Brief Answers to the Midterm

1. With beta = 1, both the market portfolio and the single stock have the same expected return, but the single stock has idiosyncratic risk while the market portfolio does not. Thus, risk aversion should lead one to choose the market portfolio instead of investing your wealth in a single stock.

2.a) PV = \( \frac{25}{0.04} \left[ 1 - \frac{1}{(1.04)^{30}} \right] \frac{1}{(1.04)^{10}} \) = 188.66 thousand. (Use the risk-free rate because the $25,000 cash flows are given, with no risk. Notice the payments are end-of-period.) ii) PV = 10,000 \times 25 = $250,000. (If you got the shares today, they would obviously be worth $25 each. By postponing, the share value grows at the 12% expected return, but the risk-adjusted discount rate is also 12%, so the PV is just $25/share.) iii) PV = 225,000/(1.04)^{10} = 152,002 (You receive $250,000 ten years from now for sure, so discount ten years at the risk-free rate.)

b) The $25,000 annuity is now a real cash flow, so discount using the real risk-free rate: real rate = \((1.04/1.02) - 1 = .0196\), so PV = \( \frac{25}{0.0196} \left[ 1 - \frac{1}{(1.0196)^{30}} \right] \frac{1}{(1.0196)^{10}} \) = 306.65 thousand. (You can also do this in nominal terms, but if so, notice that you have to inflation-adjust the entire stream of payments, not just the first one! – and then use the nominal discount rate for the entire stream of payments.)

3a) \( r(\text{equity}) = .04 + 1.3(.10 - .04) = .118 \), using the CAPM. Use \( r(\text{equity}) \) since you are discounting cash flows to equity to get the price of equity. \( P = 24 = 2.5/(.118 - g) \) \( \Rightarrow g = .0138 \), using the Gordon Growth Model (the growing perpetuity formula).

b. Gordon Model implies that \( g = \text{ROE} \times \text{plowback} \), so \( \text{ROE} = .0138/.3 = .046 \)

ROE < required return, so they should decrease their plowback ratio.

4.a. expected return to \( P = .1(.125) + .9(.15) = 14.75\% \)

var = \( .9^2 .4^2 + 2(.9)(.1)(.4)(.425)(.1) + .1^2 .425^2 \) = .134466. Std Dev of P is 36.67%.

b.

Investors might choose portfolio P or they might hold HG, but either dominates the higher risk and lower return OA stock.

c) \( x(.04) + (1-x)(.1) = .1475 \) so \( x = -0.79 \). Borrow 79% of the money you have to invest and take a levered position in the market portfolio. The standard deviation of the portfolio is 1.79(.2) = 35.8%.
5. capital structure: D/V = .20, E/V = .60, Pr/V = .20
\[ \text{beta(assets)} = .75(\text{beta(cell phones)}) + .25(\text{beta(office machines)}) = .75(1.8) + .25(1.2) = 1.65 \]

using CAPM: \( r_D = .06 = .04 + \text{beta(debt)} \times .05 \), so \( \text{beta(debt)} = .4 \)
\[ r_E = .15 = .04 + \text{beta(equity-common)} \times .05 \], so \( \text{beta(equity-common)} = 2.2 \)

a) \( \text{beta(assets)} = 1.65 = .2\text{beta(debt)} + .6\text{beta(equity-common)} + .2\text{beta(equity-preferred)} \), so \( \text{beta(equity-preferred)} = \frac{1.65 - (.2 \times .4) - (.6 \times 2.2)}{.2} = 1.25 \)

b) capital structure of spin-off: D/V = \( \frac{1}{4} \), E/V = \( \frac{3}{4} \); \( \text{beta(assets)} = 1.2 \) for office machines, \( \text{beta(debt)} = .4 \) as before
\[ \text{beta(assets)} = 1.2 = (.25 \times .4) + (.75 \times \text{beta(equity)}) \], so \( \text{beta(equity)} = \frac{1.2 - (.25 \times .4)}{.75} = 1.47 \)

using the CAPM: \( r_E = .04 + 1.47 \times .05 = 11.33\% \)

6. a. asset beta = 1.5(1.67) + .2(.33) = 1.07; return on assets = .04 + 1.07(1.1-.04) = 10.43%

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<th>Cash flow/year</th>
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<tr>
<td>Pretax rev-cost = 30-12</td>
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<td>Opportunity cost of inventories</td>
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<td>Change in working cap</td>
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<td>Net sales erosion = 10-3</td>
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<td>Capital cost</td>
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<td>b)depreciation allowance</td>
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<td>Taxes = .35(a)</td>
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<td>After tax cash flow</td>
<td>-30</td>
<td>0.2</td>
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a) Taxable revenue = pretax revenue – cost – sales erosion - depreciation
After-tax cash flow = pretax revenue – pretax cost – opportunity cost – change in working cap – net sales erosion - capital cost - taxes
Present value at time 0 = \( -30 + 0.2/(1.1043)^4 + (8.2/1.1043)(1-(1.1043)^{-3})/(1.1043) + 6.2/(1.1043)^5 + (7.15/1.1043)(1-(1.1043)^{-4})/(1.1043)^3 + 17.15/(1.1043)^{10} = -30 + 0.18 + 18.33 + 13.68 + 9.21 + 6.36 = 12.32 > 0 \). Positive NPV, so take the project, which adds 12.32 million to the value of the firm.
Notes: the consulting study has already occurred so the second installment of the payment is not incremental to the project. Only $7 million of the erosion is incremental to the project, since $3 million in erosion will occur even without the new project. (Different assumptions about the margin on the $10 million sales erosion are valid here – but need to be stated explicitly.) The erosion is pre-tax, so any erosion effect should be included in taxable revenue/cost.
b. Changing to the new equipment would have no effect on the discount rate since breakdown risk is idiosyncratic. Only market risk is priced. (Alternatively, one could argue that there is some market risk if the breakdown rate is associated with heavy usage, which is correlated with the market. This means the new equipment would reduce market risk (lower beta) and result in a lower discount rate and a higher NPV. This only makes sense if you explicitly argue that the breakdown risk is correlated with the market.)