Numerical Methods – Spring '18

PA #6

Created By: Clarisa Leu-Rodriguez

Dr. Christopher Willett

Programming Assignment #6

Problem 1:

Write a MATLAB function that inputs a function, a lower bound *a*, and an upper bound *b* and returns the 3-point Gaussian quadrature estimate of $\int_a^b f(x)\,dx$. Write a test script which tests your function for three separate integrals. Test your function with values of a and b other than just -1 and 1. Your test script should compute the estimate, the true values using the *integral()* function, and the true error.

My Solution:

See leurodriguez1.m & leurodriguez1T.m

Problem 2:

The *Fresnel C* function is defined to be:

$$C(x) = \int_0^x \cos(t^2)\,dt$$

Along with the related *Fresnel S* function, this is heavily used in optics and the study of diffraction. Write a MATLAB function that inputs a row vector of x values and return the following, in order: a row vector of values of C(x) computed using your Gaussian quadrature function from Problem 1, a row vector of C(x) computed using the trapezoid rule with 10 subdivisions, a row vector of C(x) values computed using the build in *integral()* method, and a row vector containing the run time needed to complete the computation for each method. Determine which of the three is the fastest and explain why it is the most efficient.

My Solution:

See leurodriguez2.m & leurodriguez2T.m

Problem 3:

Write a MATLAB function that inputs a function f, a lower bound a, and an upper bound b. The function should plot the graph of f(x) on [a,b] along with the derivative as computed using the high accuracy differentiation formula developed in class and in the text. Write a script that tests your function including three examples where you plot a function, the numerical derivative of the function, and the exact derivative.

My Solution:

See leurodriguez3.m & leurodriguez3T.m