

INSTITUTE AND FACULTY OF ACTUARIES

Curriculum 2019

SPECIMEN EXAMINATION

Subject SP7 – General Insurance Reserving and Capital Modelling Principles

Time allowed: Three hours and fifteen minutes

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. *Mark allocations are shown in brackets.*
4. *Attempt all 9 questions, beginning your answer to each question on a new page.*
5. *Candidates should show calculations where this is appropriate.*

Graph paper is NOT required for this paper.

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** List the key items of income and outgo in the annual accounting model for insurance contracts. [3]
- 2** List factors influencing the purchase of reinsurance by an insurance company. [8]
- 3** List four items of data per risk type that may be used in an internal capital model for modelling:
- (a) underwriting risk.
 - (b) market risk.
 - (c) counterparty default risk.
 - (d) liquidity risk.
- [8]
- 4** (i) State the purpose of sensitivity testing in internal model validation [1]
- An insurance company uses a stochastic model to estimate its reserve risk capital. Lognormal distributions are used to model volatility of individual classes and a correlation matrix is used to aggregate distributions.
- A sensitivity test is performed in which the means and standard deviations of the lognormal distributions are increased by 5% for all classes. An actuary working for the company suggests that the modelled reserve risk should increase by 5%. The test is run and shows a 4% increase.
- (ii) Suggest three possible reasons why the test may not match expectations. [3]
- A second sensitivity test is performed in which a 20% multiplicative increase is applied to the gross volatility parameter for the three lines of business with the largest gross reserves.
- (iii) Suggest four factors that influence the expected impact of this test. [4]
- [Total 8]
- 5** A reinsurer is planning to start writing reinsurance that provides protection for the direct writers' global agriculture insurance portfolios. The agriculture insurance provides cover for both crops and livestock. Cover for farm buildings is excluded.
- (i) List perils from which purchasers of this reinsurance may be seeking protection. [3]
 - (ii) Suggest, with reasons, factors the reinsurer should take into account when determining an earned premium profile for this class of business. [6]
- [Total 9]

- 6 (i) Define the terms:
- (a) captive insurer
 - (b) free reserves
- [3]

- (ii) List four potential reasons why a company might set up a captive insurer. [2]

A large multinational insurer is considering changing its reinsurance arrangements by setting up a new reinsurance company to which it will cede a significant proportion of its business under a long-term agreement.

The insurer will retain a 30% interest in the new reinsurance company which will be capitalised by a private issue of shares in the newly established reinsurer.

The company will be established in a country which has very favourable corporate and regulatory requirements for this type of venture, requiring free reserves of just \$1 to be held. The company will voluntarily hold additional capital calculated using a prudent risk based measure.

The assets of the company will be managed by a third party investment manager engaged to maximise investment returns with no restrictions on asset type or investment strategy.

- (iii) Discuss the advantages and disadvantages of this arrangement for the:
- (a) cedant.
 - (b) new company.
 - (c) investors in the new company.
 - (d) country of the new company.
- [12]

A non-executive director of the multinational insurer has raised the following concern about the investment strategy for the new company:

“I understood that the goal of investment was to maximise returns subject to meeting contractual liabilities and staying within the risk tolerance of the company. Why do we feel it is acceptable to abandon this long proven strategy?”

- (iv) Discuss this comment. [4]
- [Total 21]

- 8
- (i) Define parameter and model uncertainty in an actuarial reserving model. [1]
 - (ii) Describe three sources of parameter uncertainty and three sources of model uncertainty in an actuarial reserving model. [9]
 - (iii) Describe one other key area of uncertainty in producing an actuarial reserve estimate. [2]

Best estimate reserves have been established using deterministic techniques for the following two books of business:

- a small political risk book of business that has been written for 2 years
 - a large marine cargo book of business that has been written for 15 years
- (iv) Describe two appropriate methods for quantifying the reserve uncertainty for these books of business, justifying your choice of methods. [8]
- [Total 20]

- 9
- (i) Define the term allocated loss adjustment expenses (ALAE). [1]
 - (ii) List the diagnostics that might be used to assist in a reserving investigation. [4]

The following ratios of gross paid to reported incurred claims have been compiled at the start of a reserve investigation.

Gross paid to reported incurred claims ratio

<i>Accident year</i>	<i>Reported month 12</i>						
	<i>24</i>	<i>36</i>	<i>48</i>	<i>60</i>	<i>72</i>	<i>84</i>	
2010	0.190	0.420	0.530	0.571	0.744	0.814	0.923
2011	0.186	0.371	0.422	0.628	0.897	0.850	
2012	0.139	0.250	0.426	0.571	0.739		
2013	0.099	0.234	0.375	0.508			
2014	0.138	0.256	0.320				
2015	0.159	0.302					
2016	0.200						

An actuary has been asked to review the data and consider:

- tail factor requirements.
 - trends across accident years.
 - calendar year effects.
- (iii) Identify any features of the above dataset which may be relevant to these three areas of interest, commenting on possible underlying causes. [6]

- (iv) Comment on any effects these features might have on the choice of reserving methods for analysing this portfolio. [4]

At the start of 2016, new legislation came into force to try to reduce the cost of legal fees. Certain qualifying claims can now be processed through an online platform. Such claims have a fixed legal fee of £500 for each claim notified through the platform. In the past, such claims have had legal fees averaging 40% of the total claims cost.

The following data has been obtained relating to claims that meet the qualifying criteria, including claims paid under both the old system and new system.

Cumulative reported claims £000's

<i>Accident year</i>	<i>12</i>	<i>Reported month</i>			
		<i>24</i>	<i>36</i>	<i>48</i>	<i>60</i>
2012	2,107	4,987	7,535	9,174	9,483
2013	3,605	6,146	8,792	9,858	
2014	3,286	5,624	7,257		
2015	2,204	3,224			
2016	1,744				

Cumulative reported claim counts

<i>Accident year</i>	<i>12</i>	<i>Reported month</i>			
		<i>24</i>	<i>36</i>	<i>48</i>	<i>60</i>
2012	1,223	1,462	1,585	1,619	1,716
2013	1,320	1,652	1,706	1,875	
2014	930	1,071	1,100		
2015	772	948			
2016	800				

Incremental
development factor 1.2092 1.0492 1.0617 1.0599 1.0000

Cumulative
development factor 1.4277 1.1807 1.1253 1.0599 1.0000

- (v) Calculate the unreported claims amounts and their ALAE costs separately using a chain ladder method, stating any assumptions you make. [8]
[Total 23]

END OF PAPER