**Estimate implied volatility from Monte Carlo simulation**

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**Procedure:**

***Step 1***. Taking use of Box Muller transformation (or standard library in C++) to generate independent random values that follow normal distribution. Note: we need and only need to input one parameter: standard deviation, σ.

***Step 2***. Assuming generated normal distribution is return (ri). Add stochastic adjustment for stock price, , where h is the step size of dividing the whole time range into points.

***Step 3***. Obtaining stock price by Si = Si-1 \* ri, and calculate call option price as, , where K is the strike price, T is the expiration time, M is the overall number of samples we will generate, SN(i) is the stock price of i*th* simulation run which using N steps, namely, divide the whole T into N bins.

Note:

1. We will choose one arbitrary initial stock price, S0.
2. We will run M trajectories and each will be divided into N steps to generate final stock price, and only need the final price SN(i).

***Step 4***. On the other hand, estimate the option price and Greek letters using BMS model (will need to assume some additional parameters, e.g. interest rate).

***Step 5***. Using the result from *step 3*, namely, given the option prices, and take use of Newton-Rapson method to obtain IV (implied volatility).

***Step 6***. Similarly, use result from *step 4*, we can calculate theoretical IV as well. Compare this IV with the result from step 5 and the input σ from *step 1*, show that IV only relate with σ and in lager N and M conditions, V/ σ --> 1.

**Nest phase of this work will focus on what will be the effect of some jumps of underling prices on the option prices.**