2016 R MFE Programming Workshop Lab 4

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1 Monte Carlo Option Pricing

Assuming that a stock starts at price S_0, one random realization of the price at time T (under the risk-neutral pricing measure, which you will learn about in your derivatives class) can be modeled as:

$$S_T = S_0 e^{(r-\sigma^2/2)T + z\sigma\sqrt{T}}$$

Where z is a standard normal random variable.

Given that a call option pays off $max\{0, S_T - K\}$, we can evalute the price of the option using Monte Carlo as the discounted expected payoff in a few simple steps:

1. Generate a large number (say 10,000) of random values for the terminal stock price S_T
2. Evaluate the option price at each terminal price
3. Average over the option prices
4. Discount this expected final value by multiplying by e^{-rT}

These steps are equivalent to evaluation of:

$$E\left[e^{-rT} max\{0, S_T - K\}\right]$$

Write these steps into a function and check the results with the closed form solution from the previous exercise.