INSTITUTE OF ACTUARIES OF INDIA

EXAMINATIONS

24th March 2017

Subject ST8 – General Insurance: Pricing

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

Total Marks: 100

INSTRUCTIONS TO THE CANDIDATES

1. ***Please read the instructions inside the cover 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 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 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 booklet and this question paper to the supervisor separately. You are not allowed to carry the question paper in any form with you.

Q. 1) Insure Online is a new general insurance company setting up its business in an emerging economy where online insurance sales are picking up. You are the pricing actuary for the company. The company only sells motor and travel insurance products through online channel. Outline the various aspects, along with the reason, of the business being written that the insurer might be interested in monitoring. **[5]**

Q. 2) **i)** Define 'Return Commission' and 'Override Commission'. (2)

ii) A reinsurer is willing to provide a 50% quota share contract to an insurer with a flat ceding commission feature. The reinsurer expense details are as follows as a percentage of the ceded premium.

Management Expenses: 5%.
RI Brokerage: 2%
Retrocession RI cost: 3%

The projected loss ratio, gross of reinsurance, distribution of the underlying business is as follows:

Column A	Probability that the Loss Ratio is Less Than or Equal to Value in Column A
10%	**1%**
20%	**5%**
30%	**10%**
40%	**25%**
50%	**50%**
60%	**80%**
70%	**90%**
80%	**97%**
90%	**98%**
100%	**99%**

What is the maximum flat ceding commission the reinsurer can offer to the insurer to ensure that the probability of making a loss is not more than 20%? (4)

[6]

Q. 3) A general insurer company selling auto insurance in the country wants to increase its market share. The marketing manager has suggested that the No Claim Discount (NCD) of the insured should not be affected if the only claim arising out of the expiring policy is of windscreen damage.

i) Outline the possible consequences of the marketing manager's proposal. (4)

ii) State the possible consequences of incorporating the proposal in pricing by the following methods:

- Increasing the rates for all customers
- Offering this feature as an optional cover
- Increasing rates for segments that are more prone to windscreen damage (3)

[7]

Q. 4) i) List the modules in a Catastrophe model for the following:

- Modules that rely primarily on the data input by the user of the models
- Modules that are based on seismological and meteorological assessment
- Modules that are based on engineering assessment (2)

ii) With the increasing carbon emission level in the atmosphere, the scientific consensus is that global climate change is taking place.

Outline which modules out of these five modules will need to be revisited, along with the reasons. (4)

iii) The table below represents a typical Earthquake CAT Modelling Output of Occurrence Exceedance Probability (OEP) curve for a company which writes Fire and Engineering business on an Occurrence basis. The modelled results are obtained by running the model on Net Sum Insured exposure i.e. after application of all other reinsurance arrangements.

EQ Net Retained Modelling Results	
Exceedance Probability	**Fire + Engineering (in Crores)**
0.10%	645
0.20%	482
0.40%	336
0.50%	295
1%	190
2%	116
4%	63
10%	25
20%	11
Average Annual Loss	**16**
Standard Deviation	**49**
Coefficient of Variation	**3.2**

The company is in the process of buying an excess of loss reinsurance arrangement called CAT XL for the peril Earthquake for its RI program. Determine the level or limit of protection/cover against Earthquake required to be purchased at 200 year return period? Assume that there is no inuring reinsurance cover and no deductible layer in the CAT XL. (2)

[8]

Q. 5) i) List the important rating factors that are usually considered for aviation property. (2)

ii) An insurance company is pricing the upcoming renewal of a policy covering private jet owners' insurance pool. The company has following claim numbers and total insured values for the recent 5 Policy years of this account:

Policy Year	No. of Claims	Sum Insured (in crores)
2012	302	29
2013	219	31
2014	279	33
2015	45	36
2016	30	35

Expected Sum Insured for year 2017 is 42 crores.

Each policy year offers coverage from 1st January to 31st December.

The above claim numbers and Sum Insured are reported as at 31st December 2016.

A jet plane expert states that annual sum insured inflation was 5% prior to 31st December 2014 and zero subsequently. It has been estimated that inflation for year 2017 will be 5%.

The table below gives claims development percentages on a policy year basis for projecting claim numbers.

Development % age on policy year basis as at:	Number of Claims Reported as a % of Ultimate Claim Count
60 months	90%
48 months	80%
36 months	60%
24 months	35%
12 months	15%

Estimate the expected number of claims for the 2017 policy year, justifying your estimate and stating any assumptions that you make. (6)

[8]

Q. 6) i) Define the following terms:

a) Bonus Hunger (1)

b) Profit testing (1)

c) Swing Rated (1)

ii) A private passenger auto insurance company is studying claim frequencies for bodily injury liability coverage, based on whether the policyholder has a homeowner's policy and whether the policyholder had a prior auto policy with the insurer:

	Homeowner policy	
Prior Auto Policy	Yes	No
Yes	1.5%	2.5%
No	4%	6%

The corresponding policy count for the above frequency figures is as follows:

	Homeowner policy	
Prior Auto Policy	Yes	No
Yes	1,000	1,500
No	800	500

a) To estimate frequencies for this book of business using only 'Prior Auto Policy' and 'Homeowner policy' as the independent variables, write down the appropriate choices for the following structural components of a generalized linear model:

I. Error distribution & Link function

II. Vector of responses & Vector of model parameters

III. Design matrix

IV. Weights (4)

b) It was also observed that the independent variable information was not available for 1,200 policies. For these policies, it was not known whether the policyholder has a homeowner policy and/or whether the policyholder had a prior auto policy. State how the missing data may cause problems in developing the model and suggest a possible solution. (2)

[9]

Q. 7) i) State the various loadings which are done on risk premium to calculate office premium. (3)

ii) You are working in the Actuarial department of a relatively new medium-sized general insurance company. Two different pricing models based on external data are made available for the private car portfolio of the company. Before going ahead with any of the model, you want to assess which model is a better predictor of the experience in the internal historical data. One of your colleague suggested to you to use "Lift curve" for the purpose. You have taken the data and grouped them into 10 deciles based on the predictions on this data of the two models and evaluated the actual number of claims by decile.

MODEL 1		
Decile	Exposure	Actual Number of Claims
1	10,000	1,200
2	10,000	1,300
3	10,000	1,500
4	10,000	1,600
5	10,000	2,000
6	10,000	2,300
7	10,000	2,700
8	10,000	3,200
9	10,000	4,200
10	10,000	5,000
Total	100,000	25,000

MODEL 2		
Decile	Exposure	Actual Number of Claims
1	10,000	1,500
2	10,000	1,700
3	10,000	1,900
4	10,000	2,200
5	10,000	2,500
6	10,000	2,700
7	10,000	2,900
8	10,000	3,100
9	10,000	3,200
10	10,000	3,300
Total	100,000	25,000

a) Observing the information above, state and justify which of the two models has better predictive power. (3)

b) It was also observed that the total number of predicted claims on the historical internal data by Model 1 was 22,727 while Model 2 predicted 26,316. Your colleague suggested that the model score from model 1 be increased by a factor of 1.1 and model 2 by a factor of 0.95 and then assess the two models again.

Comment on how the predictive power of the two models compare now. Also comment on the appropriateness of this approach. (3)

[9]

Q. 8) Exposure curve is a plot of relative loss size distribution.

i) State the most important assumption while using Exposure curves for pricing for a set of different risks of different sizes. (1)

ii) State classes of business that are most suitable for pricing using exposure curves. (1)

iii) Outline the primary sources of heterogeneity in a relative distribution like exposure curves. (2)

iv) A small sized company focusses on SME property segment only and wants to purchase excess of loss reinsurance treaty (5 Cr XS 1 Cr) for protection against large claims.

The reinsurer seeks the following details for pricing its proposed XoL treaty.

The average SI coverage of a policy in this portfolio is expected to be at Rs. 10 Cr.
Total premium expected is around 300 Cr.
Overall Loss ratio is expected to be at 30% only.
No deductible in the policies.

The most appropriate Exposure Curve chosen for this portfolio has the following details.

y	G(y)
1.0	99%
0.9	98%
0.8	97%
0.7	96%
0.6	95%
0.5	93%
0.4	91%
0.3	87%
0.2	80%
0.1	66%
0	0%

What is the Loss Cost to the reinsurer for this excess of loss treaty? (2)

v) State the conditions under which a company would like to use exposure curves based on industry data. Also state the conditions under which a company would not like to use exposure curves based on industry data. (3)

vi) State the main reason for having different exposure curves for residential property and commercial property business. Also state briefly how the curves would be different. (2)

[11]

Q. 9) **i)** List the requirements for a factor to be used as a rating factor. (3)

A general insurance company writes livestock (Cattle) insurance. This insurance indemnifies for the injury or accidental death of the insured livestock due to covered perils. The company has recently taken over a book of livestock insurance from another insurer and wants to transfer the other company's premium, claims and administrative data onto its own systems.

ii) Discuss the problems the company might encounter with integrating the data systems (5)

iii) Outline the possible consequences of the problems stated in part (ii) above. (4)
[12]

Q. 10) A mobile wallet, also commonly known as E-wallet, is a digital/electronic form of physical wallet that can store money to make payments, transfer money, and perform most activities that you can with cash. To use these wallets for making payments and transfers, one needs to fill them with money first. Mobile wallets are usually used for transactions of relatively smaller value. Mobile wallets mostly rely on a phone's locking system as their security system. Even while making a payment, mobile wallets often do not ask for any kind of PIN or password.

Due to growing usage of mobile wallet in an emerging economy, the market potential for an insurance product exists. You are working on the development of this product.

i) Outline the benefits, insured perils, basis for cover, measure of exposure to which premiums are related, claim characteristics, risk and rating factors that you would consider for this product. (8)

ii) State the specific concerns you may have with this product, with respect to the general insurance principles. (4)
[12]

Q. 11) **i)** What are the three main reinsurance coverage bases? (1)

ii) For each of the three bases, state whether they are commonly used for proportional reinsurance arrangements or non-proportional reinsurance arrangements. (2)

iii) State, with one example each, the type of business for which surplus treaty is more suitable than quota-share treaty and vice versa. (2)

iv) A surplus treaty arrangement is set by a direct insurer with 10 lines and a maximum retention being Rs. 1 Crore per line. The treaty is on a Sum Insured basis. The direct insurer gets a risk with a Sum Insured of 20 Crores. Determine if the reinsurer can cede the risk to the treaty. If yes, state how. If not, state the options available with the insurer. (4)

v) Over the years, it has been observed by the reinsurer that the ceded loss ratio under the surplus treaty is much higher than that of the insurer's gross loss ratio. Establish the possible solutions to overcome the problem for the reinsurer, including solutions like proposing completely new reinsurance arrangements also, by analyzing the proper reasons causing the problem. (4)
[13]

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