

1. This problem is motivated from the Introduction section of the Notes circulated last week.

Find the area of a unit circle (circle with unit radius) , i.e. value of π

- a. Generate x_i and y_i randomly, each in the range $[-1,1]$ with uniform distribution for $i=1,2,\dots,n$ ($n=1000$) [All these points lie in a square of side 2 units].
- b. For all values of i , check if $x_i^2 + y_i^2 \leq 1$ (i.e. the point is within the circle inscribed within the above mentioned square. Think why we used this formula)
- c. if the condition is true, a counter $N_{\text{accept}} = N_{\text{accept}} + 1$ [initial point $N_{\text{accept}}=0$, number of points lying within a circle]
- d. area of the circle = area of the square * N_{accept} / n
- e. Repeat steps a-d for $M=10$ times so that you get 10 values of the “area of the circle”;
- f. Plot frequency distribution of area obtained from step “e”
- g. Calculate Mean and Standard Deviation (SD) of this distribution. Use the statistical formula for SD.
- h. In step “e”, change the value of $M=10, 50, 100, 200, 500$, and plot both Mean and Standard Deviation as a function of M [for each M value, you get one value of Mean and SD]