

Actuarial Society of South Africa

COMPUTER BASED EXAMINATION

10 OCTOBER 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 the Excel file.*
5. *Mark allocations are shown in brackets. This exam has a total of 50 marks.*
6. *There are two questions. Attempt all questions. Each question is to be answered on a separate Excel sheet as per the provided template.*
7. *You MAY NOT use any other computer program during the examination.*
8. *Save your work throughout the exam.*
9. *Upload the Excel file 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

An insurance company sells a 20-year unit linked endowment assurance to male lives aged exactly 40.

Annual premiums starting at R35 000 are paid in advance throughout the policy term or until earlier death. 90% of the premium is used to buy units at the offer price except in the first year where only 20% of the premium is used to buy units at the offer price. The compound premium increase rate is initially 6% per annum but increases to 7% per annum from the 11th policy anniversary onwards.

A bid-offer spread of 5% applies.

On death during the term of the policy, a benefit equal to the bid value of the units at the end of the year of death is paid, subject to a minimum benefit of R500 000. On maturity of the policy, the bid value of the units is paid plus a bonus of 10% of the bid value of the units.

Unit reserves equal to the bid value of the units are held. Rand reserves are calculated such as to zeroise any negative non-unit cashflows other than those occurring in the first year and calculated using the assumed return on the non-unit fund.

There are no annual management charges on the bid value of units.

Basis:

Risk discount rate	12%
Mortality	AM92 Ultimate
Initial expenses	R4 000
Renewal expenses	R1 000 at the start of the second policy year onwards and increasing at 5% pa thereafter
Unit fund growth rate	8% pa
Non-unit fund interest	4% pa

- i. Calculate the unit fund value at the end of each policy year assuming the policy is in force at the start of that policy year. [8]
- ii. Ignoring Rand reserves, calculate the profit signature for the policy and then determine the expected net present value of the profit for this policy. [12]
- iii. Then, determine the percentage reduction in the net present value of profit for the policy as a result of allowing for reserves. [11]
- iv. Explain whether you believe the result in iii) above is reasonable. [3]

[Total 34]

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QUESTION 2

A large South African energy producer considers offering its new employees some attractive new benefits to reduce the rate at which employees leave the company. They are currently seeing around 25% to 35% of employees resign each year. The majority of these resignations is in respect of younger employees.

The plan offers all new employees the following benefits:

1. Immediately on death, a benefit of R1 000 000 is paid to the estate of an employee if the employee dies due to an accident at work.
2. Immediately on disability, a guaranteed annuity benefit of R120 000 per annum is paid monthly in advance for a period of five years.
3. Immediately on resignation, a farewell benefit equal to R100 000 is paid.

The following multiple decrement table is provided, where d is for death, i is for ill-health disability and r is for resignation:

Age	$(al)_x$	$(ad)_x^d$	$(ad)_x^i$	$(ad)_x^r$
62	105 000	1 823	9 423	2 109
63	a	1 750	12 450	1 230
64	b	C	x	y
65	z			

The independent forces of transition are as follows:

$$\bar{\mu}_{64}^d = 0.035$$

$$\bar{\mu}_{64}^i = 0.030$$

$$\bar{\mu}_{64}^r = 0.020$$

The forces of transition can be assumed to be constant over each year of age.

- i. Determine the values of a , b , c , x , y , and z in the table above. [7]
- ii. Calculate the expected present value of the benefits for a male employee aged exactly 62 by using the completed multiple decrement table above.

Basis:

Interest 11.5% [9]

[Total 16]

[GRAND TOTAL 50]

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END OF EXAMINATION