Total: /50

Math 2342: Project Part 1:

General Instructions:

- This project is due on February 26th 2021 before 11:59 pm.
- Form a team of 2 or 3 students and complete all the following questions. You have to be part of a team, no individual project will be accepted.
- Your document should be clear and well organized.
- You will submit a pdf file and all your MATLAB files on the Learning Hub in the project 1 folder.
- One document per team.
- Your pdf and MATLAB files should all contained the names of all team members at the top of the file in comments.

Using Numerical Methods for Solving Equations:

Instructions:

- Find all the roots within 0.0001 accuracy.
- For each question and each root, I need the output of your program showing each iteration and the final answer for the root.

Question 1: [20 Marks]: In this question you will use both the bisection and the Newton/Raphson methods to find the roots of the following equation:

$$f(x) = 0.25x^7 + 3x^4 + 5x^2 - 12 = 0$$

There are 3 roots to this equation and I want you to use the following setting to find them:

Root 1:

Bisection method: start with the interval [-3, -2]

Newton's method initial guess -3

Root 2:

Bisection method: start with the interval [-1.5, -0.5]

Newton's method initial guess -1.5

Root 3:

Bisection method: start with the interval [0.5, 1.5]

Newton's method initial guess 1.5

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For each of the roots, compare the number of iterations required by the bisection method and the Newton's method to reach the same level of accuracy.

For each of the roots, compare the computation time required by MATLAB to perform the algorithm.

Which method seems to perform better?

Give one advantage that the bisection method has over the Newton's method.

Question 2: [10 Marks]: Some tunnels of a mine collapsed which created a cloud of dust in the remaining tunnels of the mine. A remote controlled robot will be send in the mine to assess the stability of the remaining tunnels once the dust in the mine as sufficiently dispersed. The dust particles in ppm as a function of time t (in hours) can be modeled by the following function:

$$h(t) = 1000e^{-0.05t^2+0.2t} - 10t$$

We cannot send the remote controlled robot before the dust is down to 200 ppm. Unfortunately, the equation $h(t) = 200$ cannot be solved analytically. Use the numerical method of your choice to find the solution to the equation h(t)=200.

Question 3: [20 Marks]: Use the method of your choice to find the solution of the following equation (GOOD LUCK).

$$\sqrt[5]{x-4} = 0.25$$

Illustration of Newton's Method:

BONUS: Question 4: [20 Marks]: Create a program in MATLAB that will illustrate the successive iteration of the Newton's method for the following function with $x_1=6$ and a desired accuracy of 0.01:

$$f(x) = (x-3)^2 - 2$$

To be clear, your program should create a figure on which we will see the function f(x) and the tangent line to the function at x=6, then another tangent line at $x=x_2$, etc. until you have the last tangent line that crosses the x-axis at a value within 0.01 of the actual solution of f(x)=0.

For this question, you need to submit a MATLAB file on D2L. The file should be named: "showing_Newton.m". I will download your file and try to run it in MATLAB and see if it creates the correct figure or not.

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Basin of Attraction:

BONUS: Question 5: [20 Marks]: Write a MATLAB program to recreate the basin of attraction figure on the slide 14 of section 13 of your notes. Good luck.

For this question, you need to submit a MATLAB file on D2L. The file should be named: "basin_Newton.m". I will download your file and try to run it in MATLAB and see if it creates the correct figure or not.