Key to Final B: 12/14/2015

Problems (75 points each)

Note: Unless I specifically state "Calculations required", you can just set up all problems. If you are using the result of an unsolved equation in a later step, just make that clear. One way to do this, set up the equation and call your result "A" or "B", etc. If in any step you are solving for something other than the left-hand side of the equation, indicate which variable you are solving for. If you prefer, you can solve everything (but this will take longer).

1. Ajax currently trades for $60 per share and will pay $55 if the market is weak and $80 if the market is strong. The market trades for $55 and will pay $45 if the market is weak and $70 if the market is strong. The risk-free rate equals 5%. Set up a table that shows the set of arbitrage trades today will generate an arbitrage profit, the arbitrage profit today, and that the net cash flows from this arbitrage always equal $0 a year from today. Calculations required.

Equivalent to Ajax: Buy market + buy $10 of risk-free

Cost of equivalent = $55 + \frac{10}{1.05} = 55 + 9.5238 = 64.5238 \Rightarrow$ Buy Ajax

		CF_1	
Transaction	CF_0	Weak	Strong
+$ Buy Ajax	$-60 +5$	$+55 +5$	$+80 +5$
+$ Short market	$+55 +5$	$-45 +5$	$-70 +5$
+$ Short rf	$+9.5238 +6$	$-10 +5$	$-10 +5$
Total	$+4.5238 +5$	$\emptyset$	$\emptyset$

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2. Seven months from today, you plan to make the first of a series of quarterly deposits into an account earning an APR of 6% per year with monthly compounding. After your first deposit, you would increase your deposits by 2% each through your final deposit three years and one months from today. Four years from today, you will make your first annual withdrawal from this account. You would like for these withdrawals to continue forever and for your withdrawals to grow by 3% each. Set up the calculations needed to solve for your first deposit if your first withdrawal equals $500.
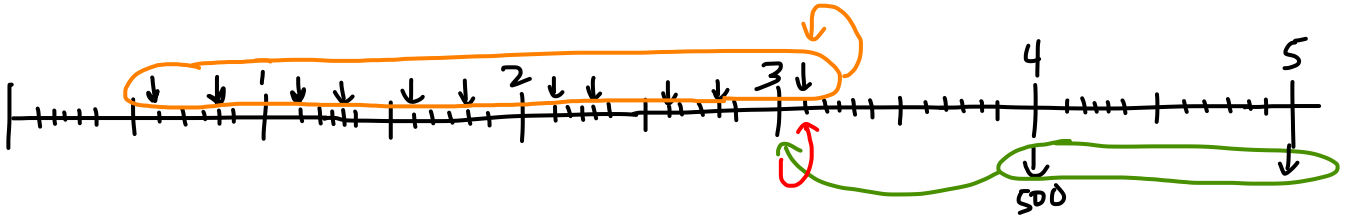
withdrawals

$$V_{3y} = \frac{500}{r(1) - .03} \quad + 15$$

$$r\left(\tfrac{1}{12}\right) = \frac{.06}{12} \quad + 8$$

$$r(1) = \left(1 + r\left(\tfrac{1}{12}\right)\right)^{12} - 1 \quad + 8$$

$$V_{3y1m} = V_{3y}\left(1 + r\left(\tfrac{1}{12}\right)\right)^1 = A \quad + 15$$

Deposits
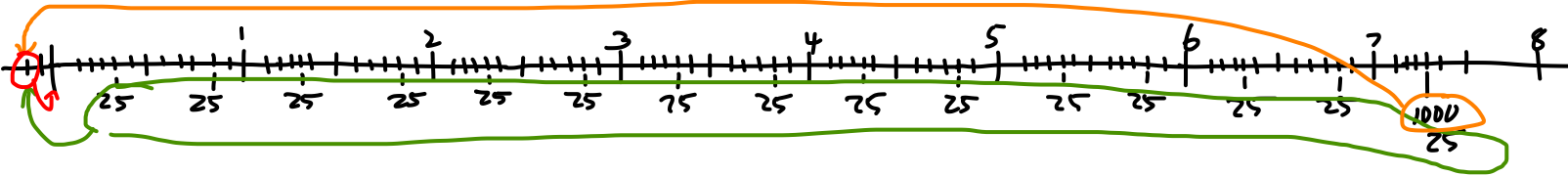
$$V_{3y1m} = \left(\frac{C}{r\left(\tfrac{1}{4}\right) - .02}\right)\left(\left(1 + r\left(\tfrac{1}{4}\right)\right)^{11} - (1.02)^{11}\right) = B \quad + 15$$

$$r\left(\tfrac{1}{4}\right) = \left(1 + r\left(\tfrac{1}{12}\right)\right)^3 - 1 \quad + 8$$

$$\Rightarrow \text{set } A = B \text{ & solve for } C \quad + 6$$

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3. Carrot Inc.'s outstanding bonds mature 7 years and 4 month from today for $1000. The annual coupon rate equals 5% and coupons are paid semiannually. Set up the calculations needed to determine the clean price of the bond if the yield to maturity on the bond equals 3%.

$$CPN = \frac{.05 \times 1000}{2} = 25 \quad +8$$

$$y = \frac{.03}{2} = .015 \quad +7$$

$$P = \left(\frac{25}{.015}\right)\left(1 - \left(\frac{1}{1.015}\right)^{15}\right) + \frac{1000}{(1.015)^{15}}\right)(1.015)^{2/6} \quad +15$$
+15   +15   +15

$$Clean = P - 25\left(\frac{2}{6}\right) \quad +15$$

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4. DontDrive Corp. is considering investing $47 million to expand its fleet of jets. The jets would be depreciated beginning a year from today using the 7-year MACRS class. DontDrive estimates that the new fleet will generate $150 million of additional revenue one year from today. Revenues are then expected to grow at a rate of 4% per year for the foreseeable future. Variable costs equal 67% of sales and fixed costs associated with the new jets will equal $14.4 million per year. DontDrive's tax rate equals 35%. DontDrive will not issue any long-term debt to fund the new jets, but the interest rate on the new short-term debt will equal 6%. With the additional jets, DontDrive will need all of the hangers in its maintenance facilities. Carry had been renting surplus space for $1 million per year. The incremental working capital associated with the new jets for the next five years will equal:

Year	0	1	2	3	4	5
Cash	0	8457	8350	8998	9236	9572
Accts Rec	0	17158	18234	19704	19626	20281
Inventory	0	3282	3498	3629	3850	3835
Accts Payable	0	7094	7426	7324	7371	7402
Short-term Debt	0	124	122	124	131	131

Set up the calculations needed to determine the unlevered net income and free cash flows associated with the jets in year 4.

See key for 12/11

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5. Extend Corp. expects earnings per share of $15 one year from today. For each of the next three years, Extend plans to pay out 25% of its earnings and reinvest 75% of its earnings in projects earning 20%. Beginning four years from today (and every year thereafter), the return on Extend's projects will fall to 3% and the firm plans to pay out 90% of its earnings. Set up the calculations needed to determine the price per share of Extend's stock if its equity cost of capital equals 8%.

See Key for 12/10

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6. Use the following to set up the calculations needed to determine Falter Inc.'s unlevered cost of capital. Falter's equity has a beta of 0.8 and the yield to maturity on Falter's debt equals 11%. There is a 15% chance that Falter will default on its debt and the expected loss rate on the bonds if Falter defaults equals 55%. The market value of Falter's equity equals $300 million and of its debt equals $100 million. The dividend yield on the market equals 2% and both earnings and dividends for the S&P500 are expected to grow by 5% per year forever. The return on U.S. Treasuries varies by maturity as follows: 1-year = 0.75%; 5-year = 1.8%; 10-year = 2.5%; 20-year = 3.5%; 30-year = 4%.

$$r_U = \left(\frac{300}{300+100}\right)r_E + \left(\frac{100}{300+100}\right)r_D \quad +21$$

$$r_E = .025 + .8\left(E(r_{Mkt}) - .025\right) \quad +21$$

$$E(r_{Mkt}) = .02 + .05 \quad +12$$

$$r_d = .11 - .15(.55) \quad +21$$

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7. Assume there is a 25% chance that Grab Corp.'s EBIT will equal $200 million, a 40% chance that Grab's EBIT will equal $500 million, and a 35% chance that Grab's EBIT will equal $900 million. Assume also that the corporate tax rate equals 25%, that the personal tax rate on equity income equals 15%, and that the personal tax rate on interest income equals 40%. Determine Grab's tax-optimal capital structure. Calculations required.

Leverage

$$200 - 500:$$

$$E(T_c) = .75 (.25) = .1875$$

$$T^* = 1 - \frac{(1-.1875)(1-.15)}{(1-.4)} = -.1510$$

$$0 - 200$$

$$E(T_c) = .25 \quad \text{+30}$$

$$T^* = 1 - \frac{(1-.25)(1-.15)}{(1-.4)} = -.0625 \quad \text{+30}$$

$$\Rightarrow \text{optimal interest} = 0 \quad \text{+15}$$

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8. Assume the corporate tax rate equals 5%, that the personal tax rate on dividends equals 25%, that the tax rate on capital gains equals 40%, and that the tax rate on interest equals 35%.
    a. Do firms has a tax incentive to pay out or to retain and reinvest surplus cash? Calculations required. Assume any surplus cash would be reinvested in risk-free securities.
    b. If firms pay out cash to stockholders, do they have a tax incentive to pay out the cash as a dividend or through a repurchase of shares? Calculations required.

a. $T^*_{retain} = \left(1 - \frac{(1-T_c)(1-T_g)}{(1-T_i)}\right) = 1 - \frac{(1-.05)(1-.4)}{1-.35} = .1231 \Rightarrow$ incentive to pay out

b. $T^*_d = \left(\frac{T_d - T_g}{1-T_g}\right) = \left(\frac{.25 - .4}{1-.4}\right) = -.25 \Rightarrow$ incentive to pay out dividends