ID2090 : Introduction to Scientific Computing

2nd Semester (Mar-2022 to Jun-2023)

Assignment : 2

As part of this assignment, you are expected to upload a tar file named after your roll number, eg., me22b001.tar which when "untar"ed will create a folder me22b001 in which your scripts or notebooks, a PDF report should be found. You need to upload the tar file on moodle page for this course.

Important: (a) The scripts will be checked for their execution. The notebooks should work when opened with jupyter notebook using sage kernel.

[Q1, 4 marks] Write a script that takes two arguments – the first being either "pi" or "e" and the second being an integer between 1 and 200. If the first argument is x and second argument is n then your script is expected to display the nth digit of x after the decimal point. The script should display a message if n is outside the range and exit elegantly. If the number of arguments is less than 2, then too the script should display an appropriate message and exit properly.

Commands you run, assuming `assn2a.sh` is the name of your script.
`./assn2a.sh pi 2`
Output expected:
`4`

[Q2. 4 marks] In a square box of size 100x100, place 20 points randomly. Connect each point to the nearest three and thus discretize the square into elements. Display the points and their connections using a plot. Save the locations of the points in a text file (assn2b.txt) in the increasing order of their distance from the origin.

[Q3. 4 marks] Consider a function a follows:

$$f = x^5 - 13x^3 - x^2 + 10x + 170$$

How many real roots does this function have? Estimate all the roots. Visualize the roots using Gerschgorin-Circle. Include a plot of the function itself, complete with labels and title in your report.

[Q4. 4 marks] Plot the natural cubic spline function that interpolates the following set of data points. Compare this graph with the one obtained from a polynomial interpolation for the same set of points. Your report should include the functions that were used to make the plots.

x	0	1	2	3	4	5	9
y	2.5	0.5	0.5	2	2	1.5	0

--- end of Assignment 1 ---