

ISC 5315
Applied Computational Science I

Numerical Integration

Due on December 1

Problem 1. Write a Python script to perform trapezoid integration. With your code, use Romberg method with successive refinement to evaluate the following integral to an accuracy of 10^{-6} . (30 points)

$$\int_0^2 x^4 \log_{10} \left(x + \sqrt{x^2 + 1} \right) dx$$

Problem 2. In the class, we described a Python code for computing Gauss-Laguerre integration. Modify that code to evaluate the following integral using Hermite integration for $n = 2, 4, 8$, and 16 points. (30 points)

$$\int_{-\infty}^{\infty} \sin x^2 e^{-x^2+x} dx$$

Problem 3. Write a program based on the accept-reject Monte Carlo method to calculate the blue area in the figure, which is the common area of the three circles. The centers of these circles are $(-2,0)$, $(2,0)$, and $(0,2)$. Their radii are all 3. The accuracy depends of the number of samplings. Show your results for different numbers of samplings. (40 points)

