

Actuarial Society of South Africa

COMPUTER BASED EXAMINATION

23 April 2019

Subject A213 — Contingencies

*Time allowed: 1 hour and 30 minutes plus 15 minutes reading time
Maximum: 50 marks*

INSTRUCTIONS TO THE CANDIDATE

1. *Follow log-in and saving instructions issued to you at the exam venue.*
2. *You have 15 minutes at the start of the examination in which to read the questions. You are strongly encouraged to use this time for reading only, but notes may be made. You then have 1½ hours to complete the paper.*
3. *The use of calculators is not permitted during the reading time.*
4. *You are given this question paper and three Excel files.*
5. *Mark allocations are shown in brackets. This exam has a total of 50 marks.*
6. *There are three questions. Attempt all questions. Each question is to be answered in a separate Excel file. A separate Excel file has been provided for each question.*
7. *The working of each part of the question should be on a separate sheet (tab). For example, question 1i should be worked out within the sheet (tab) i of the spreadsheet file named A213 Q1.*
8. *Where possible, summarise your answers for each question in the sheet (tab) named 'summary'.*
9. *You MAY NOT use any other computer program during the examination.*
10. *Save your work throughout the exam.*
11. *Upload the three Excel files with your solutions.*

Graph paper is NOT required for this paper.

Note: 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.

AT THE END OF THE EXAMINATION:

**Check that you have saved your work as per instructions given to you.
Hand in your question paper with any additional sheets firmly attached.**

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.

QUESTION 1

You have recently joined a new online only life insurance company. Your company spotted an opportunity in the market to provide life insurance to a niche market.

You are considering a brand new benefit design:

- The policy term is 15-years.
 - Premiums are payable annually in advance for the duration of the policy term, or until earlier death. The premium in the first year is R20 000 and increases with Consumer Price Inflation (CPI) on each policy anniversary.
 - The main target market is lives aged 30 years exactly.
 - The policy provides a benefit of R1 000 000 should death occur during the policy term and is paid at the end of the year of death.
 - If the policyholder survives to the end of the 15-year period, a survival benefit is payable.
- i. By projecting the expected cashflows in each year, show that the survival benefit that the company can offer under this policy is approximately R1.3 million using the following pricing basis:

Risk Discount and Investment Return Rate:	15% per annum
Mortality:	AM92 Ultimate increased by 50% (i.e. $q_x = 1.5 * q_x^{AM92 Ult}$)
Expenses	
Initial	R 1 400
Renewal	R 600 per annum in advance, increasing by CPI on every policy anniversary, from the first year onwards
CPI	6% per annum
Profit Margin	46.97% of the first year's premium
Reserves	No allowance is made for reserves

[15]

- ii. Determine the survival benefit that can be offered at each of the following profit margins: 20%, 50% and 80%. Comment briefly on the reasonability of your results. [6]
- iii. Discuss why it is appropriate in this case not to allow for any reserves in the cashflow projections. [4]

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- iv. Following a recent downgrade of the country's sovereign credit rating, the company can now only invest its reserves to earn an annual return of 14.75% rather than 15%.

The company has therefore decided to set up reserves by zeroising future negative cashflows. Determine the reserves to be held at each year of the policy as well as the revised profit margin. [10]

[Total 35]

QUESTION 2

A life aged 20 exactly purchases an assurance policy with a sum assured of R100 000 which is payable on survival to age 60 or at the end of the year of earlier death.

Calculate the expected present value of this policy by first creating a life table.

Basis:

Interest 6.5% per annum

Mortality $l_x = l_0 \cdot a^{-0.1x}$ where $a = 2.78$

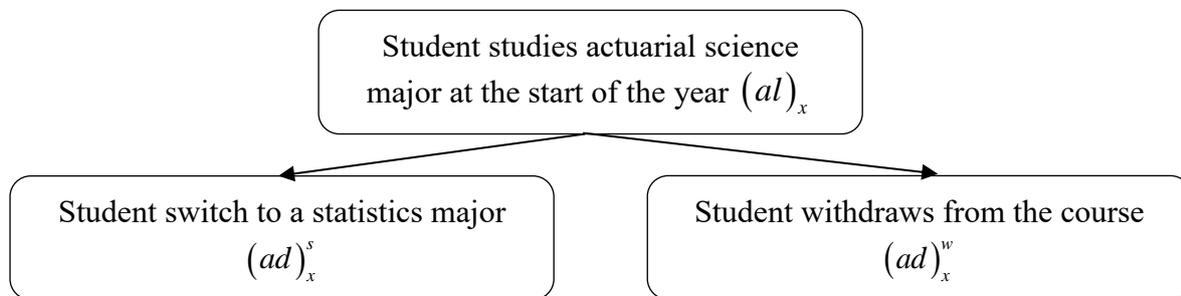
[Total 5]

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QUESTION 3

Actuarial College, a local institution offering a 2-year actuarial course, has shown a pattern for withdrawals as set out below. Students start by majoring in an actuarial science course. However, past studies show that some students opt to switch to a statistics major, with others dropping out of the course completely.



The following table shows the actual experience at Actuarial College:

Age	$(al)_x$	$(ad)_x^s$	$(ad)_x^w$
19	1 000	73	200
20	727	96	57
21	574		

- i. Calculate the dependent forces of decrement from the above multiple decrement table.

[3]

The Director of Studies has intervened and has introduced extra tutorials to assist students who enrol for the course. It is expected that the intervention will lead to an improvement of 40% in the independent forces of withdrawal for both years.

- ii. Calculate a revised decrement table assuming no change to the independent force of switching to a statistics major. State all the assumptions that you use.

[7]

[Total 10]

[GRAND TOTAL 50]

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END OF EXAMINATION