FINM331/STAT339 Financial Data Analysis – Hanson – Winter 2010

Lecture 3 Homework:

(due by Lecture 4 in Chalk FINM331 Assignments submenu)

- **You must show your work, code and/or worksheet for full credit.**
- **Justifying each non-trivial step with a reason is part of showing your work.**
- **There are 10 or more points per question if correct and best answer.**
- **Report numerical values in at least 4 significant digits (e.g., for errors use format like `%8.3e`).**

1. For the 31-December-08 to 31-December-09 get the daily S&P500 Index adjusted closings with symbol ^GSPC. For example, ***Yahoo! Finance*** has **Historical Prices** for each quote symbol where you can enter a range of dates for daily (or other) prices, then download spreadsheet (comma-separated, `'name'.cvs`), and use MATLAB to convert the `Adj Close` (last) column to a MATLAB readable `'name'.mat` file.[1]

(a) Compute the 2009 year of log-returns between the day and the day before;

(b) Compute the mean, unbiased variance, unbiased standard deviation, coefficient of skew and coefficient of kurtosis, assuming the daily 2009 log-return data consists of IID RVs.

(c) Compute the quartiles of the 2009 log-returns for the probabilities
`P = [0.00,0.01, 0.05, 0.10,0.25,0.50,0.75,1.00];`

(d) Plot the histogram of the 2009 log-returns with an appropriate bin size that gives an unbiased presentation of the tail and central parts.

(e) Get a Quantile-Quantile plot for the 2009 daily log-returns against a comparable normal simulation so that it has the same sample size, mean and standard deviation of part (b). *(25 points)*

2. The N-day Count:

(a) Prove Theorem 3.1 (L3-p45) on the Log-Value-at-Risk LVaR $\sqrt{N}$ factor to convert from the daily $\text{LVaR}_1(\alpha)$ to $\text{LVaR}_N(\alpha)$, in Lecture 3, page 45.

(b) Using the same k-day IID normal distribution with variance $\sigma^2 k\Delta t$ and zero-mean of the theorem to find the number of days k that it would take to make the cumulative tail probability (i.e., the probability on $(-\infty, |LR_i|])$ at least 0.25, if possible, for the both the minimum and maximum 2009 daily log-returns in Problem 1, using the the variance and average trading day Δt in year units. *(10 points)*

3. Using the 2009 log-return data and comparable normal of Problem 1:

(a) For both, compute Log-VaR **LVaR** for risk probabilities,
$\boldsymbol{\alpha = [0.001, 0.01.02, 0.025, 0.050]}$**;** and again compute the relative differences (errors of the normal?). Discuss the normal bias toward tail data.

(b) Do the same for the Quantile-VaR **QVaR**. *(10 points)*

[1] Every student seems to have own procedure for this, but a crudely simple way is open `'name'.cvs` file in spreadsheet to make columns; copy column minus `Adj Close` heading; paste to named `Variable` in `MATLAB Workspace`; save as `'name'.mat` in code directory; use in `'code'.m` code with `load 'name'.mat;` command.