Homework 5, Due: Wednesday, 12/5

This assignment is due on **Wednesday, December 5**, by 11:59 PM. Your assignment should be well-organized, typed (or neatly written and scanned) and saved as a .pdf for submission on Canvas. You must show all of your work to receive full credit. For problems requiring the use of MATLAB code, remember to also submit your .m-files on Canvas as a part of your completed assignment. Your code should be appropriately commented to receive full credit.

Problems

1 (6 points) Modify the function `NCweights.m` (posted on Canvas) to output the weights and nodes for all of the Newton-Cotes quadrature formulas (both open and closed) listed in Section 4.3 of the text. These rules are also provided on the Newton-Cotes quadrature rules worksheet posted on Canvas. Note that the function already outputs the weights and nodes for the open Newton-Cotes rules when $n = 0$ (midpoint rule) and $n = 1$ and for the closed rules when $n = 1$ (trapezoidal rule) and $n = 2$ (Simpson's rule) – just fill in the remaining four formulas. Verify that your code works by outputting the weights and nodes needed to approximate

$$\int_0^1 f(x)\,dx$$

for each Newton-Cotes rule.

2 (10 points) Given the function f at the following values,

x	1.8	2.0	2.2	2.4	2.6
$f(x)$	3.12014	4.42569	6.04241	8.03014	10.46675

approximate the integral

$$\int_{1.8}^{2.6} f(x)\,dx$$

using **all** of the appropriate quadrature formulas from Section 4.3 of the text. You may use MATLAB to help you compute the approximations – just make sure that you write down each of the appropriate formulas, including which nodes/function values are needed for each respective formula, and attach and describe any codes that you use.

3 (14 points) Approximate the definite integral

$$\int_0^2 x^2 e^{-x^2}\,dx$$

using $h = 0.25$ and each of the following rules:

(a) Composite Trapezoidal rule

(b) Composite Simpson's rule

(c) Composite Midpoint rule

For each rule, compute the absolute error between your approximation and the true value of the definite integral, given that the true value is

$$\int_0^2 x^2 e^{-x^2}\, dx \approx 0.422725$$

You may also use MATLAB to help you compute the approximations for this problem. Again, make sure that you write down each of the appropriate formulas (including which nodes/function values are needed for each respective formula) and include any MATLAB code that you use.

Note: For any of the above problems for which you use MATLAB to help you solve, you must submit your code/.m-files as part of your work. Your code must run in order to receive full credit. If you include any plots, make sure that each has a title, axis labels, and readable font size, and include the final version of your plots as well as the code used to generate them.