Due Date: April 21, 2012 (before class). You may use any software to solve the problem. Don’t hand in all outputs; use cut-and-paste to select the relevant part of the output.

1. You may discuss the problems with other students, but must write your own solutions.

2. You may use 5% type-I error in all tests and 95% to construct confidence regions.

Data files: Available on the course web.

1. Consider the monthly simple returns of three stocks (Coke, IBM, and Caterpillar with ticker symbols KO, IBM, and CAT, respectively) and 3 market indexes (value-weighted, equal-weighted, and S&P composite index) from January 1961 to December 2015. The returns include dividends. The data are from CRSP and also in the file m-3stocks3dx-6115.txt.

   (a) Are the monthly simple returns of three stocks jointly normal? Why?

   (b) Consider jointly the simple returns of the three stocks and three indexes. Test $H_0 : \mu = 0$ versus $H_a : \mu \neq 0$, where $\mu$ denotes the mean vector of the monthly simple returns. Perform the test and draw your conclusion.

   (c) Provide justifications for the reference distribution used in the testing of part (b).

2. Transform the simple returns of Problem 1 to log returns. Construct simultaneous $T^2$, Bonferroni, marginal, and asymptotic chi-square confidence intervals for the means of the log returns.

3. Again, consider the monthly log returns for the three stocks of problem 1. (a) Construct a $T^2$-chart for the returns and (b) construct a $T^2$-chart for future observations, starting with $t = 450$. Comment on the charts.

4. Parts (a) and (c) of Problem 5.18 of the textbook (p. 267).

5. Consider again the monthly log returns of 3 stocks and 3 indexes of problem 1. Divide the sample into two non-overlapping sub-periods such the each period has 330 data points.
(a) Let $\Sigma_i$ be the covariance matrix of the sub-period $i$. Test $H_o : \Sigma_1 = \Sigma_2$ versus $H_a : \Sigma_1 \neq \Sigma_2$. Draw your conclusion.

(b) Let $\mu_i$ be the vector of mean returns in the sub-period $i$. Based on the result of Part(a), test $H_o : \mu_1 = \mu_2$ versus $H_a : \mu_1 \neq \mu_2$. Draw your conclusion.

Reading assignments: Chapters 5 & 6 of the textbook.