CAA GLOBAL

EXAMINERS' REPORT

CAA Module 5
Models and Audit Trails

May 2017

Introduction

The attached report has been written by the Principal Examiner with the aim of helping candidates, both those who are sitting the examination for the first time and using past papers as a revision aid and also those who have previously failed the subject.

The specimen solutions are based on one possible approach to modelling the scenario set but the examiners gave credit for any alternative approach which they considered to be reasonable.

L Hatter
Chair of the Board of Examiners

June 2017

General comments on Module 5

Module 5 aims to ensure that successful candidates can model data and develop an audit trail to document the work done.

Part 1 of this examination tests the ability to produce a complete and accurate model using sound and simple techniques, and the ability to perform reasonableness checks and automated checks throughout. Candidates are therefore expected to have a working knowledge of spreadsheets.

Candidates are expected to include checks within their models and specific marks are awarded for these. The number of marks available for checks gives a guide as to how many distinct checks are required.

Part 2 of this examination tests the ability to produce an audit trail that documents all the work done, including the methods, the parameters, the checks performed and the results of those checks. This can be done in a separate sheet within the spreadsheet model or in a separate Word document.

It should be noted that there will generally be more marks available for Part II than for Part I to reflect the importance of good communication and documentation when producing models.

General comments on Examination

This examination involved projecting the likely performance of an investment asset. The projections covered a 10 year period and allowed for the change in value by the asset return at the end of years 1 to 10.

Candidates were provided with some data giving simulations of annual asset returns for the investment asset. Candidates were required to check (but not amend) this data before using it to project expected asset values over each future annual period. Further calculations and charts were then required, based on these numbers.

This exam primarily required the ability to perform data validation and analysis.

The model should be robust and adaptable with as much automation as possible such that, for example, if an alternative set of simulations were used, the changes would feed through without further intervention. Candidates will therefore have lost marks for copying and pasting the data between worksheets (as opposed to linking all future calculations to the raw data). The use of named data ranges can be helpful for understanding and adapting the model.

The most common reason for failure in this sitting (as in previous sittings) was due to an inadequate audit trail. When describing methodology, students should note that they need to state their methods and logic for each stage of the calculation clearly (in words rather than using formulae or Excel functions). Further, a simple statement that a calculation has been done, with no explanation as to how, will not be sufficient.

A possible model with an audit trail is posted on the website. It should be noted that this may include more detail than would ordinarily be possible within the time allowed for the examination.

END OF EXAMINERS' REPORT

CERTIFIED ACTUARIAL ANALYST GLOBAL

10 May 2017

Module 5: Models and Audit Trails

Time allowed: 3 hours + 15 minutes reading time

INSTRUCTIONS TO THE CANDIDATE

1. You have 15 minutes reading time 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 3 hours to complete the paper.

2. You must build your submission from the beginning and not use an imported e-template.

Your file names must include your ARN, the name of the document and the paper sat (e.g. 9000000-Summary) and each file should contain your ARN as a header or footer.

Please note that the content of this booklet is confidential and students are not to discuss or reveal the contents under any circumstances nor are they to be used in a further attempt at the exam.

If you encounter any issues during the examination please contact the Online Education team at online_exams@actuaries.org.uk T. 0044 (0) 1865 268 255

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Background

An actuary, Alex, is modelling the behaviour of an investment asset. She wishes to use a simple projection to simulate the behaviour of the asset over the next 10 years.

Alex has written a program that randomly generates some annual returns for the asset and is in the process of testing this. She has asked you to help by analysing a small subset of the output. The model does not allow the value of the asset to become negative. However, there is no limit to the amount by which the asset can increase in value over a year.

You have been provided with 100 sets of 10 annual asset returns which are to be used to produce 100 sets of 10-year projections. The value of the asset starts at £10,000 at the beginning of year 1 and will change in value by the annual asset return each year for years 1 to 10.

PART 1

Alex has asked you to construct a spreadsheet model for projecting the value of the asset. You are required to carry out checks throughout your calculations in order to validate the results. In addition to the marks awarded for parts (i) to (xiii) below there are 8 marks available for reasonableness checks and automated checks.

(i)   Set up a spreadsheet to include separate worksheets for the data inputs, the asset value projection calculations, and any other worksheets for any further calculations that will be required.   [2]

(ii)   Carry out a range of checks on the data provided and comment on whether it appears to be sensible. You are not required to make any alterations to the data.   [5]

(iii)   Identify the parameters for the model and set these out in the parameters worksheet.
                                                                                                                        [1]

(iv)   In the projection worksheet, use the data to produce 100 sets of 10-year projections. Show the value of the asset at the end of each year.   [4]

(v)   Using a new worksheet, calculate the total return over the whole 10-year period for each of the 100 projections.   [1]

(vi)   Using the same worksheet, use the results from part (v) to calculate the average annual compound return for each of the 100 projections.   [1]

(vii)   Using the same worksheet, for each year of the projection, calculate the following values for the 100 projections:

    (a)   the maximum
    (b)   the minimum
    (c)   the median
    (d)   the mean

                                                                                                                        [4]

(viii)   Still using the same worksheet, for each year of the projection, calculate for the 100 projections:

(a)   the 25th percentile (defined as 0.25 * 25th smallest value, plus 0.75 * 26th smallest value)

(b)   the 75th percentile (0.75 * 75th smallest value, plus 0.25 * 76th smallest value)

[4]

Hint: You can use the SMALL function SMALL(range, n) to find the nth smallest number in a range.

(ix)   Construct a line chart to show the median, the 25th percentile and the 75th percentile values for each year, as determined in parts (vii)(c), (viii)(a) and (viii)(b).   [4]

(x)   Determine the proportion of projections that have a value at the end of the period that is less than the starting value.   [2]

(xi)   For those loss-making projections in part (x), calculate the average monetary amount of the loss over the 10 year period.   [2]

(xii)   Determine how many of the projections from part (vi) have annualised returns over the 10 years in each of these ranges:

$$
\begin{array}{rcll}
-10\% & \leq x < & -5\% \\
-5\% & \leq x < & 0\% \\
0\% & \leq x < & 5\% \\
5\% & \leq x < & 10\% \\
10\% & \leq x < & 15\% \\
15\% & \leq x < & 20\% \\
20\% & \leq x < & 25\%
\end{array}
$$

[4]

(xiii)   Construct a column chart to illustrate the results from part (xii) and show this in a separate worksheet.   [4]

Marks available for spreadsheet model:

Model accuracy, completeness and good modelling techniques   **[38]**
Reasonableness and automated checks, other than in part (ii)   **[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 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** **[19]**
- **All checks clearly recorded** **[8]**
- **All steps clearly explained** **[7]**
- **Clear signposting and labelling** **[5]**

[Sub-total 54]

[Total 100]

END OF PAPER