Homework 5

CSE3102: Applied Probability for Computer Science

Due date: 2020/12/1

Note: Use GNU plot to illustrate your results
(http://gnuplot.info/
https://wiki.kldp.org/KoreanDoc/html/GnuPlot-KLDP/).
Use any programming language (C/C++, JAVA, Matlab, etc.)
Absolutely no copying.

1. [30pts] Write codes to simulate tossing a coin to see how the law of large numbers works. You may use any random number generator (using any programming language) as long as it follows a uniform distribution.

a. (10pts) Assuming a fair coin where P(HEAD)=P(TAIL)=0.5, plot a graph showing the proportions of heads with respect to the number of coin tosses ranged from 1 to 100.

i.e., X-axis(1~100): the number of coin tosses
Y-axis: the proportions of heads

b. (10pts) Consider an unfair coin with P(HEAD)=0.6 and P(TAIL)=0.4. Plot a graph similar to the problem a.

c. (10pts) Discuss if the graph converges to the value of P(HEAD) when the number of coin tosses are large enough.

2. [70pts] Write codes to generate a binomial random variable (Binomial ~ (n,p)) by extending the code from the problem 1.

a. (20pts) Setting p=0.5 and n=10, generate 1024 samples from the code and plot a histogram showing the frequencies of each k value. Compare your result with Figure 4.5 (Ross).

b. (20pts) Based on the samples generated in the problem a, estimate $\hat{p}$ using ML estimate. Compute the probability P($\hat{p}$=0.5)

c. (10pts) Now, setting p=0.01 and n=1000, generate as many samples you wish and plot a histogram as the similar way to the problem a.

d. (20pts) Find and plot a pmf from the problem c, and compare your results with a poisson distribution with parameter $\lambda = 10$.

What to submit: A report with (1) the answers from the problems and (2) all source codes.