Department of Mathematics
Indian Institute of Technology Guwahati
MA322: Lab Assignment 5

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1. The function $g(x)$ is defined by

$$g(x) = \int_0^x e^{-x^2}\, dx.$$

Write a program for composite rectangle rule (R_{rule}), trapezoidal rule (T_{rule}) and Simpson's rule (S_{rule}) to evaluate $g(1)$ with $N = 50, 100, 200$ subdivisions. Compare the results with the correct value $g(1) = 0.74682413$ and print the approximate values for R_{rule}, T_{rule}, S_{rule} and the corresponding errors E_R, E_T, E_S as per the format shown below.

N	R_{rule}	T_{rule}	S_{rule}	E_R	E_T	E_S

2. Apply the trapezoid rule and corrected trapezoid rule to the approximation of

$$\int_0^1 x^2 e^{-2x} dx = 0.0808308960\ldots,$$

and compare your results in light of the expected error theory for both methods, and comment on what occurs.

3. The normal probability distribution is defined as

$$p(x) = \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{(x-\mu)^2}{2\sigma^2}},$$

where μ is the mean, and σ is the variance. This is the famous bell-shaped curve that one hears so much about; the mean gives the center of the bell and the variance gives its width. If x is distributed in this fashion, then the probability that $a \le x \le b$ is given by the integral

$$P(a \le x \le b) = \int_a^b p(x) dx.$$

The change of variable $z = (x\mu)/\sigma$ leads to

$$P(-m\sigma \le x \le m\sigma) = \frac{1}{\sqrt{2\pi}} \int_{-m}^{m} e^{-\frac{z^2}{2}} dz.$$

Compute values of $P(-m\sigma \le x \le m\sigma)$ for $m = 1, 2$ using Simpson's rule.