STA4020 Assignment 2

Due Date: Thursday, October 18, 2018

1. Consider a stock with price $S_0 = 100$ at the current time 0, and a European call option on this stock with strike $K = 100$, and maturity $T = 1$. Assume Black-Scholes model, interest rate $r = 0.05$, and the stock price S_t follows $dS_t = \mu S_t dt + \sigma S_t dW_t$ with $\mu = 0.1$ and $\sigma = 0.1$.

   (a) Estimate the value of this call option at time 0 by Monte Carlo method with $N = 10000$ simulations.

   (b) Estimate the value of this call option at time 0 by finite difference method. You can assume the value at time t equals 0 if $S_t = 0$ and equals $400 - Ke^{-r(T-t)}$ at time t if $S_t = 400$. We assume that $0 \leq S_t \leq 400$ for $0 \leq t \leq T$.

   (c) Comment your results in parts (a) and (b).