CAA GLOBAL

EXAMINATION

17 May 2023 (am)

Module 5: Models and Audit Trails

Time allowed: Three hours and fifteen minutes

INSTRUCTIONS TO THE CANDIDATE

1.   You are given this question paper and an Excel file.

2.   Mark allocations are shown in brackets.

3.   Attempt all questions. Questions are to be answered as per 'exam requirements'.

If you encounter any issues during the examination please contact the Assessment Team on
T. 0044 (0) 1865 268 873.

Background

You are an independent actuarial advisor and you have been employed by the government of Country A to perform some analysis to help them determine their Olympic funding plan. The two sports you will be analysing are the high jump and the long jump. There are separate events in each sport for men and women, and therefore there are four events in total.

The government of Country A has provided you with two sets of data. The first data set shows the historic medal winners across each event for the period 1980–2020. The data shows the sex ('M' for male or 'F' for female) and team of each medal winner, and the year, event and type of medal (bronze, silver or gold). The second data set shows the winning distance or height in metres for each event for the period 1964–2020.

Country A has not performed very well in these sports historically, and they have raised $50m to invest in athlete development. They would like your help in determining how to allocate the $50m across the four events to increase Country A's chances of winning more medals in these events.

The government of Country A acknowledges that Country B's team has performed the best historically, in terms of number of medals won. However, Country A's aim is to outperform the teams with comparable historic performance. You have been asked to create a chart and table analysing some of the historic data to help motivate the team.

You have also been asked to perform some analysis on the winning distances or heights for each event, so that the coaching team know what performance they need to be aiming for.

The government of Country A is considering two options for determining how to split the $50m athlete development fund between the four events. The two options are as follows:

Option 1: Allocate twice as much money to high jump events as to long jump events, and allocate 60% of the total funding to women's events.

Option 2: Allocate the total funding to each event based on the factor multiples set out in the following table, where x is an amount in dollars ($) that will depend on the total funding amount and total number of medals. See the 'Additional guidance' for an example of how these factors would be determined.

Number of medals (1980–2020)	Gender	
	Men's	Women's
0	$4x$	$6x$
1	$3x$	$4.5x$
2	$2x$	$3x$
3	x	$1.5x$

Additional information

When performing the calculations, you should assume the following:

- The Olympics are held every 4 years.
- You do not need to make any adjustment to allow for the fact that the 2020 Olympics was actually held in 2021.
- 100% of the $50m of funding will be allocated across the four events.
- You do not need to use Excel Solver or GOALSEEK.

PART 1

(i)   Construct a spreadsheet model to include separate worksheets for data, data checks, parameters, medal analysis, distance analysis, funding calculations and any other worksheets as required.   [2]

(ii)   Carry out a range of checks on the data provided and comment on whether the data appears to be sensible, given the information that has been provided. You are NOT required to make any alterations to the data.   [4]

(iii)   Identify and set out the parameters for the model you are going to use in the 'parameters' worksheet.   [3]

(iv)   Plot the total number of medals won by Country B's team over the period 1980–2020 on a suitable chart, showing the total number of gold, silver, bronze and total medals separately.   [4]

(v)   Create a table showing the total number of gold, silver and bronze medals won by teams for Country A, Country C, Country D, Country E and Country F over the period 1980–2020.   [4]

(vi)   Plot the winning distance/height for each of the four events over the period 1964–2020 on a suitable chart.   [3]

(vii)   Calculate the average percentage change in winning distance/height per Olympics separately for each of the four events.   [4]

(viii)   Calculate the expected winning distance/height in the 2024 Olympics for each of the four events if they increase at the same average rate.   [2]

(ix)   Calculate the total number of medals that Country A's team has won separately for each of the four events over the period 1980–2020.   [2]

(x)   Calculate the amount of funding that Country A's team should allocate to each of the four events using Option 1.   [5]

(xi)   Calculate the amount of funding that Country A's team should allocate to each of the four events using Option 2 and using your result from part (ix).   [5]

Marks available for spreadsheet model:

Model accuracy, completeness and good modelling techniques and data validation of initial data (part (ii)).   [38]

Reasonableness and automated checks, other than in part (ii).   [4]

[Sub-total 42]

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.
- 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
- A description of the data used
- 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 to calculate the required values, and how and where in the model you have done it
- An explanation of all the checks you have performed
- Your key results
- A description of the charts you have produced.

The audit trail should be 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 included   [21]
- All checks clearly recorded   [8]
- All steps clearly explained   [8]
- Clear signposting and labelling.   [6]

[Sub-total 58]
[Total 100]

Additional guidance

Average percentage change in winning distance/height

To calculate the average percentage change in winning distance/height per Olympics, the first step is to determine the number of Olympic periods, **n**, covered by the data set as follows:

n = (last Olympic year – first Olympic year)/4

The average percentage change is then calculated as follows:

$$\left(\frac{\text{last winning distance/height}}{\text{first winning distance/height}}\right)^{\frac{1}{n}} - 1$$

Option 2: Example

This example sets out how the funding would be determined under Option 2 for the following situation:

Country 123 has $100m in total funding to allocate. Over the period 1980–2020, they have won zero medals in the men's high jump, one medal in the men's long jump, two medals in the women's high jump and two medals in the women's long jump.

The table of factor multiples is then used to determine the relevant factors for each event:

Number of medals (1980–2020)	Sex of event	
	Men's	Women's
0	4x	6x
1	3x	4.5x
2	2x	3x
3	x	1.5x

The relevant factors are therefore 4x for men's high jump, 3x for men's long jump, 3x for women's high jump and 3x for women's long jump.

The total funding is $100m and all of it is allocated to these four events. Therefore:

4x + 3x + 3x + 3x = $100m

Solving this equation gives **x = $7.6923m**. Therefore, the funding allocated to men's high jump (4x) is $30.769m, and $23.077m is allocated to each of the other three events.

END OF PAPER