

In a risk-neutral world the stock price follows a Wiener process i.e., it has a constant drift (r) and a variability in the path followed by stock (S), i.e., prices have a random walk, dz along this drift.

$$\frac{dS}{S} = rdt + \sigma dz$$

With the use of Ito's Lemma, the stock price at time T can be written as:

$$S_T = S_0 \exp\left(\left(r - \frac{\sigma^2}{2}\right)T + \sigma\sqrt{T}dz\right)$$

The expected payoff from the option is computed as the risk-neutral mean of the maxima of the underlying asset's values at the expiration of the option minus the exercise price X . The risk-neutral mean is then discounted at the risk-free rate to get the estimated value of the call option

$$c = \exp(-rT) [\max(S_T - X, 0)]$$

Assuming

S_0	45
r	3%
T	=120/252
σ	120%
X	50

Please run simulation to generate 1000 stock prices. Then get the corresponding call price. Calculate the mean and standard deviation.