is 22000. Assume that the loss trend has been 2% pa from 2005 onwards.

The planning and strategy team of your organization has asked you to provide them with a loss ratio that could be used for 2012 planned profit and loss statement. What loss ratio would you suggest to the planning team and why?

(5)

[30]

- Q. 4) The valuation date is 31/12/2011. The company commenced business in 2009 across four different lines of business: A, B, C and D. Assume zero expenses, commissions, zero investment returns etc. Assume normal distribution for losses. The following table shows the mean and variance of unpaid losses from each origin year: The 2012 losses are based on the projected premiums for 2012.

Year	LoB A		LoB B		LoB C		LoB D	
	Mean	Variance	Mean	Variance	Mean	Variance	Mean	Variance
2009	1000	129600	1500	360000	400	40000	1200	65400
2010	2500	360000	3000	810000	1000	78400	3000	181500
2011	4500	656100	5000	1000000	3500	313600	5000	330550
2012	7000	705600	7000	1254400	7000	490000	5500	355550

The following table lists the carried reserves for years 2011 and prior and also the projected premiums for 2012:

LoB	Carried Reserves for 2011 and Prior	Premiums for 2012
A	8000	7200
B	9500	7200
C	4900	7200
D	9200	5400

- a) In general, what might be the correlation between loss reserves for different accident years as of a given valuation date? (3)
- b) Assume that the LoBs are uncorrelated to each other. Also assume that losses from the different origin years are uncorrelated.
- i. What is the capital required to keep the probability of ruin at 1 in 100? (2)
 - ii. Allocate this capital to the four LoBs in proportion to their marginal capital. (3)
 - iii. Prepare a note to the senior management on the profitability of the four lines of business and accordingly suggest an underwriting strategy for the (5)
- c) Outlay the approach that you would follow in order to compare the effectiveness of various reinsurance strategies for this insurer (5)

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