Econ 483   Winter 2000
Take Home Midterm Exam

The due date for this exam is Thursday February 17 at the beginning of class.
In this take-home exam, you will analyze the data in the EXCEL spreadsheet file `midterm.xls`.
This file can be found on the class syllabus web page. The spreadsheet contains monthly
closing price data on the four Pacific Northwest stocks (Boeing, Microsoft, Nordstrom and
Starbucks) over the period February 1995 - January 2000.

1. Using the monthly closing price data for the four stocks, compute monthly continuously
   compounded returns.

   (a) Make time plots of the four return series and comment on any noteworthy features.
       Put the four plots on one page.

   (b) Create scatterplots of the returns on Boeing vs. Microsoft, Boeing vs. Nordstrom,
       Boeing vs. Starbucks, Microsoft vs. Nordstrom, Microsoft vs. Starbucks and
       Nordstrum vs. Starbucks . Put the six plots on one page. What correlation
       patterns do you see?

   (c) Compute histograms of the four return series. Put these bar charts on one page.
       Do the returns look normally distributed?

2. Let R_i denote the monthly return on asset $i = 1, \ldots, 4$. Assume that R_i is a random
   variable distributed normally with mean μ_i and variance $\sigma_i^2 : R_i \sim N(\mu_i, \sigma_i^2)$. Further,
   let $\sigma_{ij} = cov(R_i, R_j)$. Consider forming a portfolio with portfolio weights x_i such that
   $x_1 + x_2 + x_3 + x_4 = 1$. Let $R_p = x_1 R_1 + x_2 R_2 + x_3 R_3 + x_4 R_4$ denote the return on this
   portfolio.

   (a) Compute $\mu_p = E[R_p]$.

   (b) Compute $\sigma_p^2 = var(R_p)$.

   (c) What is the probability distribution of R_p?

   (d) Give matrix algebra expressions for μ_p and σ_p^2.

3. Assume the constant expected return (CER) model holds for data in `midterm.xls`.

   (a) What are the assumptions behind the CER model?

   (b) Using the CER model, estimate $\mu_i, \sigma_i^2, \sigma_i, \sigma_{ij}$ and ρ_{ij} for $i =$ Boeing to Starbucks.
       Comment briefly on the results.

   (c) Compute 95% confidence intervals for μ_i for $i =$ Boeing to Starbucks. Are the
       expected returns estimated precisely?

   (d) Compute an estimate of the covariance matrix Σ for the four returns.

4. Using your estimates of μ_i, σ_i^2 and σ_{ij} from question 3, compute the efficient frontier or
   Markowitz bullet for the four risky assets.

(a) Plot the Markowitz bullet. On the plot, indicate the inefficient and efficient port-folios.

(b) Compute the minimum variance portfolio and show the location of this portfolio on the plot of the Markowitz bullet.

5. Consider adding a risk-free asset (T-bill) to the investment problem and suppose that the monthly risk-free rate is $r_f = 0.005$.

(a) Compute the tangency portfolio.

(b) Compute the expected return, variance and standard deviation of the tangency portfolio.

(c) Create a graph with the Markowitz bullet and the efficient set of portfolios that are combinations of the T-bill and the tangency portfolio. Indicate the location of the tangency portfolio on this graph.