

Requirements

1. Credits are given to typed homework only.
2. Submit a pdf file on <http://compass2g.illinois.edu> before 1pm on Wednesday 1/27/2016. Append your codes. Your homework must be finished independently. It will go through plagiarism screening.
3. Submit a hardcopy at the beginning of the class on Wednesday 1/27/2016.

(20 points) Read slides p.1-p.18. Consider the European vanilla call option on SP500 with strike price $K = 1870$ and maturity $T = 1/52$ (which is one week). Assume that the index follows a geometric Brownian motion in the risk neutral world:

$$S_T = S_0 \exp \left(\left(r - q - \frac{1}{2} \sigma^2 \right) T + \sigma B_T \right).$$

The current SP500 value is $S_0 = 1868.99$. The risk free interest rate is $r = 0.3866\%$. The dividend yield of SP500 is $q = 2.32\%$. The volatility is $\sigma = 29.79\%$.

1. Compute the call price using the Black-Scholes formula.
2. Write a C++ program to compute the call price using Monte Carlo simulation. Your program should output the **sample size, the price, the estimated standard error, the 95% confidence interval, and the computational time in seconds**.
3. Construct a table showing the quantities in bold in the above for increasing sample sizes. What sample size is needed to obtain a confidence interval that is 2 cents wide?