

# Math 104B Homework #2 \*

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**General Instructions:** Please write your homework papers neatly. You need to turn in both your codes and descriptions on the appropriate runs you made by following TA's instructions. Write your own code, individually. Do not copy codes!

1. Implement (write a code) the composite trapezoidal rule  $T_h^{[a,b]}[f]$  and the composite Simpson rule  $S_h^{[a,b]}[f]$  to approximate the definite integral

$$I^{[a,b]}[f] = \int_a^b f(x)dx. \quad (1)$$

Test your routines appropriately.

2. Produce a table with the approximations  $T_h^{[0,1]}[e^{-x^2}]$  and  $S_h^{[0,1]}[e^{-x^2}]$  to  $I^{[0,1]}[e^{-x^2}]$  for  $h = 0.1, 0.05, 0.025$  and  $0.0125$  and verify the order of convergence of each quadrature.
3. Write a code to implement Romberg Algorithm to approximate (1). The code should use an estimate of the error to determine the number of levels (rows) in the Romberg Algorithm so that the error is less than a user provide tolerance  $tol$ . Test your code with  $\int_{-1}^1 e^x dx$  and  $tol = 10^{-6}, 10^{-8}, 10^{-10}$ .

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