Homework 2: ADMI 6807

A. Nieves-González

University of Puerto Rico
Río Piedras Campus
Institute of statistics

Due date: April 20, 2015.

Do the following problems using the R programming language. Hint: If unsure about how to use a command use the help function.

1 Input/Output to files.

1. In computational finance, the European call is governed by the Black-Schole equation (mathematical model)

$$\frac{\partial C}{\partial \tau} - rS\frac{\partial C}{\partial S} = \frac{1}{2}\sigma^2 S^2 \frac{\partial^2 C}{\partial S^2} - rC \tag{1}$$

where $\tau = T - t$ is the time (in years) to the expiry date, S is the value of the asset related to the call, $C(\tau, S)$ is the value of the call at time τ and asset value S, σ is the volatility and r is the interest rate. The expiry value condition is

$$C(\tau = 0, S) = \begin{cases} S - 2 & \text{if } S > 2 \\ 0 & \text{otherwise} \end{cases} \tag{2}$$

and the boundary condition is $C(0, \tau) = 0$ and $C(S, \tau) \approx S$ as $S \to \infty$. Do the following:

   (a) Write a few paragraphs explaining equation 1. Explain the meaning of all the variables and parameters. Write about the significance of the model and about the history of it.

   (b) A numerical solution of equation 1 with the corresponding initial and boundary conditions is given in file "BlackScholesResults01.csv" for the case in which $\sigma = 0.2$, $r = 0.08$, and $S \in [0, 10]$. The file is organized in the follwoing manner: First row are the column labels; First column contains the values of S , the other columns contain the values for C as a function of S for $\tau = 1, 2, 3$, respectively. Load the data in the file in R (use functions "read.csv()" or "read.table()"). Plot the results. You can plot the results for the diffent τ's in the same graph. Give an interpretation of the graph.