Submission Deadline: October 29, 2024, 23:00 hrs

For the background material (Q.2), refer to Glasserman (Chapter 3, Sub-Section 3.5.1)

1. Let us try to fit a geometric Brownian motion (GBM), which you have done in Q.4 in the previous assignment (Lab 09), to a stock price data. First download the daily price data of a stock (say, from yahoo finance) for as long as available. Let T denote the period of availability in years. Take the '*adjusted closing price*' as the daily price of the stock and call it P_i for the ith day, with the number of days as $n+1$. From these P_i values, compute the daily returns, say $R_i, i = 1, 2, \ldots, n$. Let A and B be the mean and standard deviation of these daily returns and let the corresponding annualized values be obtained as $\mu = 252\,A$ and $\sigma = \sqrt{252}\,B$. You now have all the data $(T, S(0), \mu, \sigma)$ to simulate a GBM. Try to do an exercise similar to Q.4 of Lab 09, with these values. Compare your estimated stock price value with the actual value.

2. Simulate a jump diffusion process with the following discretization:

$$X(t_{i+1}) = X(t_i) + \left(\mu - \frac{1}{2}\sigma^2\right)(t_{i+1} - t_i) + \sigma[W(t_{i+1}) - W(t_i)] + \sum_{j=N(t_i)+1}^{N(t_{i+1})} \log(Y_j),$$

   in the time interval $[0, 1]$. The parameter values to be used are $X(0) = 5$, $\mu = 0.06$ and $\sigma = 0.3$. Divide the interval $[0, 1]$ into 1000 sub-intervals.

   (a) In the first step generate the process X on $[0, 1]$ considering only the Wiener process W but not the jump process.

   (b) Now do the simulation of X including the jumps (that follow a Poisson process) with the following 5 different values of $\lambda = 0.01, 0.05, 0.1, 0.5, 1$. The Y_j values have be taken from $Y_j = 0.1Z_j + 1$, where $Z_j \sim \mathcal{N}(0, 1)$.

   (c) Plot the sample paths generated in Part (a) and Part (b) in the same graph.

   (d) Repeat the above for 4 more sets of sample paths.

Put all your observations in the report.
