IEMS 326, Homework 5, Due 12/3/2012

1. The spreadsheet with this homework shows mean returns and correlations for stock indices from seven countries (the data is from 1980-1993). The spreadsheet already has calculated the covariance matrix for you and the mean and variance of a portfolio giving equal weight to each stock index. *Do not turn in a spreadsheet.*
a) Use the Excel solver to determine the portfolio with the smallest variance. Do this both for the case when you allow the portfolio weights to be negative (i.e., allowing short-sales) and for the case where you restrict them to be nonnegative.
b) Now we look at the problem of finding the minimum variance portfolio that achieves some specified expected return. For each of the expected returns listed on the spreadsheet, find the portfolio with minimum variance that achieves this expected return. Enter the standard deviation of the minimum-variance portfolio in the neighboring column. Then plot the expected return (y-axis) versus the standard deviation (x-axis). You should have some sort of parabola. Do this both for the case when you allow the portfolio weights to be negative (i.e., allowing short-sales) and for the case where you restrict them to be nonnegative. Plot both cases on the same graph.
c) In the financial crisis it was observed that correlations between different assets increased (limiting the advantages of diversification). Describe how your results to (a) and (b) would change if the correlation between each country pair were to increase to 0.75.

2. We will consider a portfolio composed of the following mutual funds: VIPSX (inflation adjusted bonds), VWEHX (junk bonds), VTSMX (US stocks), and VGTSX (foreign stocks). Go to yahoo finance and download the monthly historical prices starting on 8/1/2000. Then keep the price from the adjusted close column for the first trading day in **August** of each year. This will give us an annual time series for 2000-2012. Estimate the expected annual return for each fund and the covariance matrix. What is the portfolio with the minimum variance of the annual return (make sure the investment in each fund is nonnegative)? What is its expected annual return and standard deviation? How does its performance (in expectation and standard deviation) compare to a portfolio giving equal weight to each of the funds? If you had invested $10k in 8/1/2000, then what would your annual return be through 8/1/2012 under the minimum variance portfolio and under the equal weight portfolio? Suppose you had known ahead of time which asset would have the best return each year and each year invested the entire portfolio in that asset. In that case, what would your annual return have been through 8/1/2012?