Assignment 2

1) The first part of this assignment is a CAPM exercise. The data comes from the Beta Management Case. In addition to getting a feel for the CAPM this demonstrates that even though a security can have a really high standard deviation, if you add it to a portfolio it can reduce the portfolio standard deviation.
   a) Calculate the standard deviation of the stock returns of the California REIT and the Brown group during the past two years. How variable are they compared with Vanguard Index 500 Trust? Notice which stock is the riskiest.
   b) Suppose Beta's position is 99% of equity funds invested in the index fund and 1% in the individual stock. Calculate the standard deviation of this portfolio using each stock. Interpret your results.
   c) Regress each stock's monthly returns on the Index returns and a constant. How do your beta estimates relate to b) above?
2) This question lets you estimate a variance/covariance matrix with a one factor model. The purpose of the exercise is to compare the variance covariance matrix that you get through the factor approach with the variance/covariance matrix that you get by estimating the variances/covariances directly.

observation	F	A	B	C	D
1	5.52	1.31	-18.14	-12.23	-9.04
2	14.62	15.81	17.86	37.19	27.33
3	13.88	17.77	5.18	20.35	16.45
4	2.10	-16.92	-30.09	-28.47	-7.78
5	2.34	-26.80	-37.61	-32.71	-23.34
6	16.00	37.72	38.77	33.76	44.78
7	10.01	26.26	28.25	29.20	-7.56
8	11.35	-4.81	9.80	10.53	21.26
9	15.95	7.39	16.95	15.81	25.51
10	16.13	21.82	58.47	31.91	15.83
11	20.94	32.70	30.61	37.28	14.53
12	-3.18	-4.22	-6.10	-0.01	-8.93
13	11.96	20.72	4.93	21.87	5.74
14	7.66	23.00	28.27	22.17	22.8
15	5.17	6.88	-5.45	-9.31	1.67

a) Estimate the Variances of each of the securities (A,B,C,D) then estimate each of the pair wise covariances. Tabulate your results in a variance/covariance matrix.

b) Now suppose that the world is best explained by a one factor model. So, $r_{A1} = A + \beta F_1 + u_{A1}$. That is, the first observation for security A (1.31), can be explained by a constant A and β times the value of the factor 5.52. The part of the return that is not explained by the index is the residual. Regress each of the securities on the factor to estimate the factor loading (β).

c) Use the residuals from each regression to calculate the variance of the idiosyncratic shock. So, for observation 1 of security A you would calculate $r_{A1} - A - \beta F_1$, this would give you u_{A1}

d) Estimate the variance of the index and hence estimate the variance/covariance matrix of the securities. Compare this with your results in a). Why do you think that the results are so different?

Doing Regressions in Excel

You can either do regressions by choosing data analysis from the tools menu, or for this one factor model, you can just calculate the regression coefficient by using the slope command from the 'function wizard' (This appears in the tool bar as a script f). The intercept term can be calculated with the 'intercept' command.

Excel also works out variances and covariances: once again go the function wizard and look under the statistical functions. You are interested in sample variances and covariances. Unfortunately, Excel does not provide a "sample" covariance. You can adjust for this by (a) ignoring the issue (but you should mention that you are ignoring it) or (b) multiplying the Excel calculated covariance by $\frac{n-1}{n-2}$ where n is the number of the observations.

If anyone is leery of typing in the data — send me an email and I'll send you an Excel file with the data in it. (parlourc@andrew.cmu.edu).