INSTITUTE AND FACULTY OF ACTUARIES

EXAMINATION BOOKLET

May 2016

Certified Actuarial Analyst

Module 5: Models and Audit Trails

This document must be destroyed after the examination has been completed

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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 assessment 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 assessment not being marked.** To submit your assessment please upload as instructed or email your files to 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 assessment without assistance from another person. The exam 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. 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. 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.

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. Worksheet_90XXXXX.docx) and each file should also contain your ARN as a header or footer on at least one page. If you experience difficulties in submitting your work, you must inform the Online Exams Team immediately at 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

Each year a charity receives annual donations from a number of individual donors.
The charity has provided you with data for each donor for years 2011 to 2015 (inclusive).
For each donor you are provided with:

- first name initial
- surname
- gender
- date of birth
- annual donation amounts for each year

The charity is interested in the pattern of donations each year and what the expected total donation may be for 2016.

Donors may cease giving but it is assumed that if this happens, the donor makes no further donations. The data does not include any additional one off donations.

PART 1

Your manager has asked you to construct a spreadsheet model for the donations. You are required to carry out checks throughout. In addition to the marks awarded for steps (i) to (xiii) below, there are 8 marks available in total for reasonableness checks and automated checks.

(i)   Set up a spreadsheet to include separate worksheets for the data, amended data, parameters, analysis, results, and any other worksheets as required.   [2]

(ii)   Validate the data supplied by the charity, amend any missing or invalid data items and calculate the following summary statistics for each year both before and after amending the data:

- minimum donation
- maximum donation
- average donation
- number of donors

[7]

Hint: to verify whether a data entry is valid you should consider acceptable values for lower and upper limits, where appropriate, and test that the values lie within those limits
Hint: If a donation is above your upper limit, or nil (but the donor appears to be continuing to contribute), use the average donation for that donor over the previous and following years.

(iii)   In the analysis worksheet, calculate:

- Which age group each donor is in as at 1 January 2016, the age groups being 20s, 30s, 40s and 50s
- the annual increase per donor for each of the years
- the average annual increase for each donor over the whole period
- the average annual increase over all donors over the whole period

[7]

(iv) In the results worksheet, calculate the total donations for each year, split by gender. [1]

(v) Construct a suitable chart to show the total donations each year and also the total donations by gender, as determined in part (iv). Produce your charts in the results worksheet. [2]

(vi) Still in the results worksheet, calculate the total donation for 2015, split by age group 20, 30, 40 and 50. Then calculate the average amount donated by each donor in 2015, also split by age group 20, 30, 40 and 50. [1]

(vii) Construct a chart to illustrate the average amount donated by each donor in year 2015 for each age group, as determined in part (vi). Produce this chart in the results worksheet. [2]

(viii) Again in the results worksheet, calculate the minimum, average and maximum annual increases for the total donations over the years 2011 to 2015. [1]

(ix) Construct a chart to illustrate the minimum, average and maximum annual increases, as determined in part (viii). Produce this chart in the results worksheet. [2]

The charity hopes that each donor will increase their donation in 2016. It is hoped that those who donated less than £200 in 2015 will increase their donation by 4% compared to 2015 and those who donated more than £200, by 6%. However, they also assume that exactly one of the donors will stop donating. The director of the charity has told your manager that the target total donation for 2016 is £6,000.

(x) Identify the parameters for the model and set these out in the parameters worksheet. [2]

(xi) In the analysis worksheet, calculate the expected annual donation for each of the current donors and hence calculate the expected total donation for 2016.

Hint: To allow for the assumption that exactly one donor ceases to donate, assume that this is equivalent to the same proportionate reduction in donation for each current donor, i.e. each donation increases by 4% or 6% but also reduces by 1 in 28 to allow for the probability that one donor will cease. [4]

(xii) Again in the analysis worksheet, calculate the total expected donation for 2016 and calculate (in £s) any shortfall or excess compared to the £6,000 target. [2]

(xiii) In order to meet the £6,000 target, calculate the required increase in donations for those who donated over £200 in 2015. Continue to assume that those who contributed less than £200 increase their donation by 4%. [3]

Marks available for spreadsheet model:

Model accuracy, completeness and good modelling techniques **[38]**
Reasonableness and automated checks **[8]**

[Sub-total 46]

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, and
- run your model on different assumptions, or extend your model to allow for extra data fields or scenarios

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**   **[8]**
- **Written in clear English**   **[4]**
- **Written in a logical order**   **[3]**

Audit content

- **All model steps accurately covered**   **[18]**
- **All checks clearly recorded**   **[7]**
- **All steps clearly explained**   **[8]**
- **Clear signposting**   **[3]**
- **Clear labelling**   **[3]**

[Sub-total 54]

[Total 100]

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