**CECS 451**
**Assignment 7**
**Total: 20 Points**

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General Instruction

- Submit uncompressed file(s) in the Dropbox folder via BeachBoard (Not email).

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1. (20 points) Implement a program to estimate $\pi$ using Monte Carlo simulation method using the `Jupyter` notebook. Submit both `pi.ipynb` and `pi.html` (or `pi.pdf`).
   (a) The program should generate $n$ random points of $(x, y)$ where $0 \leq x < 1$ and $0 \leq y < 1$ for $n \in \{10^3, 10^4, 10^5, 10^6\}$.
   (b) You can use `math.pi` to compute error rates.
   (c) Please follow the output format. Note that the error rates may be different. (Fix precision using `"0:.nf".format`)

```
n = 10 ^ 3  pi =  3.096000  error =  1.4513 %
n = 10 ^ 4  pi =  3.136800  error =  0.1526 %
n = 10 ^ 5  pi =  3.145280  error =  0.1174 %
n = 10 ^ 6  pi =  3.140568  error =  0.0326 %
```

   (d) For $n = 10^4$, draw a scatter plot as Figure 1, i.e., blue color for dots whose distances from the origin $(0, 0)$ are less than 1, otherwise red color.

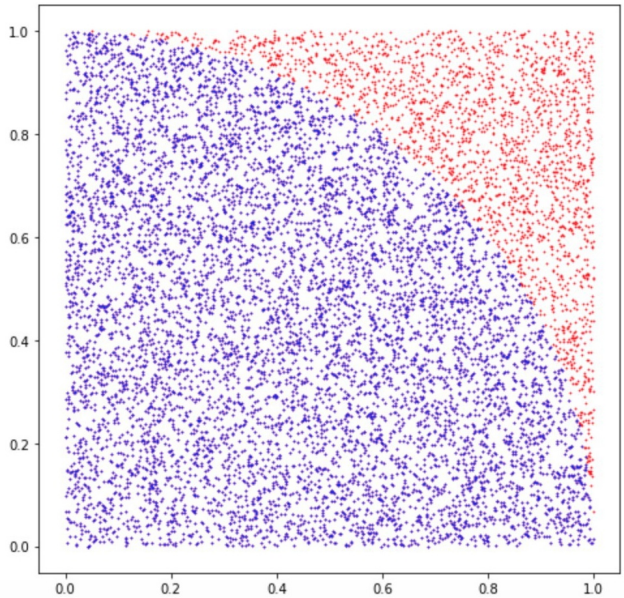


Figure 1: Estimating $\pi$ using simulation