Guidelines

To complete assignments you must hand in a report including:

1. Title
   - The name of the homework assignment. Ex. “Bisection Method”

2. Description of Problem
   - Description of the problem with a discussion of relevant mathematics. Ex. Explain how and why the bisection method works. Be specific and include a few steps worked out by hand with explanations of each step.

3. Description of the Program
   - Description of your program which describes the algorithm you used and details your implementation. Ex. Explain how you implement the bisection method. You may also copy the relevant piece of code to help explain your implementation.

4. Results and Conclusions
   - Discussion of the results including any tables or figures needed. Ex. Tell me all the roots for the two equations with error bounds. You must also explain why you believe the answer is correct. The correct answer alone is not enough, you have to convince me that it is correct to get credit for it.

5. Program Listing
   - Include all your source code, makefiles and instructions on how to execute your code.

You must also email me your source code, makefiles and instructions on how to execute your code.

- Email me at pgarreau@math.fsu.edu
- Include [MAT5939-03] in the subject line of the email.
3 Normal Distribution CDF

Let $\Phi(x)$ be the standard normal cumulative distribution function (cdf) defined by $\Phi(x) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{x} e^{-\frac{t^2}{2}} dt$.

1. Compute and report the value of $\Phi(0.1)$ using the right-hand rule with 100, 1,000, and 10,000 sub-rectangles.
2. Compute and report the value of $\Phi(0.1)$ using the midpoint rule with 100, 1,000, and 10,000 sub-rectangles.
3. Compare the above computed values to the estimate found by using intrinsic functions to evaluate $\Phi(x) = \frac{1}{2} \left[ 1 + \text{erf} \left( \frac{x}{\sqrt{2}} \right) \right]$.

When writing your program you must use multiple functions and multiple files. The cdf will be used again in the next assignment so make sure the functions are portable. Explicitly, you should write your routines so that the quadrature rules you use are neither function-dependent, nor interval dependent:

MidPoint(f,a,b,N)
RightPoint(f,a,b,N)

Your functions should all be coded in separately from the methods (quadratures).

Below is a sample code.

Algorithm 2 Quadrature rules for Normal CDF

1: Input: $f, a, x, N$
2: Set values for: $a, x$
3: for $i = 1, \ldots, 3$ do
4: \hspace{1cm} $N = 10^i$
5: \hspace{1cm} $\Phi_{rhr}(x) = \text{RightPoint}(f, a, x, N)$
6: \hspace{1cm} $\Phi_{mid}(x) = \text{MidPoint}(f, a, x, N)$
7: Print $N, \Phi_{rhr}(x), \Phi_{mid}(x)$
8: end for
9: $\Phi(x) = \text{Exact}(x)$
10: Print $\Phi(x)$