Johns Hopkins University
Department of Applied Mathematics & Statistics
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Fall 2015

EN 443
Financial Computing in C++
Assignment 5

due on Wed, Oct 7, 1:30pm

1. a) Write a function that given a stock price S_T at time T, calculates the payoff of a European call option maturing at time T with strike K.
   b) Write a Monte-Carlo simulation, that calculates the price of a European call option that uses the payoff function from part a. Use the Box-Muller method to generate normal variables. Assume $T = 1$, $S_0 = K = 100, r = 5\%, \sigma = 0.2$.
   c) Write two additional Monte-Carlo simulations as in part b. One that uses the acceptance rejection method and the other that uses Marsaglia method to generate the normal variables.

2. This question is a continuation of question 4 from the previous HW, in which you were asked to calculate the implied volatility as a function of strike for MSFT stock priced \$28 from the following put options expiring in one year (i.e. T=1) assuming zero interest rate and no dividends

Strike	Price
17.5	\$0.28
20	\$0.48
22.5	\$0.81
25	\$1.41
27.5	\$2.42
30	\$3.8
32.5	\$5.56

   For this problem you should write a function to find the implied volatility implementing the other two methods – Newton-Raphson method and the secant method.

   For Newton-Raphson method you should use (and check) the fact that "vega", the derivative of the (option) price with respect to σ is

$$\frac{\partial C}{\partial \sigma} = S_0 \phi(d_+)\sqrt{T},$$

where ϕ is the standard normal p.d.f.

Check that the results are the same for all the methods. Comment on the speed of convergence. How did you choose the initial bounds? Graph the implied volatility in Excel. For this question, you should submit both the Excel spreadsheet and your code.