INSTITUTE AND FACULTY OF ACTUARIES

EXAMINATION

27 September 2017 (am)

Subject ST8 – General Insurance: Pricing Specialist Technical

Time allowed: Three hours

INSTRUCTIONS TO THE CANDIDATE

1. *Enter all the candidate and examination details as requested on the front of your answer booklet.*

2. *You must not start writing your answers in the booklet until instructed to do so by the supervisor.*

3. *You have 15 minutes of planning and reading time before the start of this examination. You may make separate notes or write on the exam paper but not in your answer booklet. Calculators are not to be used during the reading time. You will then have three hours to complete the paper.*

4. *Mark allocations are shown in brackets.*

5. *Attempt all nine questions, beginning your answer to each question on a new page.*

6. *Candidates should show calculations where this is appropriate.*

AT THE END OF THE EXAMINATION

Hand in BOTH your answer booklet, with any additional sheets firmly attached, and this question paper.

In addition to this paper you should have available the 2002 edition of the Formulae and Tables and your own electronic calculator from the approved list.

1 An actuary is pricing marine hull cover for a large fleet of ships. The insured has provided the following historic data:

Year	*Incurred losses from weather-related catastrophe events*
2013	\$4.0m
2014	\$0.0m
2015	\$6.3m
2016	\$7.3m
2013–2016 average: \$4.4m	

The actuary has proposed a loading for catastrophe events of \$4.4m in the premium for 2017.

(i) Assess the suitability of this proposal, explaining your reasoning. [4]

(ii) Propose, with reasons, an alternative approach that could be used to allow for catastrophe events within the premium. [2]

[Total 6]

2 The following data are available for a book of professional indemnity policies:

Year	*Number of policies sold*	*Total losses (\$000s)*
2014	20	1,000
2015	50	5,000
2016	100	2,500
2017	150	1,200

The distribution of average losses per unit in year i is $X_i \mid \theta_i \sim \text{Gamma}(V_i, V_i / \theta_i)$ where V_i is the number of policies sold in year i and $\theta_i \sim N(100,50)$.

Calculate, showing all workings, the Bühlmann-Straub risk premium for the total losses in the year 2018, assuming that 250 policies will be sold in that year. [7]

3 Discuss the reasons why insurers have problems with the quality and quantity of internal data. [8]

4 A general insurance company has launched a new product that provides extended warranty cover for cars. If a mechanical fault is discovered after the initial two-year manufacturer's warranty has expired, the policy will cover the cost of repair, up to a maximum of seven years after the purchase date. Policies are sold through the sales network of the car manufacturer. Five years after launching the product, the insurer has noticed that the cancellation rate on the product has been higher than expected.

Outline the analyses the insurer could undertake to understand the reasons for this high cancellation rate. [8]

5 A reinsurance company transacts only individual risk excess of loss reinsurance. In order to calculate the reinsurance premium to be paid by each company in the following year, the reinsurer uses the following formula:

$$\text{RI premium} = \frac{A \times B}{C}$$

where A = total claims paid by the reinsurer over the last three years to that individual company

B = expected level of premiums to be written by the insurer in the following year

C = total premiums written by the insurer over the last three years

(i) Suggest the advantages to the reinsurer of using this formula. [2]

(ii) Suggest the disadvantages to the reinsurer of using this formula. [6]

[Total 8]

6 (i) State the key difference between experience rating and exposure rating. [2]

A commercial property insurer wishes to purchase £500,000 xs £200,000 risk excess of loss treaty reinsurance. The following information for Year 1 is available for the business which is to be reinsured:

Table 1: Original accumulated loss costs by percentage of risk size

% of Maximum Probable Loss (x%)	*Total value of losses ≤ (x% of Maximum Probable Loss)*	*Total of x% of Maximum Probable Loss, for all losses which are > x% of Maximum Probable Loss*
	£000	*£000*
10%	5,800	5,000
20%	8,700	5,700
30%	10,900	5,500
40%	13,600	5,200
50%	15,700	5,000
60%	18,600	3,500
70%	19,800	3,200
80%	21,100	2,600
90%	22,400	2,300
100%	25,000	0
110%	25,000	0

(ii) Determine the empirical exposure curve values from the loss data provided in Table 1. [2]

For the same business which is to be reinsured, the following information for Year 1 is also available:

- original ultimate loss ratio for Year 1 (based on ground-up data): 65%
- expected future claims inflation: 6% p.a.

Table 2: Original policy information for Year 1

Sum insured band £	*Original premium £*
0 to 50,000	8,000
50,001 to 100,000	9,000
100,001 to 150,000	8,500
150,001 to 200,000	7,000
200,001 to 300,000	13,500
300,001 to 400,000	12,000
400,001 to 500,000	10,000
500,001 to 750,000	11,000
750,001 to 1,000,000	7,000
Total	**86,000**

Using the exposure curve derived in part (ii) and this additional information, the reinsurance company calculates the expected loss cost to the layer for this business in Year 2 as follows:

Table 3: Calculations for the expected loss cost to the layer in Year 2

Average sum insured (SI) *£000*	*Original premium* *£*	*Attachment point % of SI*	*Exit point % of SI*	*Attachment point % of loss cost*	*Exit point % of loss cost*	*Cost to the layer* *£*
250	13,500	75.47%		93.53%		567.56
350	12,000	53.91%		84.99%		1,170.88
450	10,000	41.93%		76.67%		1,516.72
625	11,000	30.19%	75.47%	65.78%	93.53%	1,984.19
875	7,000	21.56%	53.91%	58.85%	84.99%	1,189.28
					Sum	**6,428.64**

(iii) State four assumptions that have been made in the calculations above. [2]

(iv) Comment on the appropriateness of each assumption made in part (iii). [4]

(v) List four adjustments that would be applied to the expected loss cost in order to obtain the premium to be charged for this layer. [2]

[Total 12]

7 (i) Outline the benefits that are likely to be provided under a mobile phone (cellphone) insurance policy. [5]

A free game has been launched which lets players explore the real world using their location and phone camera to capture virtual monsters. Virtual monsters can be found anywhere in the world, although they don't stay in a single place for more than a few minutes. As players move around, their phone vibrates to let them know if any virtual monster is nearby. Once caught, monsters come into the ownership of the player. The aim of the game is for players to catch as many different monsters as possible.

A general insurance company is designing an insurance product which covers risks that arise specifically for players of this game.

(ii) Describe the cover that may be provided for players of this game, in addition to standard mobile phone insurance. [4]

The game uses augmented reality, which is a technology that combines the real world as seen by the user and a virtual scene generated by a computer. This enhances the real world with additional information which can help the user make decisions.

(iii) Propose other possible uses of augmented reality in the general insurance industry. [3]

[Total 12]

8 The following table and notes have been provided by a broker who is seeking quotes for a fleet of delivery vans.

Year	*Exposure (vans)*	*Claims paid (€)*	*Proportion of claims developed*
1	99	6,959	0.98
2	125	9,038	0.92
3	153	12,111	0.85
4	207	14,481	0.75
5	225	15,350	0.65

- Exposure is the number of vans at the start of the year.
- Annual inflation has historically been 2% p.a.
- The number of vans at the start of Year 6 is expected to be 245, and 275 at the start of Year 7.

(i) Estimate the risk premium for Year 6 using a burning cost approach, stating any assumptions you make. [7]

(ii) Outline other items of information that may be helpful in refining the risk premium estimated in part (i). [5]

The broker has advised that in the last few days of Year 5, there was a large loss which has not yet been recorded in the data shown above.

(iii) Describe the different ways in which this large loss may be included in the risk premium estimate. [4]

[Total 16]

9 Some of the rating factors used to set motor insurance premiums are proxies for the true risk factors.

(i) Assess, using examples, the effectiveness of motor insurance rating factors as proxies for the true risk. [6]

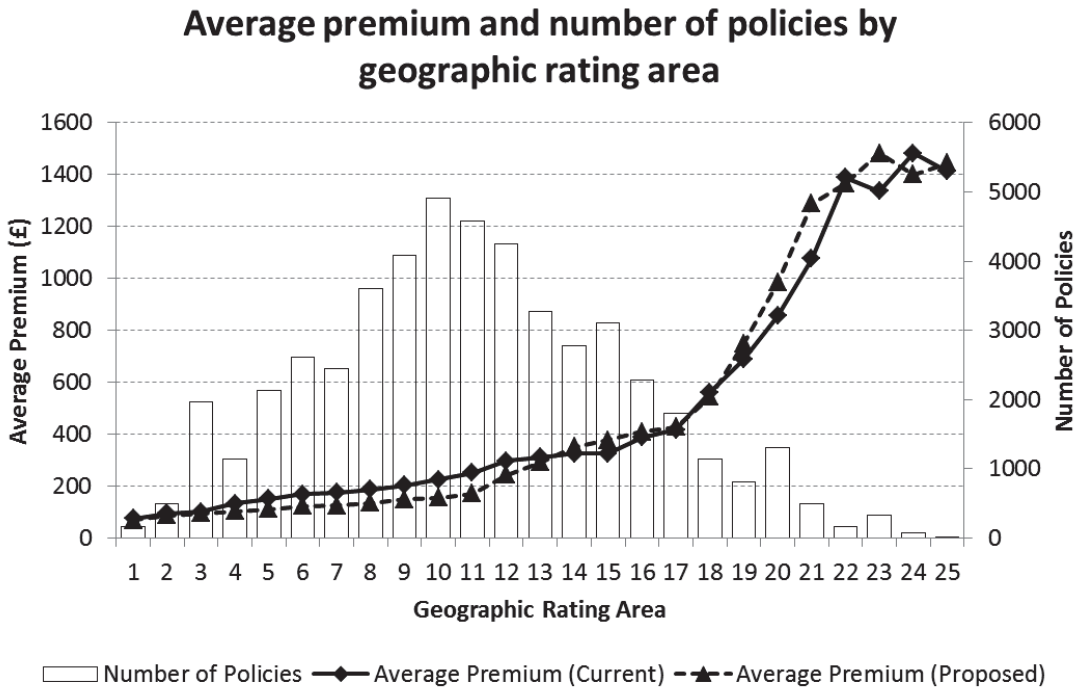
An actuary working for a general insurance company has collected several years of its own property damage claims from a large portfolio of private motor insurance policies. She wants to estimate the own property damage claims frequency for policies written in six months' time.

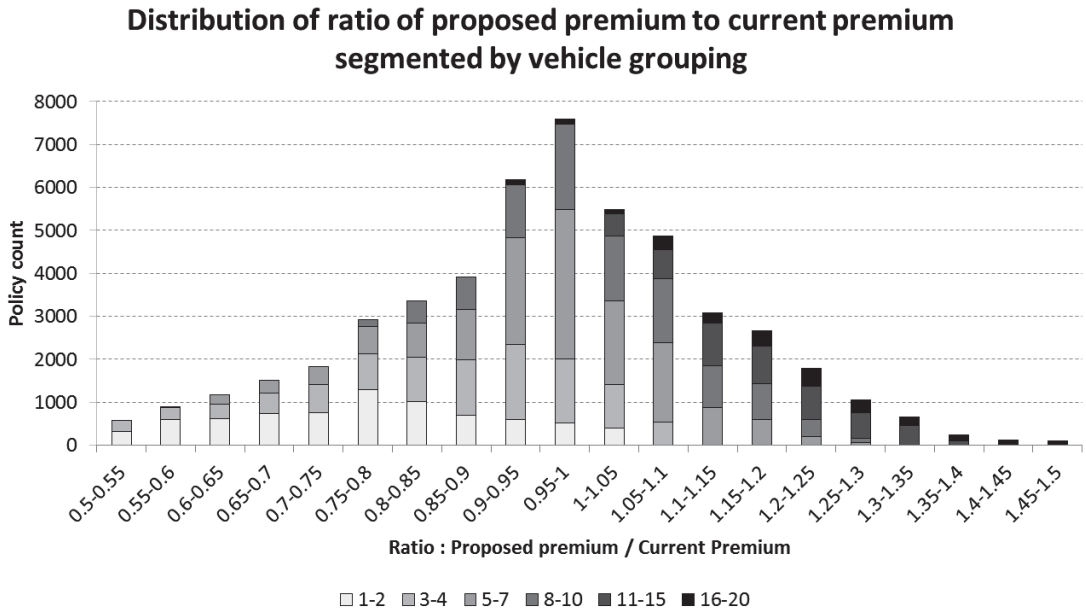
(ii) Describe the adjustments she may have to make to the claims data that she has collected, in order to derive her estimate. [5]

The actuary is building generalised linear models of the motor claims experience and has built offsets into her model.

(iii) Describe the use of offsetting in modelling. [7]

Having fitted a risk premium model, the actuary is assessing the impact of using the model for rating. The actuary has produced the two charts below to analyse the effect of the new model:





The vehicle grouping is a clustering of vehicles by manufacturer and model.

(iv) Comment on the impact of the proposed model using the two charts. [5]

[Total 23]

END OF PAPER