1. See Excel spreadsheet

2. a). $E(R_c) = (.10)(.25) + (.20)(.10) + (.50)(.15) + (.20)(-.12) = .096$ or 9.6%

$E(R_M) = .10(.18) + .20(.20) + .50(.04) + .20(.00) = .078$ or 7.8%

b). For stock C:

Prob.	R	$R-\bar{R}$	$(R-\bar{R})^2$	Prob. $(R-\bar{R})^2$
.10	.25	.154	.02372	.00237
.20	.10	.004	.00002	.000002
.50	.15	.054	.00292	.00145
.20	-.12	-.216	.04666	.00933

$Var(c) = \Sigma\, prob\,(R-\bar{R})^2 = .01315$

$SD.\,C = \sqrt{.01315} = .11467 = 11.467\%$

Market can be found similarly, SD Market $= 7.720\%$

c).

Prob	$C(R-\bar{R})$	Market $(R-\bar{R})$	Prob. $(R-\bar{R})(M-\bar{M})$
.10	.154	.102	.001571
.20	.004	.122	.000098
.50	.054	-.038	-.001026
.20	-.216	-.078	.003370

cov is the sum of the last column; $COV = .004013$

$$Corr = \frac{COV}{\sigma_M \sigma_C} = \frac{.004013}{(.11467)(.07720)} = .45332$$

d). $\beta = cov(c,m)/Var(M) = \frac{.004013}{.00596} = 0.6733$

3. Sec. 4 has 0 var, thus must be the risk-free asset. $\boxed{\text{corr} = 0, \beta = 0}$

Sec. 1 has the same return as the risk-free rate $\Rightarrow$ $\boxed{\beta = 0, \text{ corr} = 0}$

since sec. 2 has a $\beta = .8$, and a return of 14%, a portfolio of 80% market and 20% risk free must also have a return of 14%. Thus

$$.8 \cdot \overline{R}_m + .2(.07) = .14 \quad \text{so } \overline{R}_m = 15.75\%.$$

$$EMRP = 15.75\% - 7\% = 8.75\%$$

$$\boxed{SML: \; E(R_i) = 7\% + 8.75\% \cdot \beta_i}$$

Security 3: $E(R_3) = .10 = .07 + .0875\beta_3 \Rightarrow \boxed{\beta_3 = .343}$

Security 2: $\beta_2 = 0.8 = \dfrac{cov(R_2, M)}{Var(M)} = \dfrac{cov}{.0484} \Rightarrow cov(R_2, M) = 0.03872$

$$\Rightarrow \boxed{corr = \frac{.03872}{.20 \cdot .22} = .88}$$

4. a). $X_{HM} = \dfrac{\$50}{\$100} = .5 \qquad X_{HRF} = \dfrac{\$50}{\$100} = .5$

$$\overline{R}_H = .5(12) + .5(4) = 8\%$$

$X_{SM} = \dfrac{\$150}{\$100} = 1.5 \qquad X_{SRF} = \dfrac{-50}{100} = -.5$

$$\overline{R}_S = 1.5(12) + (-.5)(4) = 16\%$$

b). $Var = X_m^2 \sigma_m^2 + 2 X_m X_{rf} \cancel{\sigma_{rf,m}}^{0} + \cancel{X_{RF}^2}^{0} \sigma_{rf}^2$

$$\sigma_{Harry} = .5(20\%) = 10\%$$

$$\sigma_{Sally} = 1.5(20\%) = 30\%.$$

5. SML : $R_i = .06 + \beta(.085) = .06 + 1.132(.085) = .156 = \boxed{15.6\%}$

6. $\beta_{Asset} = 1.2$; $\beta_E = \left[\frac{D+E}{E}\right]\beta_{Asset}$, $R_s = R_{rf} + \beta(R_{rf} - R_m) = 6\% + \beta(8\%)$

Debt ratio	β_E	Cost of Equity
0.00	1.20	15.6%
.3	1.71	19.68 ← D = 30%, E = 70%,
.4	2.00	22.00
.5	2.40	25.20
.6	3.00	30.00

$\frac{.30 + .70}{.70} = 1.4286$

$\beta_E = 1.4286 \cdot 1.2 = 1.714$

(although don't worry if you assumed "debt ratio" meant Debt/Equity ratio

7. a). $\beta_{Asset} = \frac{E}{D+E}\beta_E = \frac{\$665}{\$665 + \$285} \cdot 1.25 = .875$

b). $r_{WACC} = \frac{B}{S+B} \cdot r_B + \frac{S}{S+B} r_S = 6\% \cdot \frac{\$285}{\$950} + 16\% \frac{\$665}{\$950} = 13.0\%$

since $r_S = r_{rf} + \beta(EMRP) = 6\% + 1.25 \cdot 8\% = 16\%$

c). $r_{WACC} = \frac{B}{S+B} \cdot r_B(1 - T_c) + \frac{S}{S+B} r_S = 11.635\%$ $(T_c = .35)$

$r_s = 14.95\%$

d). $NPV = -275{,}000 + \frac{34{,}905}{.11635} = \$25{,}000$

8).