

INSTITUTE AND FACULTY OF ACTUARIES

18 October 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

The racing committee of your local cycling club has been organising some weekly cycling races during the summer months in which participants have to complete a 10 mile course on their bicycles as quickly as they can. The same course is used every week and each rider is timed to the nearest second. Eligible participants compete in three main competitions; at the end of the season there will be trophies for the winners and runners up.

Although there are nearly 60 potential participants, there is a limit of 20 riders allowed in each race and therefore not every rider can ride in every race.

“Fastest” Competition

The first trophy is given to the rider who completes the course in the fastest time. All riders between the ages of 18 and 80 are eligible for this competition.

“Average” Competition

The second trophy is given to the rider with the best average time across all the rides they participated in. Only riders who have ridden, and recorded times in, a minimum number of races during the season are eligible to participate in the average trophy. All riders between the ages of 18 and 80 are eligible for this competition.

“Veterans” Competition

The third trophy is given to the fastest veteran rider. A rider must satisfy particular criteria to be eligible to enter the veterans’ competition, and further details of the criteria are outlined below.

The racing season has just finished and the results of each race have been recorded in a spreadsheet. One of the committee members would like you to help him to analyse the results and hence determine who the winners are for each of the three competitions. The spreadsheet you have been given shows the name and date of birth for each cyclist as well as their recorded times, week by week. Where a result is blank, this signifies that the cyclist did not participate in that particular race.

Hint: you will need to use the custom mm:ss formatting style for cells that denote times, as has been used for the data provided.

PART 1

The committee member has asked you to construct a spreadsheet model to analyse the race results. You are required to carry out checks throughout.

- (i) Set up a spreadsheet to include separate worksheets for the “data”, “parameters”, “fastest&average”, “veterans”, “results”, and any other worksheets as required. [2]
- (ii) Perform a range of checks on the data provided to check the validity of the data, and comment on whether the data appears to be reasonable. For example, check that the race times are sensible. You are not required to make any alterations to the data. [9]
- (iii) In the “fastest&average” worksheet, calculate the fastest time for each rider. [4]
- (iv) Hence determine which three cyclists will take the first, second and third position trophies for the “fastest” competition. [2]

The racing committee is considering the minimum number of races that a participant must complete during the 2017 season to be eligible to enter the “average” competition.

- (v) Still in the “fastest&average” worksheet, calculate the number of races each cyclist has participated in. [1]
- (vi) For those riders who have participated in at least 4 races, calculate their average time and hence determine the cyclists who will take first, second and third positions for the “average” competition. [4]
- (vii) Repeat part (vi) for those riders who have participated in at least 6 races. [3]

It is acknowledged that, all other things being equal, older riders would be expected to ride more slowly than younger riders. The “veterans” competition aims to standardise for the effect of age in order to make a fairer comparison between the achievements of riders of different ages. This is achieved by setting a standard time for each age and judging each rider’s performance against that standard time.

The rules for this competition are as follows:

- To be eligible for the “veterans” competition, riders must be aged 40 or over.
- For this year’s competition, the age of each rider is defined as their age at their last birthday, in whole years as at 1 March 2017.
- All ages will be treated as integer values.
- The age standard time for a 40 year old on this course is 25.00 minutes.
- For every additional year of age up to and including age 49, the age standard time increases by 11 seconds.
- For every additional year of age between ages 50 and 59, the age standard time increases by 12 seconds.

- For every additional year of age between ages 60 and 69, the age standard time increases by 13 seconds.
- For every additional year of age between ages 70 and 80, the age standard time increases by 14 seconds.

(viii) In the “veterans” worksheet, calculate the age of each rider. For this purpose, you should assume that there are 365.25 days in each year. [2]

(ix) In the “parameters” worksheet, generate the age standard times for each age up to and including age 80. [6]

(x) Assign an age standard time to each individual veteran rider in the “veterans” worksheet. [4]

(xi) Compare each veteran rider’s fastest time to their age standard time and hence determine which three cyclists will take the first, second and third position trophies for the “veterans” competition. [6]

Note: Excel cannot display negative times. Where a calculated time difference is negative, the cell contents will display as “#####” and it is acceptable to retain this formatting within your worksheet.

(xii) Produce a summary table in the “results” worksheet to show who the three prize winners are for each competition; this should include the results for both versions of the “average” competition. [3]

Marks available for spreadsheet model:

Model accuracy, completeness and good modelling techniques [46]

[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 any charts you may 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** [7]
- **Written in clear English** [5]
- **Written in a logical order** [3]

Audit content

- **All model steps accurately covered** [20]
- **All checks clearly recorded** [6]
- **All steps clearly explained** [7]
- **Clear signposting and labelling** [6]

[Sub-total 54]

[Total 100]

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