THE UNIVERSITY OF HONG KONG
DEPARTMENT OF STATISTICS AND ACTUARIAL SCIENCE
STAT3910 Financial Economics I
Computer-based Assignment

Due: November 29, 2022

1. Let $S = \$80$, $K = \$80$, $T = 1$, $\sigma = 30\%$, $r = 0.08$, and $\delta = 0$.
   (a) Compute the European put price using Black-Scholes formula.
   (b) Compute the European put price again using binomial tree with number of periods $n = 2, 50, 100, 500, 1000$.
   (c) Compute the European put price again using Monte Carlo method (sample size = 100000).
   (d) What do you observe?

2. Suppose $S_0 = 100$, $T = 1$, $r = 0.08$ and $\delta = 0$. For different strike price K, you observe the European put price p in the market:

K	85	90	95	100	105	110	115
p	3.90459	5.05327	6.66885	8.02293	10.6531	13.5959	16.8072

   Assume the Black-Scholes framework, calculate the implied volatility for each strike price. What do you observe?

3. Let $S = \$100$, $K = \$100$, $T = 1$, $\sigma = 30\%$, $r = 0.08$, and $\delta = 0$. Assume the Black-Scholes framework, using Monte Carlo method to calculate the price of the option with the following payoff:
$$\max\{S_T, \sup_{0 \le t \le 1/2} S_t\}.$$