

# MTH 600: Computational Methods in Mathematics

## Lab 4 Exercise

### Question 1.

Assume the stock price follows a geometric Brownian motion

$$dS = rSdt + \sigma SdZ_t, \text{ where } S_0 = 20, \text{ and } \sigma = 0.3,$$

and annual risk free interest rate  $r = 5\%$ .

a). Implement the Monte Carlo method to price a European call option and its corresponding 95% confidence level with the number of simulations,  $M = 1,000, 10,000, 100,000$ , respectively. The European option matures in 3 months with strike price  $K = 20$ .

b). Implement the Monte Carlo method to price an Asian option, whose payoff function is

$$\text{payoff} = \max\{(A_N - K)^+\}, \text{ where } A_N = \frac{1}{N} \sum_{i=1}^N S_i,$$

and its corresponding 95% confidence level with the number of paths,  $M = 1,000, 10,000, 100,000$ , respectively. The Asian option matures in 3 months with strike price  $K = 20$  and the number of observation dates,  $N = 30$ , i.e.,  $\Delta t = \frac{0.25}{30}$ .