

# Actuarial Society of South Africa

## EXAMINATION

19 November 2021

### Subject F101 – Health and Care

#### Fellowship Principles

*Time allowed:* Three hours and fifteen minutes, plus an additional five minutes to allow for scrolling in the ASSA Exam Platform

*Total marks:* 100

#### **INSTRUCTIONS TO THE CANDIDATE**

1. Ensure that you are logged in and authenticated through Examity before you attempt the examination.
2. Questions are only available in the ASSA Exam Platform and may not be printed.
3. Submit all of your answers in the ASSA Exam Platform only. No uploads of answers (handwritten or otherwise) to the ASSA Exam Platform will be accepted.
4. You may not use any other computer program (e.g. Email, MS Word or Excel) or files, nor open any other browser during the examination.
5. You may not make use of a Formulae and Tables book during the examination. Any such information that may be required will be provided to you within the examination.
6. You are strongly encouraged to use the first 15 minutes as reading time only, however, you may commence answering the paper whenever you are ready.
7. Mark allocations are shown in brackets.
8. Attempt all seven (7) questions.
9. Show calculations where this is appropriate. You may use blank paper to carry out rough work calculations. You may use a calculator from the approved list only.
10. You may return to your answers to review and amend during the allotted examination time. Once you are happy with your answers you need to **Finish all and Submit** your work. Once you have submitted you will not be able to make any more changes to your answers.
11. You must submit all work **BEFORE** the end of the allotted examination time. Take this into account when planning your review and submission. There will be no time announcements.
12. An option to opt out of the exam will become available 1 hour after the official exam start time. If you select the Opt-Out option, you agree and understand that your entire script/answers will be deleted and cannot be retrieved at a later stage and that your script or part thereof will not be put forward for marking.

**Note: Answers will be saved automatically during the examination if you are connected to the ASSA Exam Platform. However, the Actuarial Society of South Africa will not be held responsible for loss of data where candidates have not followed instructions as set out above.**

**END OF INSTRUCTIONS**

## QUESTION 1

A large life office has been writing without profit immediate needs long term care cover for a number of years. The cover is indexed to inflation.

- i. Outline how the company might invest its assets to match its liabilities as closely as possible. [6]
- ii. State any controls relating to the investments that may apply in regulations. [5]

[Total 11]

## QUESTION 2

A new disease has been resulting in increased hospital admissions and is causing an increase in observed in-hospital mortality. As an analyst for a healthcare research firm, you want to understand the demographic and clinical drivers of in-hospital (IH) mortality for the cases affected by the new disease.

- i. Suggest a type of GLM that would be best suited to model IH mortality, the reason why it would be appropriate, and give the link function. [3]

You have run the model and are reviewing the results.

- ii. After plotting the residual versus fitted values, what features of the plot would suggest that the model is a good fit? [1]
- iii. How would you determine which explanatory variables are significant drivers of IH mortality for admissions of interest? [2]

[Total 6]

## QUESTION 3

Recently a developing country with a population of around 60 million citizens has experienced a devastating virus. The virus caused significant loss of life and measures aimed at curbing the spread have had massive economic implications for the country.

A vaccine has been developed by a large international pharmaceutical company. The government of this developing country is currently embarking on a mass-vaccination drive in order to achieve so-called “herd-immunity” from the virus.

- i. Explain how this vaccine drive is likely to be aligned with the government’s health system objectives. [6]
- ii. Outline 8 challenges the government may encounter in rolling out their vaccine plans. [8]

[Total 14]

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#### QUESTION 4

- i. Outline briefly the differences between the two main types of long-term care cover. [2]

You are the CEO of a medium-size health insurer operating in a region with an insurance market that is not fully developed. The people in this country have strong family values such as taking care of their grandparents. Your sales manager has suggested that the company should launch a long-term care product.

- ii. Discuss the advantages and disadvantages of selling such a product in this market. [4]

The government has introduced new tax rules surrounding long-term care insurance premiums and benefit proceeds. According to the new tax rules, long-term care insurance premiums paid before retirement are tax deductible and the long-term care benefits are not taxable. Previously there was no tax deduction.

- iii. Describe the impact that the change in tax rules may have on the insurer's launch of this product. [4]

[Total 10]

#### QUESTION 5

MedCo is a medium-sized PMI insurer offering annually renewable comprehensive in- and out-of-hospital benefits.

MedCo's annual premium increases have been consistently higher than those of its competitors over the past three years due to increasing claims ratios. The Marketing Director of MedCo is concerned that the reason for the higher claims ratios might be due to its marketing strategy. She approaches you, a healthcare actuary working in MedCo's analytical department, to assist her in performing some analyses on the profile of the lives on book.

- i. Outline the main demographic analyses you would perform for the Marketing Director. [3]

Your analyses show that there have not been any marked changes in the demographic profile of the lives insured and that it is not likely to be the driving factor for adverse claims experience. The Marketing Director has suggested a comparison of main benefits offered by MedCo and its competitors.

- ii. Outline what high-level benefit comparisons you would include for the Marketing Director. [4]

**PLEASE TURN OVER**

The analyses show that the different insurers have similar benefit levels.

The Marketing Director next asks you to investigate the type of claims categories that have shown the biggest claims increases over the past three years. Your analysis shows that it is the hospital claims category that has consistently shown the biggest overall year-on-year claims increases.

- iii. Explain what type of further hospital analyses you would perform in order to determine the reason for the high hospital cost increases?

[4]

MedCo handles its own administration and managed care services. The managed care department has very few staff members and currently performs only a basic set of services with regards to medicine management and out-of-hospital claims management.

MedCo decides to approach QuickCare, a managed care services provider, to provide hospital benefit management services to MedCo.

- iv. List the type of managed care services that QuickCare could offer MedCo to assist with its hospital benefit management.

[3]

QuickCare also assist its clients in drafting alternative reimbursement agreements with its healthcare services providers.

- v. Describe the two types of alternative reimbursement models that MedCo could consider in order to reduce the risks associated with its hospital claims outgo. In your description, make reference to the following:

- a) The risks MedCo would transfer in each case
- b) Any perverse incentives created for the hospitals by each reimbursement agreement
- c) Ways in which QuickCare can manage these perverse incentives

[6]

QuickCare further suggests to MedCo that a chronic disease management programme would also be helpful in managing hospital claims.

- vi. Explain ways in which such a chronic disease management programme could assist with MedCo's hospital outgo.

[2]

[Total 22]

**PLEASE TURN OVER**

## QUESTION 6

CareCo is a relatively new insurer offering stand-alone critical illness products. They currently insure 20,000 lives.

- i. Outline how you would allow for the risk associated with pricing a product where there is a lack of data.

[5]

CareCo has managed to source the following data on critical illness rates for some of the main diseases their product covers.

Cause of illness	Incidence rate
Heart disease	0.00953
Stroke	0.00640
Cancer	0.01020
Other causes	0.00584

The total sum assured is R542.7million. The probability of NOT surviving the survival period is 0.0141. Note that 5% of all stroke cases were also included in the heart disease data.

- ii. Calculate the expected total claims cost for CareCo.

[3]

- iii. List 6 premium loadings that could be added to the expected claims cost to derive the final premium.

[3]

- iv. Explain the difference between stand-alone critical illness cover and accelerated critical illness cover.

[1]

You have done some research and data investigations to find that the proportion of deaths due to all causes other than the critical illnesses insured by CareCo is 62%. You also found that the expected mortality rate is 0.0082. The pricing actuary uses a total loading of 11.5% of gross premium for margin and expenses.

- v. Calculate the expected monthly premium for CareCo if their critical illness product was an accelerated critical illness product instead of a stand-alone product.

[4]

[Total 16]

**PLEASE TURN OVER**

## QUESTION 7

You are an actuary working for an established health insurer specializing in private medical insurance (PMI) and critical illness (CI) products that are exclusively available for large group clients operating in the mining, manufacturing and industrial sectors of the economy. Their group clients prefer to work through independent financial advisors with whom they have long standing relationships.

- i. List reasons why these clients would want to purchase (or facilitate the purchasing of) these products for their staff. [5]
- ii. Explain likely benefits of combining private medical insurance and critical illness insurance into one product. [4]
- iii. Indicate, with reasons, whether the exclusive use of independent financial advisors is an appropriate form of distribution for the insurance policies. [4]

The insurer is considering various growth opportunities to expand and diversify their business. The marketing director suggests that the insurer considers selling products to include individual clients. She argues that individual clients will help diversify the client base to counteract declining employment trends in the sectors.

- iv. Describe the implications to the insurer of expanding the business model to cater for individual policyholders in addition to group policyholders. [8]

[Total 21]

**END OF EXAMINATION**