MSDM5004 Spring 2024
Homework 1 Part I
Due Feb. 25

Remarks:

(1) For all problems, write down the formulas and the calculate the results by calculators and **do not** compute it by MATLAB or other software, unless it is specified in the problem that you are required to write a code.

(2) **Do not** directly use the MATLAB bulit-in functions or similar available ones, unless it is specified in the problem.

(3) When you are required to write a code, you can use MATLAB or any other programming language.

1. Consider the problem of solving the equation $f(x) = 0$, where

$$f(x) = 4x \sin x - 4 \sin^2 x - x^2.$$

(1) Write down the iteration algorithm of Newton's method, then perform 4 iterations with the starting point $x_0 = 1.5$.

(2) Write codes using MATLAB to solve this equation with an accuracy of 10^{-5} using (i) Newton's method and (ii) the secant method.

2. Consider the nonlinear system

$$f_1(x_1, x_2) = 1 + x_1^2 - 4x_2^2 + e^{x_1} \cos 2x_2 = 0,$$
$$f_2(x_1, x_2) = 4x_1 x_2 + e^{x_1} \sin 2x_2 = 0.$$

(1) Write down the iteration algorithm of Newton's method,

(2) Write a code using MATLAB to solve it using Newton's method. Use starting values $x_1^{(0)} = -1$ and $x_2^{(0)} = 2$. Perform 5 iterations.

3. (1) Find the Lagrange interpolating polynomial for these data:

x	-1	1	2
$f(x)$	3	4	2

(2) Find approximation of $f(1)$ using the interpolating polynomial.