# Applied Stochastic Processes

## Homework 1

### CHEUNG Ying Lun

Please send your solution and the R file to `cheungyinglun@cueb.edu.cn`. You may form a group of at most three people.

**Exercise 1** *Find the value of $\pi$ through simulation.*

**Exercise 2** *Suppose $X \sim Geo(p)$ with $p = 0.2$. Find $\mathbb{E}\left[g(X)\right]$ through simulation, where*

- $g(X) = |X|^3$.

- $g(X) = \cos(X)$.

- $g(X) = \mathrm{e}^X$.

- $g(X) = \log(X^4 + X^2)$

**Exercise 3** *Let $X_1, X_2, \ldots$ be a sequence of independent Poisson random variables with parameter $\lambda = 0.2$. Let*

$$S_N = \sum_{i=1}^{N} X_i.$$

1. *Find the mean $\mu_N$ and variance $\sigma_N^2$ of $S_N$ when $N = 10, 20, 100, 1000$.*

2. *Plot the distribution of $\sigma_N^{-1}(S_N - \mu_N)$ when $N = 10, 20, 100, 1000$.*