

COMP 350 Numerical Computing
Assignment #6, Numerical Integration

Date given: Wed, Nov 15. Date due: 5:00pm, Wed, Nov 29, 2017.

1. (15 points) The function $\text{erf}(t) = \frac{2}{\sqrt{\pi}} \int_0^t e^{-x^2} dx$ is called an error function in statistics.
 - (a) (3 points) If we want to ensure the absolute error of the trapezoid rule to be bounded by 10^{-6} , how many points should be used?
 - (b) (6 points) Compute $\text{erf}(1)$ by the recursive trapezoid rule. Stop the iteration when the difference between two consecutive computed integrals is smaller than or equal to 10^{-6} . Let the computed result be denoted by I_T . Compute the error $I - I_T$, where I can be obtained by the MATLAB built-in function `erf`. Report the number of function evaluations, and print the final result, the error, and the MATLAB codes as well.
 - (c) (6 points) Compute $\text{erf}(1)$ by the adaptive Simpson's method. Try to avoid redundant function evaluations. Take $\epsilon = 10^{-6}$ and `level_max=100`. Let the computed result be denoted by I_S . Compute the error $I - I_S$.
Report the number of function evaluations, and print the final result, the error, and the MATLAB codes as well.
2. (5 points) Construct a rule of the form

$$\int_{-1}^1 f(x) dx \approx \alpha f\left(-\frac{1}{2}\right) + \beta f(0) + \gamma f\left(\frac{1}{2}\right)$$

such that it is exact for all polynomials of degree ≤ 2 .

Hint: Use one of the approaches we used in class to derive the two-point Gaussian quadrature rule.