Numerical Analysis, Spring 2019

Homework 1 due January 28th

Please show your work. Exercises in 1-5 should be done by hand (or using LaTeX). For the programming exercises in Chapter 4, hand in your MATLAB codes and outputs. (You can use the MATLAB function *diary* to copy your command window output - read about it in Chapter 2.) Page `http://academics.davidson.edu/math/chartier/Numerical/matlab.html` contains MATLAB m-files mentioned in the assignments, but you can (and are encouraged to) write your own routines.

1. Show that the following equations have at least one solution in the given intervals.

   (a) $2x\cos(2x) - (x-2)^2 = 0$, intervals $[2,3]$ and $[3,4]$

   (b) $x - (\ln x)^x = 0$, interval $[4,5]$

2. Find $\max_{0\le x\le 1}|f(x)|$ for $f(x) = (2 - e^x + 2x)/3$.

3. Given $f(x) = 1 - e^x + (e-1)\sin((\pi/2)x)$, show that $f'(x)$ is 0 at least once in the interval $[0,1]$.

4. Let $f(x) = x^3$.

   (a) Find the second Taylor polynomial $P_2(x)$ about $x_0 = 0$.

   (b) Find $R_2(0.5)$ and the error in using $P_2(x)$ to approximate $f(0.5)$.

   (c) Repeat part (a) using $x_0 = 1$.

   (d) Repeat part (b) using the polynomial from part (c).

5. Use three iterations of the Bisection method to find approximation of the root of $f(x) = \sqrt{x} - \cos x = 0$ on $[0,1]$.

Programming part:

NOTE: Hand in all your MATLAB codes and outputs. Answer all questions. When you submit any graphs (generated in MATLAB), make sure you label axes and title and annotate your plots.

- Chapter 4, Exercise 2(a).

- Chapter 4, Exercise 18.