

CS 3320 – Numerical Software
Module 12 Homework
Monte Carlo Simulation

1. (10 pt) Evaluate $\iint_R e^{x^2 y^2} dx dy$ where the region of integration, R , is the unit circle in the x - y plane. Use 1,000,000 points inside the unit circle to estimate the integral. Use the function average technique or type 1 Monte Carlo simulation.

Notes:

- a. Generate pairs of random number (x, y) only keep the pairs that satisfy $x^2 + y^2 \leq 1$. You may need more than 1,000,000 pairs to get the required set.
 - b. The area of the unit circle is $\iint_R dx dy = \pi$.
2. (10 pt) Find the volume of the 3-d region bounded by the following equations using dart throwing, type 2 Monte Carlo simulation, with 1,000,000 points.

$$0 < x < 1, 0 < y < 1, 0 < z < 1$$

$$x^2 + \sin^2 y \leq z,$$

$$x - z + e^y \leq 1.$$