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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. On a per share basis, an ETF holds a short position in risk-free assets that mature for $50 one year from today. The return on the risk-free bonds equals 5%. And on a per share basis, the ETF holds 7 shares of Ascend and has sold short 3 shares of Bounce. Ascend shares trade for $35 per share today and a year from today will pay either $40 if the economy is strong or $31 if the economy is weak. Bounce shares trade for $20 today and will pay either $30 if the economy is strong or $19 if the economy is weak. The ETF's shares trade for $130 today. 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.

No arbitrage price of risk free $= \frac{50}{1.05} = 47.62$

No arbitrage price of ETF $= 7(35) - 3(20) - 47.62 = 137.38 \Rightarrow$ buy

Payoffs on ETF:

strong $= 7(40) - 3(30) - 50 = 140$

weak $= 7(31) - 3(19) - 50 = 110$

Transaction	CF_0	CF_1: S	CF_1: W
+6 Buy ETF	−130 +4	+140 +4	+110 +4
+6 Short 7 Ascend	+7(35) = +245 +4	−7(40) = −280 +4	−7(31) = −217 +4
+6 Buy 3 Bounce	−3(20) = −60 +4	+3(30) = +90 +4	+3(19) = +57 +4
+6 Buy Treasury	−47.62 +4	+50 +4	+50 +4
	+7.38 +3	∅	∅

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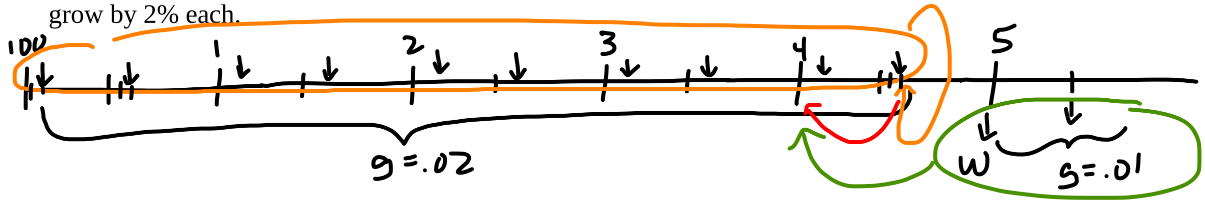
2. Two months from today, you plan to make the first of a series of semiannual deposits into an account earning an APR of 7% per year with quarterly compounding. Four years and eight months from today you will make your final deposit. Five years from today, you will make your first annual withdrawal from this account. You would like for these withdrawals to continue forever and for your withdrawals to grow by 1% each. Set up the calculations needed to solve for your first withdrawal if your first deposit equals $100 and subsequent deposits grow by 2% each.



Deposits

$$V_{4y8m} = \left(\frac{100}{r(\frac{1}{2})-.02}\right)\left(\left(1+r(\tfrac{1}{2})\right)^{10}-(1.02)^{10}\right) \quad +15$$

$$r(\tfrac{1}{4}) = \frac{.07}{4} \quad +8$$

$$r(\tfrac{1}{2}) = \left(1+r(\tfrac{1}{4})\right)^{2}-1 \quad +8$$

$$V_{4y} = V_{4y8m}\left(\frac{1}{1+r(\frac{1}{2})}\right)^{\frac{8}{6}} = A = V_{4y8m}\left(\frac{1}{1+r(1)}\right)^{\frac{8}{12}} \quad +15$$

Withdrawals

$$V_{4y} = \frac{W}{r(1)-.01} = B \quad +15$$

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

$\Rightarrow$ set A=B & solve for W +6

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3. Assume a U.S. Treasury bond pays an annual coupon of \$100 and matures five years from today for \$1000. Set up the calculations needed to determine the price and yield to maturity on the bond if the yields on zero-coupon Treasuries vary by maturity as follows: 1-year = 3%; 2-year = 5%; 3-year = 6%; 4-year = 6.5%; 5-year = 7%.

$$\text{Price} = \overset{+7}{\frac{100}{1.03}} + \overset{+7}{\frac{100}{(1.05)^2}} + \overset{+7}{\frac{100}{(1.06)^3}} + \overset{+7}{\frac{100}{(1.065)^4}} + \overset{+7}{\frac{1100}{(1.07)^5}} = A$$

$$A = \overset{+18}{\frac{100}{y}\left(1-\left(\frac{1}{1+y}\right)^5\right)} + \overset{+18}{\frac{1000}{(1+y)^5}} \Rightarrow \text{solve for } \overset{+4}{y} \text{ to get YTM}$$

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4. Carry Corp. is considering investing $24 million to expand its fleet of trucks. The trucks would be depreciated beginning a year from today using the 5-year MACRS class. Carry estimates that the new fleet will generate $10 million of additional revenue one year from today. Revenues are then expected to grow at a rate of 3% per year for the foreseeable future. Variable costs equal 36% of sales and fixed costs associated with the new trucks will equal $2.5 million per year. Carry's tax rate equals 35%. Carry will not issue any long-term debt to fund the new trucks, but the interest rate on the new short-term debt will equal 6%. With the additional trucks, Carry will be large enough to demand a discount on the fuel it purchases. Carry estimates that it will save $1 million per year in fuel costs on its existing fleet if it proceeds with the expansion. The incremental working capital (in thousands) associated with the new trucks will equal:

Year	0	1	2	3	4	5
Cash	0	837	899	900	958	951
Accts Rec	0	908	937	977	1048	1041
Inventory	0	203	207	218	216	215
Accts Payable	0	1061	1065	1072	1097	1137
Short-term Debt	0	86	93	99	107	108

Set up the calculations needed to determine the unlevered net income and free cash flows associated with the trucks in year 3.

$UNI_3 = (R_3 - E_3 - D_3)(1 - T_C)$ +14

$R_3 = 10(1.03)^2$ +11

$E_3 = .36(R_3) + 2.5 - 1$ +11

$D_3 = .1920(24)$ +11

$T_C = .35$

$FCF_3 = UNI_3 + D_3 - CE_3 - \Delta NWC_3$ +14

$CE_3 = 0$ +3

+11

$\Delta NWC_3 = NWC_3 - NWC_2$

$NWC_3 = 900 + 977 + 218 - 1072$

$NWC_2 = 899 + 937 + 207 - 1065$

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5. Delay Corp. expects earnings per share of $5 one year from today. For each of the next four years, Delay plans to pay out 20% of its earnings and reinvest 80% of its earnings in projects earning 25%. Beginning five years from today (and every year thereafter), the return on Delay's projects will fall to 5% and the firm plans to pay out 85% of its earnings. Set up the calculations needed to determine the price per share of Delay's stock if its equity cost of capital equals 10%.

$$g_{2-5} = .8(.25) = .2 \quad +6$$

$$g_{6+} = .15(.05) = .0075 \quad +6$$

$$D_1 = .2(5) = 1 \quad +6$$

$$E_5 = 5(1.2)^4 \quad +6$$

$$D_5 = E_5(.85) \quad +6$$

$$P_0 = \underbrace{\left(\frac{1}{.1-.2}\right)\left(1-\left(\frac{1.2}{1.1}\right)^4\right)}_{+15} + \underbrace{\left(\frac{D_5}{.1-.0075}\right)}_{+15}\underbrace{\left(\frac{1}{1.1}\right)^4}_{+15}$$

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6. Set up the calculations needed to determine Exhale Inc.'s unlevered cost of capital. Exhale's equity has a beta of 1.1 and the yield to maturity on Exhale's debt equals 15%. There is a 25% chance that Exhale will default on its debt and the expected loss rate on the bonds if Exhale defaults equals 40%. The market value of Exhale's equity equals $100 million and of its debt equals $60 million. The market risk premium equals 5% and the return on U.S. Treasuries varies by maturity as follows: 1-year = 0.5%; 5-year = 1.3%; 10-year = 2%; 20-year = 3%; 30-year = 3.5%.

$$r_U = \left(\frac{100}{100+60}\right) r_E + \left(\frac{60}{100+60}\right) r_D \quad +25$$

$$r_E = .02 + 1.1(.05) \quad +25$$

$$r_D = .15 - (.25)(.4) \quad +25$$

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7. Flip Corp. is currently funded with 100% equity. There is a 30% chance that Flip's assets will pay off $400 million a year from today, a 50% chance that Flip's assets will pay off $600 million a year from today, and a 20% chance that Flip's assets will pay off $900 million a year from today. All the risk is fully diversifiable and the risk-free interest rate equals 5%. Flip is considering issuing debt that matures for $500 million one year from today and using the proceeds to repurchase common stock. In the event of default, 20% of the value of Flip's assets will be lost due to bankruptcy costs.
   a. Set up the calculations needed to determine the value of Flip's equity before the debt issue/stock repurchase.
   b. Set up the calculations needed to determine the gain or loss by Flip's equity holders if Flip issues the debt.

a. $E(CF_1) = .3(400) + .5(600) + .2(900)$ +11

$V_0 = \frac{E(CF_1)}{1.05}$ +11

b. $E(CF_B) = .3(400 \times .8) + .5(500) + .2(500)$ +11

$V_0(B) = \frac{E(C_B)}{1.05}$ +11

$E(C_{SH}) = .3(0) + .5(100) + .2(400)$ +11

$V_S = \frac{E(C_{SH})}{1.05}$ +11

$Gain = (V_0(B) + V_S) - V_0$ +9

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8. Assume markets are perfect. Assume also that Gallop Inc. has assets (including cash) with a market value of $500 million. Gallop has a total of 25 million shares outstanding. Today, Gallop plans to pay out $25 million in dividends and plans to use an additional $75 million to repurchase shares. A year from today, the market value of Gallop's assets (including cash) is expected to be $510 million. Set up the calculations needed to determine the price per share of Gallop's stock a year from today.

$P_0 = \frac{500}{25}$ +18

$\#\text{shares repurch} = \frac{75}{P_0} = A$ + 19

$\#\text{shares left} = 25 - A = N$ +19

$P_1 = \frac{510}{N}$ +19