

Part A. Excel

Use Excel software to do the following (save the file on a floppy disk (A: drive) under the name #####.xls, where the #s represent your student number):

- i. Format your Excel sheet to look as the following sheet:

The screenshot shows an Excel spreadsheet with the following elements:

- Cell C1:** A text box containing "Name:", "Student No.:", and "Computer:".
- Cell C5:** A cell containing "Pi = 3.14159265".
- Cell B7:** A cell pointing to the first row of a table.
- Cell A18:** A cell pointing to the "Average", "Min", and "Max" rows of a table.
- Table:** A table with 4 columns: "x", "Circle Area", "f(x)", and "g(x)". The first 10 rows have "x" values from 1 to 10. The last three rows are "Average", "Min", and "Max".

Use font Arial, size 12 pt, center justified. Table headings should be **bold** and shaded.

- ii. Use equations to calculate the following:
- For the **Circle Area** column, use the equation $area = \pi x^2$. The π value should only be from the cell **D5**.
 - For the **f(x)** column, $f(x) = 10 e^{-x} + \cos(x)$
 - For the **g(x)** column,

$$g(x) = \begin{cases} f(x) \cdot \sin(f(x)) & f(x) \leq 0 \\ f(x) \cdot \ln(f(x)) & 0 < f(x) \leq 0.5 \\ f(x) \cdot \log(f(x)) & f(x) > 0.5 \end{cases}$$

- d. For the **Average**, **Min** and **Max** rows, use their respective functions

- iii. Draw a chart with the following characteristics on a new sheet:

<u>Chart type</u> XY (scatter) chart – subtype 2	<u>x-axis</u> x	<u>y-axis</u> f(x) and g(x)
<u>x-axis title</u> x	<u>y-axis title</u> f(x) and g(x)	<u>Legend</u> place legend in bottom of chart
<u>Line for f(x)</u> solid, circles	<u>Line for g(x)</u> dotted, triangles	<u>Line labels (legend)</u> f(x), g(x)
<u>Gridlines</u> No gridlines	<u>Shading</u> None	<u>Chart title</u> f(x) and g(x) vs. x

Part B. MATLAB

- After starting Matlab and with your floppy disk in drive A:, type `>> cd a:` to have the files saved in it.
- Use the `help` and `lookfor` commands to get more help on Matlab commands.
- Use the variable names indicated in their respective questions!

Q1. Calculate the following equations (20 marks):

a. $a1 = \sin^2 30^\circ + \cos^2 45^\circ$ b. $b1 = 3 \frac{\sqrt{5}-1}{(\sqrt{5}+1)^2} - 1$ c. $c1 = e^{\pi\sqrt{163}}$

d. $e1 = \ln e^3$ e. $d1 = \frac{2^5}{2^5-1} \cdot \left(1 - \frac{1}{2^5}\right)^{-1}$ f. $f1 = \frac{d}{dx}(4x^3 + 5y^2)$

Save workspace as `q1.mat` in drive A:

Q2. Perform the following (20 marks):

- a. Generate array $i2 = 1, \frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \dots, \frac{1}{100}$.
- b. Generate array $j2$, where its elements are the even numbers between 24 and 75.
- c. Define array $A2 = \begin{bmatrix} 9 & 5 & 2 \\ 3 & 8 & 3 \\ 1 & 2 & 7 \end{bmatrix}$, then change the element $A2_{3,2}$ to -3.5.
- d. Generate two arrays $k2 = 1, 2, \dots, 10$ and $l2 = 2, 4, \dots, 20$, then find $m2 = \sum_{i=1}^{10} k2_i \cdot l2_i$
- e. Solve the equations $(x_2)^{y_2} = 25$ and $\frac{x_2}{y_2} = 2\frac{1}{2}$

Record the output through the `diary` command as `q2.txt` in drive A:

Q3. Calculate the following functions for $0 \leq t \leq 10\pi$ (with step = 0.1) (20 marks):

$$f(t) = t \cdot \sin t$$
$$g(t) = t \cdot \cos t$$

Plot $f(t)$ and $g(t)$ versus t (i.e. t in x-axis, $f(t)$ and $g(t)$ in y-axis). For the graph:

- Draw $f(t)$ in red X, and $g(t)$ in blue O.
- Label the x-axis 't', and the y-axis 'f(t) and g(t)'.
- Title the graph 'f(t) and g(t) vs. t'
- Display legend information and gridlines on the graph

Save the figure as `q3.fig` in drive A:

Q4. Write a function called `function_q4` that solves n linear equations $Ax = B$ by multiplying A^{-1} into B . The function has two inputs and two outputs (20 marks):

- a. The first input is matrix A , while the second input is matrix B
- b. The first output is $|A|$, while the second output is the solution of the linear equations
- c. Write a clear help description for the function (test by typing `>> help function_q4`)

Use the function to solve the following set of linear equations:

$$\begin{aligned}x + y - 2 &= -2z \\3x + z &= y + 6 \\x + 3y + 4z - 4 &= 0\end{aligned}$$

- ✓ **Bonus:** you can earn bonus points by adding the following checks to your function:
- i. Make your function check that the first input matrix, A , is square, and if not, that it prints an error message and exits the function (Hint: use Matlab functions `size` and `return`). (10 marks)
 - ii. Make your function print an error message and exits if the determinant of A is zero (Hint: use the Matlab function `return`) (10 marks)

Save the function as `function_q4.m` and workspace as `q4.mat` in drive A:

Q5. Write a script m-file that uses the Matlab function `rand` to generate a 1-D array of 100 elements ($x5$) of random numbers, and then finds the values of array $y5$ according to the following relationship (20 marks):

$$y5(i) = \begin{cases} 0.1 & \text{if } x5(i) < 0.3 \\ 0.4 & \text{if } 0.3 < x5(i) < 0.7 \\ 0.9 & \text{if } x5(i) > 0.7 \end{cases}$$

Save the script file as `q5.m` in drive A: