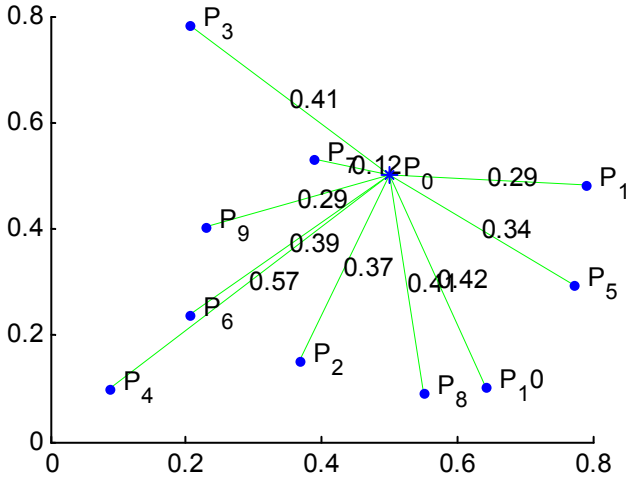
Numerical Methods for Engineering – Graduate Course 019003

Homework 1- introduction to Matlab

Due date: November 2nd, 2021 through Moodle

1. You are given an array of points on the plane: P=rand(10,2), and a single point P0=[0.5 0.5].
   a. Write a function R=MyDist_a(P,P0) that takes inputs P and P0 and returns the vector R containing the distances from point P0 to the points in P. **Use only one Matlab line of code**. (don't use the *pdist* command).
   b. Write a function R=MyDist_b(P,P0) that takes inputs P and P0 and returns the vector R containing the distances from point P0 to the points in P. **Use a for-loop**.
   c. Compare the two functions runtimes using *tic toc* commands.
   d. Write a function []=MyPlot(P,P0) that plots a graph of the array P, the point P0, and lines connecting the origin P0 to the points. Write the point number next to each point and the distances next to the line connecting them as in this figure below. Use MyDist_a or MyDist_b as subfunction.



2. Write a formula to calculate $f = \sin(x)\ln(xy)$ using a 2-D Talyor series around the point (1,1):
   a. Find the Taylor polynomial of order 1, 2, and 3 using Matlab's symbolic calculations. Do NOT use *taylor* command. Explicitly write the approximations in your submission.
   b. On a single graph, plot the given function f and on top of it the approximate functions which you calculated in 2.a. Each function should be in a different color. Draw the graph with the center in (1,1) , plot the result in the range [0.5,1.5] . **Similar** to the following figure

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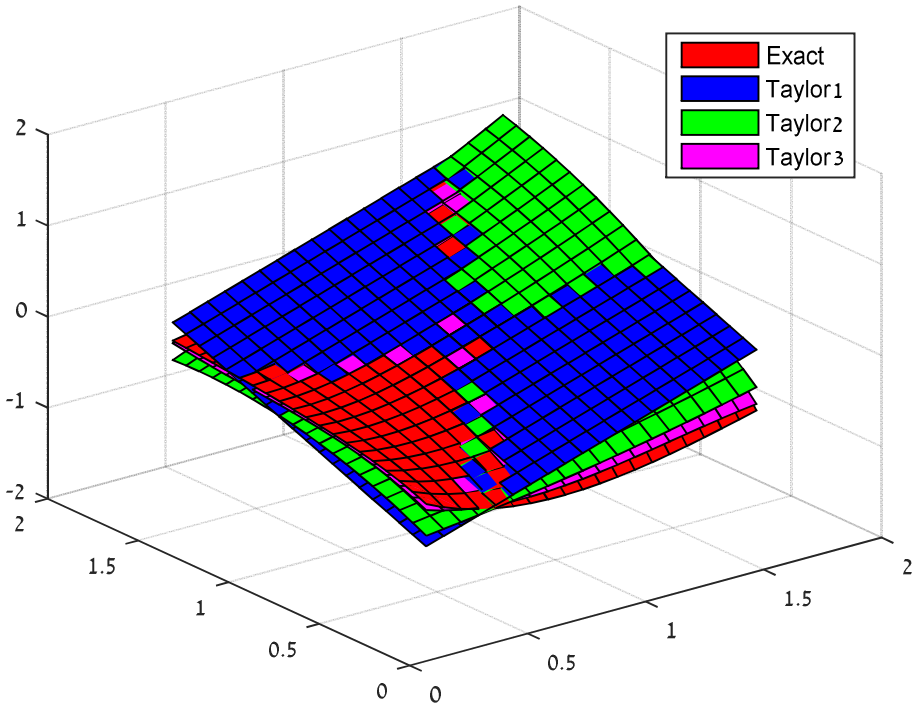

3. Use the file given in HW1_3.m and fix it. In the file, we have used an algorithm to solve this set of non-linear equations using the Newton Method with error less than 0.01:

$$\begin{cases} x^2 + y^2 = 4 \\ e^x + y = 1 \end{cases}$$

(As a reminder, here is link to a summary of the method:
http://www.ohiouniversityfaculty.com/youngt/IntNumMeth/lecture13.pdf

4. Exercise given in first lecture. Write the pseudocode described by this next flow-chart