

COMPUTER-BASED EXAMINATION

4 MAY 2023 (pm)

Subject A213 — Contingencies Intermediate Technical

Time allowed: One hour and forty-five minutes (which includes 15 minutes of reading time)

Total marks: 50

INSTRUCTIONS TO THE CANDIDATE

1. *Ensure that you are logged in and authenticated through Examity before you attempt the examination.*
2. *You are strongly encouraged to use the first 15 minutes as reading time only, however, you may start answering the paper whenever you are ready.*
3. *The question paper is only available on the ASSA Exam Platform as a PDF download and may not be printed.*
4. *An Excel answer template will be available for download on the ASSA Exam Platform.*
5. *Ensure that you have your exam permit handy. It reflects your candidate number to input on the first tab sheet within the Excel answer template. Do not use your name or member number anywhere on your answer script.*
6. *You may not access any file from your computer, use any other computer program (e.g., Email, MS Word or Excel), or open any other browser during the examination.*
7. *Mark allocations are shown in brackets.*
8. *Attempt all questions. Each question must be answered on a separate Excel sheet as per the provided template.*
9. *You may not use any other material (e.g., a Formulae and Tables book) during the examination. Any such information that may be required will be provided to you in the examination.*
10. *Save your work throughout the examination. Save your file using your candidate number as file name. Do not use your name or member number anywhere in your answer script nor as file name.*
11. *Upload your Excel answer file to the ASSA Exam Platform before the examination time expires. Take this into account when planning your review and submission. There will be no time announcements.*
12. *Once you have added your file, you must click on **Finish Attempt** to save your file. You will still be allowed to go back and make changes (**Review Attempt**) if you have time.*
13. *Once you are satisfied with your uploaded file, click **Finish Attempt** and **Finish All and Submit**. No further changes will be possible.*

Note: The Actuarial Society of South Africa will not be held responsible for any late submissions or loss of data where candidates have not followed instructions as set out above.

END OF INSTRUCTIONS

QUESTION 1

A life insurance company is busy updating their premium quotation system used by their intermediaries. As part of this exercise, the company is required to compile relevant mortality tables.

- i. Calculate ${}_t p_x$ and ${}_t q_x$ for ages 30 and 31, where $0 \leq t \leq 90$.

Basis:

Mortality AM92 Ultimate

[6]

- ii. Calculate the following actuarial functions for ages 30 to 31:

- a_x
- A_x
- ${}^2 a_x$
- ${}^2 A_x$
- $(I\ddot{a})_x$
- $(IA)_x$

Note: Functions with superscript 2 should be calculated at an interest rate of $(1+i)^2 - 1$.

Basis:

Mortality AM92 Ultimate

Interest 7.5% p.a.

[12]

- iii. Calculate the joint life annuity functions $\ddot{a}_{x:y}$ for a male aged 60 and females aged 55 to 58, respectively i.e. $\ddot{a}_{60:55}$, $\ddot{a}_{60:56}$, $\ddot{a}_{60:57}$ and $\ddot{a}_{60:58}$.

Incorporate the following annuity escalations/increases within the annuity functions:

- Escalation 1: females below age 57 at inception: 4% p.a. for first 15 years, 3% p.a. thereafter.
- Escalation 2: females aged 57 and above at inception: 3% p.a. for first 12 years, 2.5% p.a. thereafter.

Note that the first increase only takes effect from the start of the second year.

Basis:

Male mortality $q_x + 0.01\%$, where the q_x is as per AM92 Ultimate

Female mortality $85\% * q_y$, where q_y is as per AM92 Ultimate

Interest 6.5% p.a.

[6]

[Total 24]

**REMEMBER TO SAVE
PLEASE TURN OVER**

QUESTION 2

A person aged 70 exactly decides to invest his retirement savings of R1 250 000 in a tax-free unit-linked product which provides the policyholder with monthly payments from the unit fund. The rules of the unit-linked fund state that a policyholder is allowed to determine the annual amount that they wish to receive from the fund at the start of each year. The payment will be made to the policyholder at the end of each month. Upon death of the policyholder, the value of the unit fund at that point in time is paid to the beneficiaries of the policyholder.

The following charges are deducted from the unit-fund:

Initial advice fee:	3% of the single premium.
Renewal advice fee:	1% nominal per annum of the unit fund, for the first 5 years. The company deducts 1%/12 at the start of every month, including the first month.
Management fee:	2% nominal per annum of the unit fund, for the first 5 years. The company deducts 2%/12 at the start of every month, including the first month.

- i. Calculate the balance of the unit fund at the end of each month if the policyholder wishes to withdraw an annual amount of R120 000, payable monthly in arrears, in the first year. From the second year onwards, the policyholder has opted to increase the annual amount by 5% at the start of each year.

Basis:

Unit growth effective annual rate: 9% [8]

- ii. Determine the exact age to which any payment can be made to the policyholder. [1]
- iii. Determine whether this policy is profitable to the company or not.

You may assume that only unit reserves are held for this policy. You may assume that deaths are uniformly distributed between integer ages.

Basis:

Mortality	AM92 Ultimate
Non-unit growth effective annual rate	6%
Initial expense	R5 000
Renewal expenses	R3 600 p.a. incurred monthly, excluding the first month
Expense inflation effective annual rate	4% effective from the start of the second year
Risk discount rate	12% effective annual rate

[10]

- iv. Comment on one of the drawbacks of the current management fee structure for the company. [2]

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The policyholder wishes to have a unit fund balance of R200 000 at the time of his/her expected death, which his/her beneficiaries will inherit.

- v. Determine the maximum annual amount, payable monthly in arrears, that the policyholder can start withdrawing in the first year, and still meet the goal for his/her inheritance. (As before, this annual amount will increase at 5% per annum from the start of the second year onwards).

You may assume that no withdrawal payment will be made during the month of death and that the remaining unit fund will be paid to the beneficiaries at the end of the month of death. All other assumptions remain the same.

Basis:

Mortality

AM92 Ultimate

[5]

[Total 26]

[GRAND TOTAL 50]

REMEMBER TO SAVE

END OF EXAMINATION