Lab Work - Week 4

Math 105B Lab

Summer Session II - 2022

1 Enhanced Integration

CODING ASSIGNMENT 11 - Romberg Integration

Produce a function with the following specifications:

NAME:	rombergInt_########
INPUT:	f,a,b,N
OUTPUT:	Rout
DESCRIPTION:	Rout is the N by N lower triangular matrix of the iterative Romberg Integration approximations to the integral $\int_a^b f(x)\,dx$.
PSEDUOCODE:	Pg. 216

EXERCISES

1. Use the composite trapezoidal rule to compute the integral $\int_{-\pi/2}^{\pi/2} \cos(x)\,dx$ for $N = 1, 2, 4, 8, 16$. Then compare your results to the output you get from rombergInt.

CODING ASSIGNMENT 12 - Adaptive Simpsons's Method

Produce a function with the following specifications:

NAME:	adaptSimpsonInt_########
INPUT:	f, a, b, TOL, N
OUTPUT:	APP
DESCRIPTION:	APP is the approximate value of the integral $\int_a^b f(x)\,dx$ using adaptive Simpson's method with error tolerance TOL, and maximum level N
PSEUDOCODE:	Pg. 224

EXERCISES

Consider the integral $\int_0^{2\pi} \cos(2x)e^{-x}\,dx$.

1. Calculate the exact value of this integral.

2. Use the composite Simpson's rule over the whole interval to evaluate the integral, using n=10, 20, 50, 100. Produce one plot showing the error from the numerical quadrature as a function of n. Compare the result to the error estimate.

3. **(Participation Assessment)** Apply the adaptive Simpson's rule to the integral listed above, with desired accuracy 0.5×10^{-4}. Suppose the maximum number of levels is N=2. Is this possible? If not, what do you need to set the maximum number of levels to? How many quadrature points would the non-adaptive method require for this level of accuracy?