MATH2059 Numerical Methods
Homework 4

Question 1. (Regression) – Use MATLAB or a calculator

Given the data tabulated below, it is known that such data can be modeled by the following equation:

$$x = e^{(y-b)/a}$$

Where *a* and *b* are parameters. Use a transformation to linearize this equation and then employ linear regression to determine *a* and *b*. Based on your analysis predict *y* at *x = 2.6*. (Hint: You should obtain *y* = 2.575683 at *x* = 2.6)

x	1	2	3	4	5
y	0.5	2	2.9	3.5	4

Question 2. (Multiple linear Regression) – Use MATLAB or a calculator

Use multiple linear regression to fit the data below. Compute the coefficients, the standard error of estimate, and the correlation coefficient. (Hint: corr. coeff. = 0.958333).

x_1	0	0	1	2	0	1	2	2	1
x_2	0	2	2	4	4	6	6	2	1
y	14	21	11	12	23	23	14	6	11

Question 3. (Interpolation) – Use MATLAB

Runge's function is written as:

$$f(x) = \frac{1}{1 + 25x^2}$$

(a) Develop a plot of this function for the interval from x = -1 to 1.
(b) Generate and plot the fourth-order Lagrange interpolating polynomial using equispaced function values corresponding to $x = -1, -0.5, 0, 0.5, 1$.
(c) Use the five points from (b) to estimate $f(0.8)$ with first-through fourth-order Newton interpolating polynomials.
(d) Generate and plot a cubic spline using the five points from (b).
(e) Discuss your results.

Question 4. (Numerical Integration) – Use a calculator

Integrate the following function both analytically and numerically. Use both the trapezodidal rule and Simpson's 1/3 rules to numerically integrate the function. For both cases, use the multiple-application version, with n=4. Compute the percent relative errors for the numerical results.

$$\int_0^3 x^2 e^x dx$$

Question 5: (Numerical Integration) – Use a calculator

Evaluate the integral of the following tabular data with (a) the trapezoidal rule and (b) Simpson's rules:

x	-2	0	2	4	6	8	10
$f(x)$	35	5	-10	2	5	3	20

How to Submit Your Homework:

1. Each student should submit his/her own homework. You can discuss the questions with your friends, but you must write your own code. Group work is not allowed.

2. Write a detailed report, which includes explanations about each part in each question. Explain how your scripts and functions work, i.e., which parts of your functions/scripts accomplish which task and how it is accomplished. Include the outputs of your functions to your report. You can save a figure as a *.jpg image file using "File —> Save as" in the Figure window. Then, you can include the jpg image to your Word document.

3. Don't forget to put detailed comments into your functions/scripts to explain what your code is doing. Also indicate the inputs and outputs in the comment section. (% sign is used to put comments in MATLAB)

4. Combine your report and MATLAB codes into a single file. Plots should go into the report. Name your zip file as "name_surname_studentnumber_hw_no.zip". For example, a student whose name is Ayşe Çalışkan and student number is 1234567 will name her file as: "ayse_caliskan_1234567_hw1.zip" for the first homework. Also, write your name, surname and student number as comments at the beginning of your codes.

5. Submit your homework via Google Classroom.