BEM 103
Introduction to Finance
Fall 2001/2

Homework 3
Suggested Solutions

7.1 (No graphics here) In matrix notation (ρ=correlation between two asset returns):

$$\mu = \begin{bmatrix} .125 \\ .16 \end{bmatrix};$$

$$\Delta = \begin{bmatrix} .15^2 & \rho(.15)(.2) \\ \rho(.15)(.2) & .2^2 \end{bmatrix}.$$

Then, for a vector of weights x:

$$E[r_p] = x'\mu;$$
$$\sigma_p = \sqrt{x'\Delta x}.$$

E.g., $\rho = 0$, $x' = [.25\ .75]$:

$$E[r_p] = .15;$$
$$\sigma_p = \sqrt{.0239} = .155.$$

7.2

$$E[r_i] = r_F + \beta_i^M(E[r^M] - r_F) = .05 + 0.5(.14 - .05) = .095.$$

7.5 To apply the formula in the first answer, set

$$\mu = \begin{bmatrix} .10 \\ .15 \\ 0.05 \end{bmatrix};$$

$$\Delta = \begin{bmatrix} .05^2 & \rho(.05)(.2) & 0 \\ \rho(.05)(.2) & .2^2 & 0 \\ 0 & 0 & 0 \end{bmatrix}.$$

With $\rho = 0.25$ and $x' = [.25\ .25\ 0.50]$,

$$E[r_p] = .0875;$$
$$\sigma_p = \sqrt{.0030} = .055.$$

7.9 1. None dominates or is dominated in mean-variance space.

2. a) $x' = [.5\ .5\ 0]$. Then: $E[r_p] = .08$ and $\sigma_p = .05$.

   b) $x' = [.5\ 0\ .5]$. Then: $E[r_p] = .13$ and $\sigma_p = .19$.

   c) $x' = [0\ .5\ .5]$. Then: $E[r_p] = .15$ and $\sigma_p = .20$.

   None dominates or is dominated.

7.10 First compute cost-of-capital. Firmwide:

$$E[r] = .05 + (1.3)(.1) = .18.$$

Division P:

$$E[r] = .05 + (1.)(.1) = .15.$$

Division E:

$$E[r] = .05 + (1.5)(.1) = .20.$$

Within a one-period (two-date) context, IRR and NPV produce the same decisions (unless there is no IRR). Decisions are as follows:

1. Company-wide: accept none.
2. Division P: accept none; Division E: accept none.

7.11 1. discount rate is

$$.06 + (1.15)(.1) = .175.$$

2. First determine the beta of the entire firm (β_V). Let B be the value of debt and E be the value of equity. Note: $B/E = 0.25$, so $E/B = 4$. Betas are additive (like expectations), so

$$\beta_V = \frac{B}{B+E}0.3 + \frac{E}{B+E}1.15 = (\frac{1}{1+E/B})0.3 + (\frac{1}{1+B/E})1.15 = (0.2)(0.3) + (0.8)(1.15) = 0.98.$$

The discount rate is

$$.06 + (.98)(.1) = .158.$$