**Part 2**

1. Number of paths used is 100,000 to achieve high level of precision and accuracy.
2. 50 steps are used each corresponding to one day interval. NumPaths are still kept at 100,000 to ensure precision and accuracy.
3. Same number of 100,000 paths chosen for barrier option for both single and multistep. High number of simulated paths is vital for pricing barrier options as number of paths would how many cahsflows are positive at maturity. On the other hand, number of steps ensure accuracy in terms of how many times barrier has been crossed.
4. The red line in the plot shows the barrier price for knock in option and the blue line shows the exercise price.

**Results from 3 pricing strategies:**

* Black-Scholes price of an European call option is 8.0214
* Black-Scholes price of an European put option is 7.9004
* One-step MC price of an European call option is 7.9617
* One-step MC price of an European put option is 8.1572
* Multi-step MC price of an European call option is 7.326
* Multi-step MC price of an European put option is 8.3987

Monte Carlo simulation multi step provides the most accurate answer although it requires more computation than single step MC. Black Scholes provides a relatively accurate answer in this case but BS equation can be only be used for deriving answers for European call option while MC can be used for other derivative pricing as well

**European vs Barrier:**

European option price will always be higher than the barrier option price because of the simple reason that barrier behaves as a European option when the specified barrier is crossed and otherwise results in a cash flow of 0. In this way since European will always have a better payoff than barrier, the European option will always be priced higher.

**Increasing barrier volatility:**

Increasing volatility by 10% results in barrier being crossed more frequently leading to higher option price. Decreasing volatility had the opposite outcome

**Part 3:**

Intuitively to get the same answer as BS equation, the number of paths have to be decreased. So I reduced paths from 100,000 to 25,000, 50,000 and 75,000 and by trial and error was able to get the price to be the same at 37500 paths to the cent. Separate file in code.