Homework #1 Due: Friday September 9

MTHBD/CMPBD 423

Use the required cover sheet

1. MATLAB Program 1: *Yourlastname*Trap.m *(5 pts)*

   This should basically be a copy of Trap.m which is available from the class website. You must correct the error discovered in class and modify it to evaluate

   $$\int_a^b x\, e^{x^2}\, dx$$

   instead of $\int_a^b \cos x\, dx$. It should allow the user (me) to input a, b, and the number of subintervals. It should print the analytic solution, the trapezoid rule approximation, and the difference between the two. Place it in my P-drive (sas56/public) in your folder.

2. MATLAB Program 2: *Yourlastname*Nested.m *(5 pts)*

   This program file should prompt the user for coefficients a, b, c, and d for a polynomial

   $$p = ax^3 + bx^2 + cx + d \tag{1}$$

   and then prompt the user for a value of x at which to evaluate the polynomial. It should evaluate p at x using the traditional method (equation 1) and with nested multiplication (Horner's Method). It should return this evaluation for both types and the difference between them. Place it in my P-drive (sas56/public) in your folder.

3. *Taylor Polynomials and Error Analysis*:(one page) *(5 pts)*

   (a) Write the Taylor Series for e^x about $x = 0$.

   (b) Use Taylor's Theorem (page 22) to determine the minimal number of terms that must be used in order to approximate e with an error less than 10^{-2}. Show how you came up with this number.

   (c) Use the Alternating Series Theorem (page 28) to determine the minimal number of terms that must be used to approximate e^{-1} with an error less than 10^{-2}. Show how you came up with this number.

4. *Plotting Taylor Polynomials and Errors*:(one page) *(5 pts)*

   You may wish to download **PlotExpTaylorError.m** from the class website and edit it for this problem making sure the graphs are labelled correctly. **All graphs should have your name in the title**. Using the subplot command in MATLAB generate the following two graphs on one figure.

   upper graph: Plot $\sin(x)$, and the Taylor (Maclaurin) polynomials: $P_1(x)$, $P_3(x)$, and $P_5(x)$ over the interval [0,2].

   lower graph Plot the associated errors for each polynomial over the same interval.

   Print this figure and on the same piece of paper briefly describe the relationship between:

   (a) The error and the distance of x from zero.

   (b) The error and the degree of the approximating polynomial.

   Do not submit the code for this problem.