Project 8
Higher Order Quadrature vs. Composite Quadrature

1. Suppose you are using the trapezoid rule to approximate an integral over an interval $[-1, 1]$. You wish to obtain a more accurate approximation of the integral so write down the formulas for the following:

(a) Dividing the interval in half and using the trapezoid rule on each sub-interval.

(b) Using Simpson’s rule on the original interval.

2. Using the formula $|I_f - Q_n(f)| \leq \frac{1}{4} h^{n+1} ||f^{(n)}||_\infty$ from page 344, compare the error bounds of these two methods to the original trapezoid rule. Is it generally better to use a higher order quadrature or composite quadrature based on your analysis?

3. Test each of these methods of the following functions, which method performs better and why?

(a) $f(x) = x^2$

(b) $f(x) = \sin(\pi x)$

(c) $f(x) = \begin{cases} x^{-1} & x < -0.1 \text{ and } x > 0.1 \\ 10 & -0.1 \leq x \leq 0.1 \end{cases}$

4. Based on your results in the previous Step, is there any disadvantage to using a higher order quadrature? Can you explain this based on the formula in Step 2?

Due: Tuesday, Nov. 3