

Main Examination period 2020 – January – Semester A

MTH4114: Computing and Data Analysis with Excel

Duration: 2 hours

Apart from this page, you are not permitted to read the contents of this question paper until instructed to do so by an invigilator.

You should attempt ALL questions. Marks available are shown next to the questions.

INTERNET ACCESS. You can access the internet to download and upload the exam materials from QMPlus, and e.g. to look up Excel Help. You CANNOT use the internet to communicate (or attempt to communicate) with anyone. If you are caught using email, instant messaging (e.g. Facebook) or any other potential method of communication, you will have committed an assessment offence.

Calculators are not permitted in this examination. The unauthorised use of a calculator constitutes an examination offence.

Complete all rough work in the answer book and cross through any work that is not to be assessed.

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Exam papers must not be removed from the examination room.

Examiners: T. Popiel and L. Wunderlich

Additional Instructions and Notes.

(1) Download the Excel workbook "Answer Booklet" from the "January 2020 Exam" section of the MTH4114 QMPlus page, and save it to your computer's "G" drive.

(2) The workbook contains four worksheets: "Question 1", "Question 2", "Question 3", "Question 4". Answer each of the four questions in the corresponding worksheet.

(3) There is also a fifth worksheet, called "Marks" — do **not** edit this worksheet; it is for your lecturers to enter your marks only.

(4) Save your work regularly throughout the exam. When you have finished the exam, upload your saved workbook to the "Exam Submission" assignment in the "January 2020 Exam" section on QMPlus.

(5) The total number of marks available in this exam is 100. Of these, **5 marks are available for presentation and proper organisation of work.**

Question 1 [25 marks]. Download the CSV file "Q1 data" from the "January 2020 Exam" section on QMPlus. This file contains weekly stock price data for two mining companies, RIO (Rio Tinto) and BHP, in a certain 6-month period.

- (a) Import the data from the file "Q1 data" into the "Question 1" worksheet of your answer file. The dates should be listed in column A, and the stock prices of RIO and BHP should be listed in columns B and C, respectively. [2]
- (b) Draw a single line chart showing the prices of both stocks versus the date. Add an appropriate title and appropriate axis labels to your chart. [5]
- (c) Calculate the weekly returns for both stock prices. The RIO returns should be listed in column D, and the BHP returns in column E. [4]
- (d) Draw a scatter plot showing the BHP returns (on the y-axis) against the RIO returns (on the x-axis). Include an appropriate title and appropriate axis labels. [5]
- (e) Perform a linear regression analysis, assuming that the BHP returns are the dependent (y) variable and the RIO returns are the independent (x) variable. [5]
Hint: You may need to load the **Analysis ToolPak**. If you do not remember how to do this, instructions are provided in the PDF file "Instructions for loading the Analysis ToolPak", located in the "January 2020 Exam" section on QMPlus.
- (f) Provide a short commentary on the regression output, explaining the dependence of the BHP returns on the RIO returns. [4]

Question 2 [25 marks]. In the "Question 2" worksheet of your answer file, the cell range F1:L11 contains data about the marks of 10 mathematics students. The data for each student comprises: their ID number, forename and surname, and their marks in four modules. The accompanying cell range A1:D11 also contains the students' ID numbers, along with three empty columns which you will need to complete by using the data in cells F1:L11 and appropriate Excel functions.

- (a) Convert the cell range F1:L11 to a table named "Marks". [4]
- (b) Use VLOOKUP and AutoFill to enter the students' surnames in cells B2:B11. The names should correspond to the correct ID numbers in cells A2:A11; for example, cell B2 should contain the surname "West". [6]
- (c) Use VLOOKUP, AVERAGE and AutoFill to calculate the average mark for each student across the four modules, in column C. For example, cell C2 should contain Sarah West's average mark, which is $(92 + 85 + 79 + 68) / 4 = 81$. [8]
- (d) A "First Class" student is one whose average mark is at least 70. Use the IF function and AutoFill to enter Boolean values TRUE or FALSE into column D according to whether the students are First Class students or not. [5]
- (e) Use COUNTIF to calculate the total number of First Class students in cell A14. [2]

Question 3 [15 marks]. In the "Question 3" worksheet of your answer file, the cell range A5:E150 contains a table with sales data for a certain cosmetics store. Each row represents one transaction, and comprises the following data: the name of the Salesperson, the transaction Date, the Product that was sold (e.g. eyeliner, mascara), the number of Units that were sold, and the store Location (e.g. south, midwest).

(a) Use an Advanced Filter to show only those transactions that satisfy:

- Salesperson is "Zaret" and Product is "mascara"; **or**
- Salesperson is "Betsy" and Location is "east".

Put the filtered data into a new cell range, beginning in cell G1. (Do **not** filter the table in place.)

[8]

(b) Construct a Pivot Table showing the sum of Units of each Product sold by each Salesperson. Put your Pivot Table into a cell range beginning in cell M1.

[7]

Question 4 [30 marks]. Solve the following problems in the "Question 4" worksheet of your answer file.

(a) Use appropriate matrix calculations to solve the following system of equations:

$$\begin{aligned}x + y - 2z &= 6 \\x - 2y + z &= -5 \\3x + y + 3z &= 2\end{aligned} \quad [8]$$

(b) The following function has precisely one (real) root:

$$f(x) = \cos(x) - x$$

(i) Generate a list of 11 equally spaced points in the interval $-2.5 \leq x \leq 2.5$, and use it to draw a chart plotting $f(x)$ over this interval. [5]

(ii) Use the bisection method to calculate the root of $f(x)$ correctly to 3 decimal places. [9]

(c) Use the trapezium rule with 4 subdivisions (i.e. with $N = 4$) to approximate the value of the following integral:

$$\int_2^6 x^2 \sqrt{x^2 - 1} \, dx \quad [8]$$

End of Paper.