

# EXAMINATION BOOKLET

June 2015

## Module 5: Models and Audit Trails

**This document must be destroyed after the examination has been completed**

**Please note that the content of this booklet is confidential and students are not to discuss or reveal the contents under any circumstances.**

### Examination instructions

1. You must download the exam assignment at the start of the exam time stated. All times given are UK times. Please note that it will not be available to you at any other time. The exam period commences at 09:00 and ends at 12:15. The exam paper is three hours plus 15 minutes reading time. **It is your responsibility to ensure that all of your files are submitted within this time limit. Failure to do so will result in your assignment not being marked.** To submit your assignment please upload as instructed or email your files to [online\\_exams@actuaries.org.uk](mailto:online_exams@actuaries.org.uk). Only your first submissions will be accepted and marked.
2. You may refer to any written or electronic reference material provided as part of the Module 5 exam. You have been supplied with all data electronically at the start of the exam time. It is recommended that you use the first 15 minutes as reading and planning time.
3. The work you submit **MUST** be saved in Microsoft 2007 format, i.e. using docx (Word) or xlsx (Excel) file extensions. Do not embed documents in your spreadsheet.
4. You must build your model from scratch and not use an imported e-template.
5. You are required to work through the exam assignment without assistance from another person. The assessment regulations of the Institute and Faculty of Actuaries apply as set out in the Examination Regulations except that you may refer to reference material. By submitting your files you are confirming that all material is entirely your own work and you wish this to be taken into account for this assessment.
6. Save your work regularly. You do not have to print out your work but you may choose to do so from time to time if you prefer to check a printed copy. Saving your work is your responsibility so failure to do so will not be a significant mitigating circumstance.
7. You must not discuss or disclose the material. To do otherwise may lead to a disciplinary case.
8. You are reminded that by undertaking this exam you are bound by the Institute and Faculty of Actuaries' Examination Rules and Regulations.
9. At the end of the allotted time or when you have completed your exam, you need to submit your work.

Your filenames must include your ARN (e.g. Summary\_90XXXXXX.docx) and each file should also contain your ARN as a header or footer on at least one page. You will receive an acknowledgement by email from the Online Exams Team confirming receipt. The Online Exams Team will send you an email after the exam requesting you to delete all your files relating to the exam, together with your planning notes and any print-outs. If you experience difficulties in submitting your work, you must inform the Online Exams Team immediately at [online\\_exams@actuaries.org.uk](mailto:online_exams@actuaries.org.uk) or T. +44 (0)1865 268 255.

**Professional behaviour is mandatory and no material relating to the exam may be disclosed or discussed with others, nor used in a further attempt at the exam.**

**Failure to comply with this will be deemed to be a breach of examination regulations and may result in disciplinary action.**

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## Background

You work for a company that provides its own retirement savings scheme. Your manager is preparing a presentation for new joiners giving information about the scheme.

The scheme operates as follows:

- Each employee has their own individual fund.
- A percentage of their salary is contributed into their fund each month.
- Salaries are assumed to increase at a fixed rate each year.
- The fund grows with investment returns each year.
- On their 65<sup>th</sup> birthday, the employee retires and can use their fund as they wish.

Your manager wants to show how the scheme will work for a new starter in the following scenario:

- They join the scheme on their 25<sup>th</sup> birthday.
- Total annual contribution is 8.0% of salary.
- Starting salary is £20,000 per annum.
- Salary is expected to increase by 4.0% per annum on their birthday.
- Investment return is expected to be 5.0% per annum.

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# PART 1

Your manager has asked you to construct a model to work out the potential size of an employee's investment fund at retirement age (the "final fund value"). To enable employees to understand the size of their fund in relation to the cost of living he would like the fund to be expressed in terms of today's money. You have been told to simplify the calculations by assuming that each year's contributions are made as a single payment half-way through the year.

Your manager also wants to show how the investment return could affect the size of the final retirement fund, and also the effect of any delay in joining the scheme.

The model should include checks throughout; there are 10 marks available for reasonableness checks and automated checks.

- (i) Set up a spreadsheet to include separate worksheets for the parameters and fund value calculations. [2]
- (ii) Identify the parameters for the model and set these out in the parameters worksheet. [3]
- (iii) In the fund value calculations sheet, construct a table to project, for each year from age 25 to 65:
  - (a) the contribution amount in £s.
  - (b) the total fund value at the end of each year.
  - (c) any intermediate calculations you feel necessary. [6]
- (iv) Calculate the final fund value expressed in terms of today's money, using expected price inflation of 2.5% per annum. [1]
- (v) Construct a new worksheet and repeat the projections in parts (iii) and (iv) for each of the investment return assumptions below. You will need to set up a separate table for each interest rate.
  - (a) 2.5% per annum
  - (b) 7.0% per annum. [3]
- (vi) Show your results to parts (iv), (v)(a) and (v)(b) in a Column Chart. [3]
- (vii) Construct a new worksheet to repeat the projections in parts (iii) and (iv) with contributions starting on the birthdays below. The employee is currently aged exactly 25. Use an investment return of 5.0% per annum.
  - (a) 35
  - (b) 45 [2]
- (viii) Use your answers to parts (vii)(a) and (vii)(b) to calculate the contribution required, with the delay in joining the scheme, to achieve the same final fund value as if there had there been no delay. Express your result as an annual percentage of salary. [2]

(ix) Create a summary worksheet to present the results of the analysis. [2]

(x) Show the contribution rates from part (viii) on a suitable chart. [2]

**Marks available for spreadsheet model:**

**Model accuracy, completeness and good modelling techniques [26]**

**Checks [10]**

**[Sub-total 36]**

## PART 2

You need to document all your work in an audit trail so that a fellow Analyst student (with similar experience to yourself) could:

- peer review and check your model.
- continue to work on your model.
- use your model again for a similar purpose in the future.

Your audit trail should include the following aspects:

- the purpose of the model
- any assumptions you have made
- any limitations of your assumptions or of the model
- your methodology, i.e. a description of what you have done, and how and where in the model you have done it
- an explanation of all the checks you have performed
- a description of your summary of the results and of the charts you have produced

The audit trail can be in a separate worksheet within your Excel model or in a separate Word document.

### Marks available for audit trail:

#### Audit approach

**Fellow Analyst student can review, check and modify the model** [10]

**Written in clear English** [5]

**Written in a logical order** [3]

#### Audit content

**All model steps accurately covered** [20]

**All checks clearly recorded** [10]

**All steps clearly explained** [8]

**Clear signposting** [4]

**Clear labelling** [4]

[Sub-total 64]

[Total 100]

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