Assignment 4: Return, Autocorrelation and Geometrical Brownian Motion

Due: Oct 16th, 2015 at 11:59 pm

Question 1: Returns and Autocorrelations

- Use package quantmod, download an arbitraty stock historical daily data. Note that the stock you choose should have at least 2-years data available.

- Calculate the one period simple return and one period log return. Save them into different vectors.

- Calculate the multiperiod simple and log returns (means returns between the last day (P_t) and the first day (P_0)). Verify the relationship between multipleriod and single period for both simple return and log return.

- Calculate and print out the autocorrelation function for the log return series and squared log return series.

Question 2: Geometrical Brownian Motion

Here is again the GBM:

$$dS_t = \mu S_t dt + \sigma S_t dW_t$$

Given a set of parameters: $\mu = 0.05, \sigma = 0.2, T = 1$, steps $= 252$, $S_0 = 100$. Simulate the Geometrical Brownian Motion by the following equation:

$$S_{t+1} - S_t = \mu S_t \Delta t + \sigma S_t \Delta W_t \tag{1}$$

Now you should have a path of S_t. Next, simulate the stock TERMINAL price by the solution of GBM:

$$S_T = S_0 \exp\{(\mu - \frac{\sigma^2}{2})T + \sigma W_T\} \tag{2}$$

Compare the terminal value from method (1) and the result from method (2). Make an argument that these two numbers are very close to each other.

Note that:

- You need to use the same SEED form two methods (use *set.seed* function).

- Pleas try 10 to 20 different seeds so that you argument is more reasonable.