NBA 5420 – Investments and Portfolio Management
Problem Set 4 – CAPM and Factor Models

Problem 1:

Are the following true or false, under the CAPM? Explain why.

a. Stocks with a beta of -1 must have an expected return of zero.

b. The CAPM implies that investors require a higher return to hold more volatile stocks (measured by total variance of returns).

c. You can construct a portfolio with beta of 1.5 by borrowing 50 percent of your budget and investing the proceeds plus the initial amount in the market portfolio.

Problem 2:

Stock A has a beta of 0.6 and investors expect it to return 5 percent. Stock B has a beta of 1.8 and investors expect it to return 11 percent. Use the CAPM to find the market risk premium and the expected rate of return on the market.

Problem 3:

Assume that the CAPM is true. Give brief answers to the following three questions:

a. Sitwell, Inc., a maker of sofabeds with a beta of 1.25 acquires Sleepwell, Inc., a maker of mattresses with a beta of 0.5. After the acquisition, does Sitwell's beta increase, decrease or remain unchanged? Does Sitwell's expected return increase, decrease or remain unchanged?

b. The consensus forecast for the market return over the next year has just been revised upwards. Does Sitwell's beta increase, decrease or remain unchanged? Does Sitwell's expected return increase as a result, decrease or remain unchanged?

c. After repeated incidents of consumers being trapped inside while trying Sitwell sofabeds, a class-action suit seeking substantial punitive damages is filed against the company. After the lawsuit is announced, will Sitwell's beta increase, decrease or remain unchanged? Will Sitwell's expected return increase, decrease or remain unchanged?

Problem 4:

You have been hired by a pension fund to evaluate three portfolio managers, A, B and C. The pension fund's staff has decided to use the Fama and French three-factor model (this is a factor model where the three common factors are the market return, size and value) to evaluate the performance of the funds. The staff estimates the three-factor model using the monthly excess returns (in percent per month) of the three funds over the past 5 years. The results are as follows:

Fund A: $rA - rf = 0.7 + 1.1*(rm - rf) - 0.54*SMB + 0.45*HML + e$, $R2 = 0.85$
Fund B: $rB - rf = 1.5 + 1.4*(rm - rf) + 0.71*SMB - 0.62*HML + e$, $R2 = 0.55$
Fund C: $rA - rf = 1.12 + 0.9*(rm - rf) + 0.45*SMB + 0.5*HML + e$, $R2 = 0.65$

where (rm – rf) is the market factor, SMB is the size factor, and HML is the Book-to-Market (value) factor. The intercepts are also in percent per month and significantly different from zero.

a. What proportion of the variation in the returns of each portfolios is systematic risk? What proportion is idiosyncratic risk?

b. From the regression findings above, describe where each fund places in the Morningstar 3x3 style decomposition matrix (size/value).

Problem 5:

Use the related Excel spreadsheet, which reports the monthly returns of five funds:

- Long-Term Capital Management (a bond arb hedge fund)
- Vanguard Growth (a passively-managed equities mutual fund)
- PIMCO Total Return (an actively-managed fixed income mutual fund)
- Berkshire Hathaway A stock (Warren Buffett's investment company)
- Templeton Emerging Markets (an actively-managed equities mutual fund).

The spreadsheet also contains monthly factors for (rM – rf), HML, SMB, and Momentum, taken from Ken French's website. You can do your work directly in Excel (or in Stata, Matlab, R, etc., if you prefer another statistical software package), but please report your final answers in the Problem Set write-up (no need to turn in the Excel file or code).

In order to run multivariate regressions in Excel, please refer to the following website: http://smallbusiness.chron.com/run-multivariate-regression-excel-42353.html. Note that the Analysis ToolPak can only be used on Windows computers. Mac users will need to use a school computer (for example, in the library) to complete this question.

Also note that the Regression tool in Excel cannot handle blank cells, so you will have to make sure that, for each fund, you select the range of only non-blank cells.

a. For the four funds and the market index, calculate the annualized mean excess returns, standard deviations, and Sharpe ratios.

b. Calculate the 1-, 3-, and 4-factor monthly alphas for each of the four fund.

For part a, it's important to compound returns, so you may want calculate and report everything in log annualized excess returns. However, use monthly simple (arithmetic) returns for part b (i.e. just the returns given), since that's how Fama-French models are traditionally estimated.