

CECS 451
Assignment 7
Total: 20 Points

General Instruction

- Submit uncompressed file(s) in the Dropbox folder via BeachBoard (Not email).
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1. Implement a program to estimate π using the simulation method.

- (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) (10 points) Please follow the output format. Note that the estimated π and 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 %
```

You can use the formula

$$error(\%) = \left| \frac{\pi - \pi'}{\pi} \right| \times 100,$$

where π' is the estimation.

- (d) (10 points) 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.
- (e) Submit `pi.ipynb`.

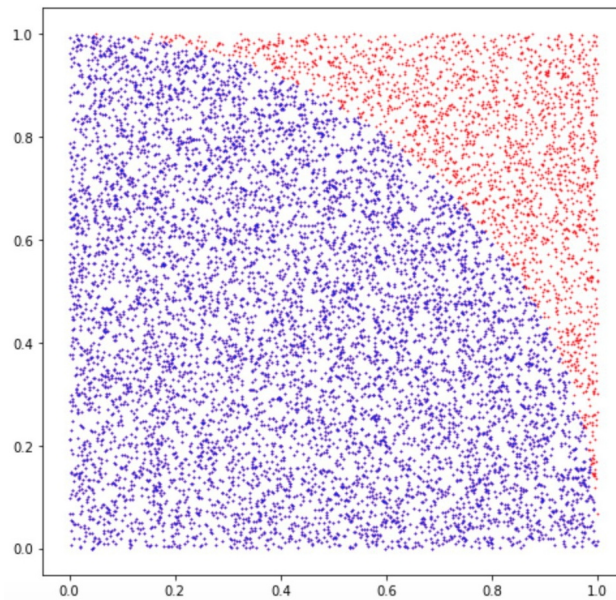


Figure 1: Estimating π using simulation