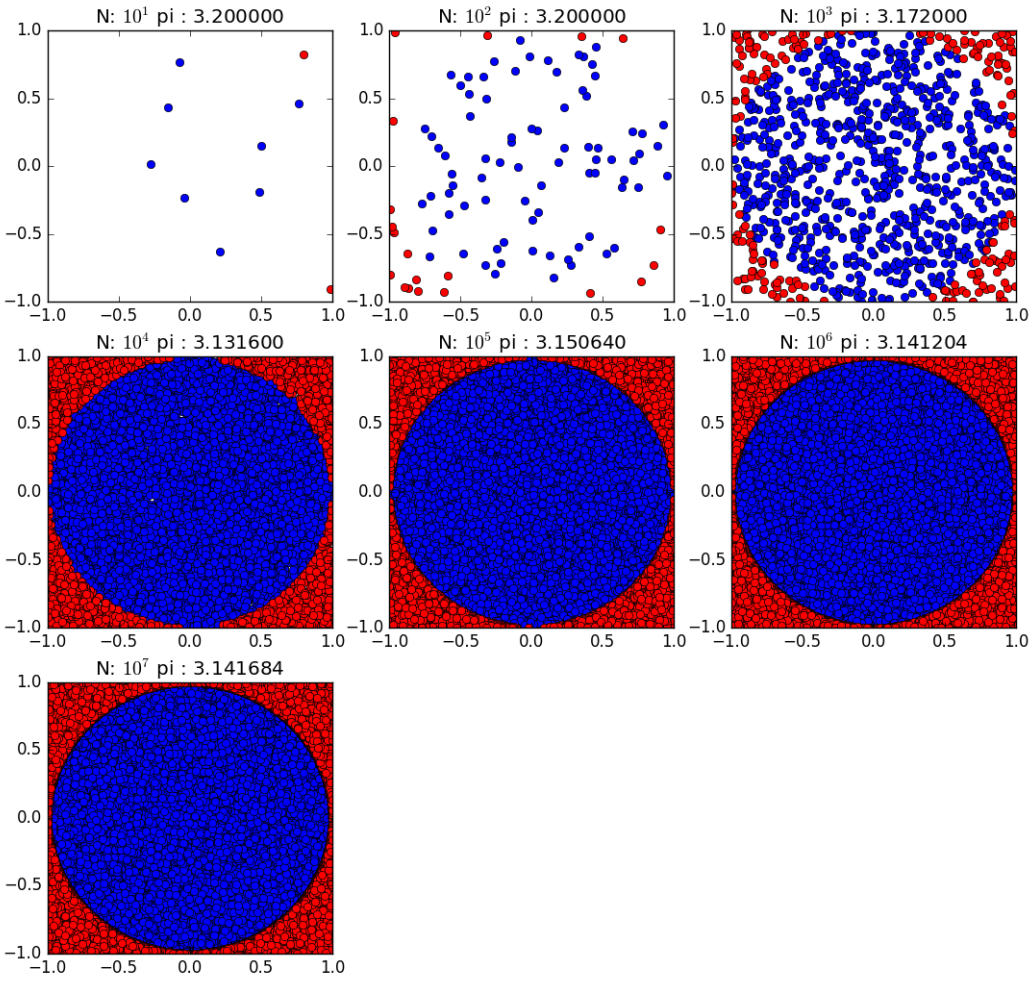
FoDS Assignment 2

Shivam Bhagat 2015B5A70460H
Abhinav Kumar 2015B5A70674H
Nikhil Madaan 2015A3PS0283H

Part A: Circle approximation

Estimates of pi:

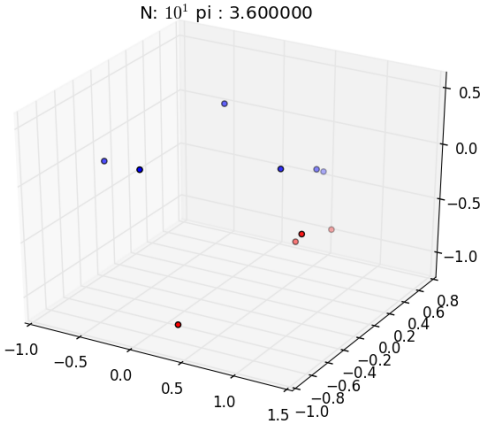
N (Number of points)	π estimated
10^1	3.2000
10^2	3.2000
10^3	3.1720
10^4	3.1316
10^5	3.1506
10^6	3.1412
10^7	3.1416

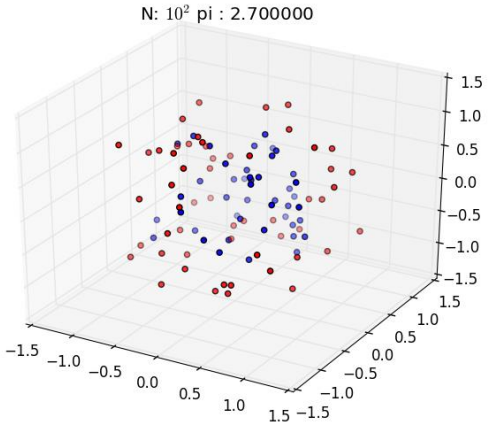


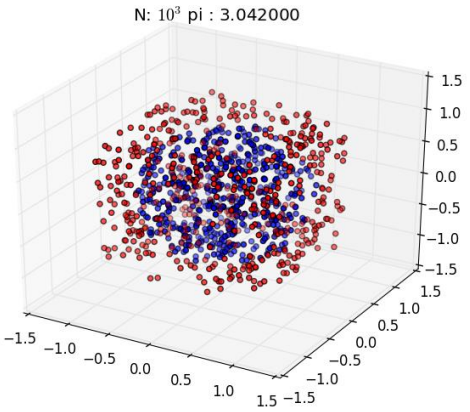
Part B: Sphere approximation

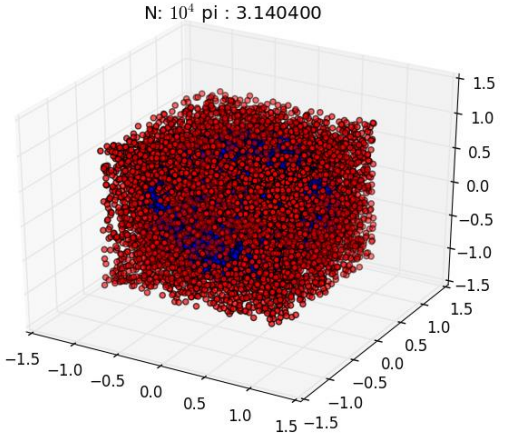
Estimates of pi:

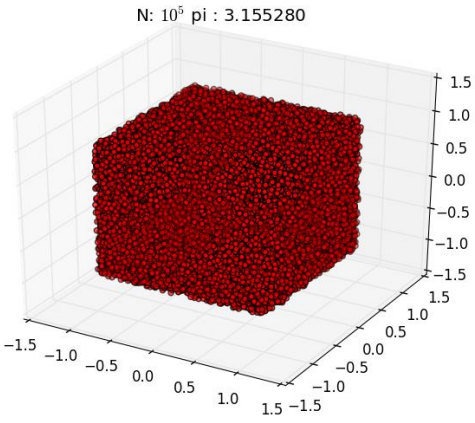
N (Number of points)	π estimated
10^1	3.6000
10^2	2.7000
10^3	3.0420
10^4	3.1404
10^5	3.1552
10^6	3.1376
10^7	3.1424

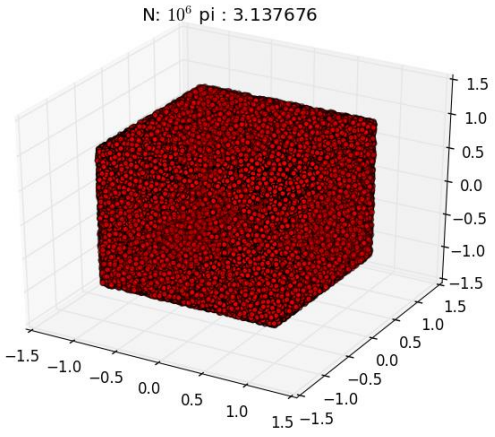


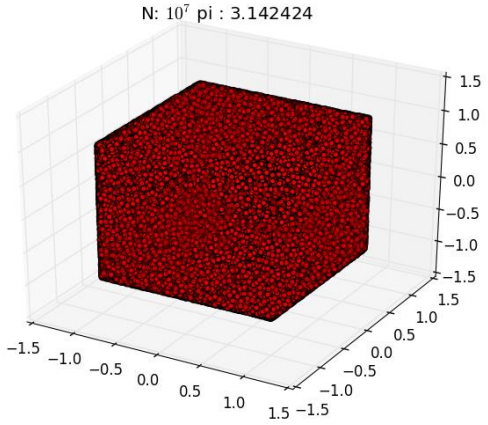












Part C: Analysis

Similarities:

1. As N approaches infinity, the probability of a point landing in the inner region (circle/sphere) approaches the ratio of volume of inner region and total volume.

$$\lim_{N\to\infty} \frac{hits}{N} = \frac{Volume/area\ of\ sphere/circle}{Volume/area\ of\ cube/square}$$

2. Higher the number of points/trials (N), better is the estimate for π
3. Error in estimation varies as $\propto \frac{1}{\sqrt{N}}$

Differences:

1. Given a value of N, 2D approximation performs better than 3D, if N is small. This is because more space is available and the model is less packed with points for 3D than 2D.
2. If N is large, Monte Carlo approximation is independent of dimensions.
3. In general, more number of points are needed for 3D approximation than 2D approximation (if N is small)