

# INSTITUTE AND FACULTY OF ACTUARIES



## EXAMINATION

15 April 2019 (pm)

### Subject SP9 – Enterprise Risk Management Specialist 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 questions, begin 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 An entrepreneur is setting up a life insurer in Germany, to write business in Europe, US and Canada.

The company intends to use data from policyholder application forms, claims and industry databases, as well as information from social media, for pricing and claim handling purposes. The analytics and marketing will be handled internally, with other functions outsourced to external firms around the globe. The company will offer term assurance policies with fixed sums assured.

In a press release, the company states:

“... because of our innovative use of data analytics, we do not need to follow the traditional enterprise risk management control cycle approach to pricing and managing the risks we underwrite ...”.

- (i) Outline the enterprise risk management control cycle. [3]
- (ii) Discuss the statement in the company’s press release. [6]
- (iii) Outline the main risks to which the company is exposed. [10]

The company does not intend to purchase any single-event cover from the reinsurance market to protect itself against an accumulation of claims from a single event. It proposes to hold a small reserve against this single-event risk, based on the best estimates of the frequency and severity of such events.

- (iv) Comment on the company’s proposal. [4]

The company expects that the pricing model will be able to automatically:

- determine the pricing and deliver finalised contracts using standardised terms.
- update the pricing basis, which allows for results from the automated experience analysis and forecasting of future claim experiences.

- (v) Discuss the advantages and disadvantages to the company of having this level of automation. [10]

[Total 33]

- 2** Country A is a developing country with a small but growing insurance market. The main products purchased in Country A are motor insurance and life insurance, accounting for 60% and 25% of the market respectively. The remaining 15% of the market is mostly commercial insurance, covering domestic companies for both property and liability risks. The country is politically stable, but corruption is a significant problem within the country.

You are working in the insurance department of the A-FSA, the financial regulator for Country A. The A-FSA is developing a new set of regulations aimed at ensuring the solvency of insurers operating in Country A.

- (i) Define what it means for a risk measure to be ‘subadditive’. [1]
- (ii) Define the ‘diversification benefit’ when two risks are combined. [1]
- (iii) Describe two distinct risk measures that might be used within these regulations. [3]

The A-FSA has a secondary objective which is to ensure the stability of the insurance market in Country A. It is considering requiring all insurers to make certain financial information publicly available. This information will include:

- balance sheets from the last five years
- profit and loss statements from the last five years
- planned premiums and loss ratios for pre-defined lines of business for the coming year
- current market value of invested assets held in pre-defined asset classes
- biography and qualifications of all board members
- an overview of the risk management and governance frameworks in place.

- (iv) Describe, with reasons, five different stakeholders who may be interested in these disclosures. [5]
- (v) Describe the key advantages, to each stakeholder in part (v), of having this information. [10]
- (vi) Discuss briefly other requirements that the A-FSA may wish to place on insurance companies in order to ensure the stability of the insurance market in Country A. [5]

BigCarCo is the country's largest general insurance company. It represents around 25% of the motor insurance market in Country A. A copy of BigCarCo's three most recent balance sheets and two most recent profit and loss statements are shown below. All figures are shown in millions of the local currency in Country A. All policies cover a one-year period, are written on 1 January and incept immediately.

<b>BALANCE SHEET</b>	<b>31 December 2018</b>	<b>31 December 2017</b>	<b>31 December 2016</b>
<u>Assets</u>			
Cash and equivalent	1,800	1,600	1,300
Invested assets	3,250	2,950	2,700
<i>Corporate bonds (domestic)</i>	450	450	450
<i>Government bonds (domestic)</i>	1,250	1,250	1,250
<i>Corporate bonds (overseas)</i>	800	700	600
<i>Government bonds (overseas)</i>	250	150	100
<i>Equity</i>	400	300	200
<i>Property</i>	100	100	100
Reinsurance share of reserves	240	250	270
<i>Motor</i>	200	200	200
<i>Commercial property</i>	10	10	10
<i>Commercial liability</i>	0	0	0
<i>Other</i>	30	40	60
Other assets	50	50	50
<b>Total assets</b>	<b>5,340</b>	<b>4,850</b>	<b>4,320</b>
<u>Liabilities</u>			
Gross reserves	3,570	3,310	3,050
<i>Motor</i>	2,000	2,000	2,000
<i>Commercial property</i>	120	110	100
<i>Commercial liability</i>	1,250	1,000	750
<i>Other</i>	200	200	200
Other liabilities	50	50	50
<b>Total liabilities</b>	<b>3,620</b>	<b>3,360</b>	<b>3,100</b>
<u>Equity</u>	<b>1,720</b>	<b>1,490</b>	<b>1,220</b>

**PROFIT & LOSS STATEMENT**

	<b>2018</b>	<b>2017</b>
<i>Gross Written Premium</i>	3,750	3,500
<i>Reinsurance Written Premium</i>	(425)	(400)
Net Written Premium	3,325	3,100
Gross Claims Incurred	(2,850)	(2,510)
<i>Motor</i>	(2,000)	(2,000)
<i>Commercial property</i>	(100)	(70)
<i>Commercial liability</i>	(300)	(320)
<i>Other</i>	(450)	(120)
Reinsurance recoveries	275	250
<i>Motor</i>	200	200
<i>Commercial property</i>	25	0
<i>Commercial liability</i>	0	0
<i>Other</i>	50	50
Expenses	(650)	(750)
Investment income	130	180
Total profit	230	270

- (vii) Discuss the risk profile of BigCarCo, including figures where appropriate. [12]  
[Total 37]

- 3 You work for WidgetCo, a small manufacturer producing component parts for machinery. WidgetCo's clients use these components to produce a wide range of end products for sale to the general public.

WidgetCo only operates in its domestic country and employs around 50 staff. Ten of these are based in WidgetCo's head office and the remainder are spread out amongst WidgetCo's four regional offices. The regional offices serve their local markets and are generally self-sufficient. Head office sets high-level concentration limits and provides strategic guidance. Head office also sets quality control standards for each of WidgetCo's key products. In particular, WidgetCo aims to manage concentrations of exposure to individual clients. WidgetCo often sells the same components to several different clients.

WidgetCo's head office also performs human resources, financial reporting and compliance functions for each of the regional offices to ensure consistency across the organisation. All other functions are performed locally by the regional offices. This includes manufacturing, marketing, distribution and quality control.

WidgetCo is considering setting up an ERM function within the head office and has asked you to help with this process.

- (i) Describe, with reasons, an appropriate structure for the new ERM function. [3]
- (ii) Propose some key features of company culture which may be required in order to establish an effective ERM function. [2]

As a result of your recommendations, WidgetCo's ERM function is now well-established and is seen as a valuable resource across the company. WidgetCo is starting to develop a single model to aggregate the company's exposure to various risks and would like to use this model within the head office to help set strategic guidance and concentration limits. The regional hubs are also interested in using the model in order to operate more efficiently.

Your manager mentions they have heard that models can be deterministic or stochastic. They are interested in knowing more about these two types of models.

- (iii) Compare the features of deterministic and stochastic models. [2]
- (iv) Compare the pros and cons of each of these types of model. [3]
- (v) Recommend, with reasons, which type of model WidgetCo should use. [2]
- (vi) Discuss how WidgetCo could use such a model to set:
  - (a) strategic guidance for each regional office. [5]
  - (b) concentration limits for each regional office. [5]

The newly-established ERM function has identified a major risk which WidgetCo was not appropriately considering. This is the risk that a defect in WidgetCo's manufacturing processes results in a widespread recall of its products. Depending on the type of defect, this could affect anything from a single product in a single regional office to all products across all regional offices. WidgetCo would like to include this risk within its new company-wide model.

WidgetCo will use a frequency-severity approach to model this risk. The frequency distribution will be set with reference to industry data.

- (vii) Recommend, with reasons, a distribution which could be used to model the severity distribution for this risk. [3]

WidgetCo has decided that it would be most appropriate to model this risk for each of its regional offices separately. Head office will provide each regional office with suitable parameters for a frequency distribution, depending on what they produce and the controls they have in place within that regional office. The regional offices will then be required to parameterise the severity distribution identified in part (vii) above. WidgetCo is considering using a copula to link the total loss between regional offices.

- (viii) Explain the advantages and disadvantages to WidgetCo of using copulas in this way. [3]

- (ix) Recommend, with reasons, a suitable copula to link these losses between different regional offices. [2]  
[Total 30]

**END OF PAPER**