

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. Sinking Fortress ETF trades for \$500 and has the following positions (on a per-share basis) in the following securities: it has purchased 10 shares of Chasing Dollars Bank, it has short-sold two shares of AB AllBev, and it has short-sold risk-free bonds that mature for \$100 one year from today. The price of these risk-free bonds today is \$95. Each share of Chasing Dollars Bank trades for \$100 and will pay either \$90 or \$120 a year from today depending on whether the economy is weak or strong. Each share of AB AllBev trades for \$200 and will pay either \$190 or \$260 a year from today depending on whether the economy is weak or strong. Set up a table that shows net cash flows will always equal \$0 next year and which answers the following questions. Note: Use "+" for inflows and "-" for outflows. Calculations required.

- a. What set of transaction today generates an arbitrage profit?
- b. What arbitrage profit do these transactions create?
- ~~c. Assume the economy is strong a year from today. What transactions are required to unwind your arbitrage trades?~~

Payoff on ETF:

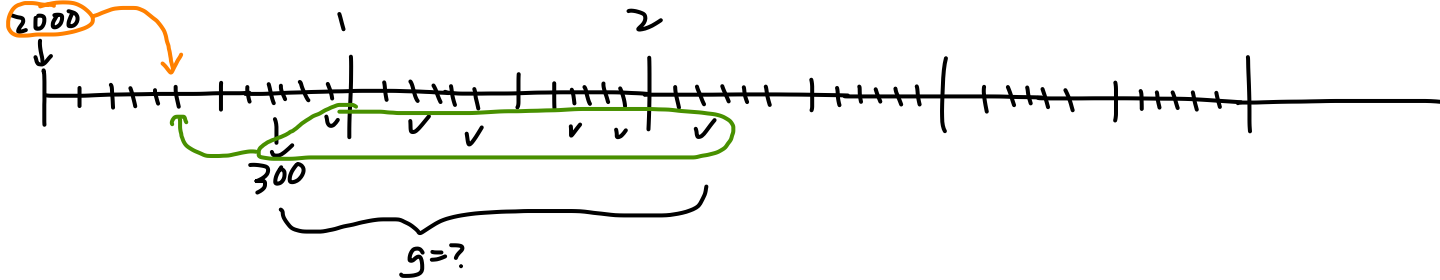
$$W = 10(90) - 2(190) - 100 = 420$$

$$S = 10(120) - 2(260) - 100 = 580$$

$$\text{Cost of equivalent portfolio} = 10(100) - 2(200) - 95 = 505$$

Transact (t=0)	CF ₀	CF ₁	W	S
+6 Buy ETF	+4 - 500	+4 + 420	+4 + 420	+4 + 580
+6 Short 10 Chasing	+4 +1000 = 100 x 10	+4 - 900 = -90 x 10	+4 - 900 = -90 x 10	+4 - 1200 = -120 x 10
+6 Buy 2 AllBev	+4 - 400 = -200 x 2	+4 + 380 = 190 x 2	+4 + 380 = 190 x 2	+4 + 520 = +260 x 2
+6 Buy Treasury	+4 - 95	+4 + 100	+4 + 100	+4 + 100
Total	+3 + 5			

2. You have just deposited \$2000 into an account earning an APR of 5% with monthly compounding. You plan to begin quarterly withdrawals from this account beginning 8 months from today. Your final withdrawal would occur 2 years and 2 months from today. Your first withdrawal will equal \$300 and subsequent withdrawals will all grow or shrink by the same percent. Set up the calculations needed to determine the rate at which you can increase or shrink each withdrawal.



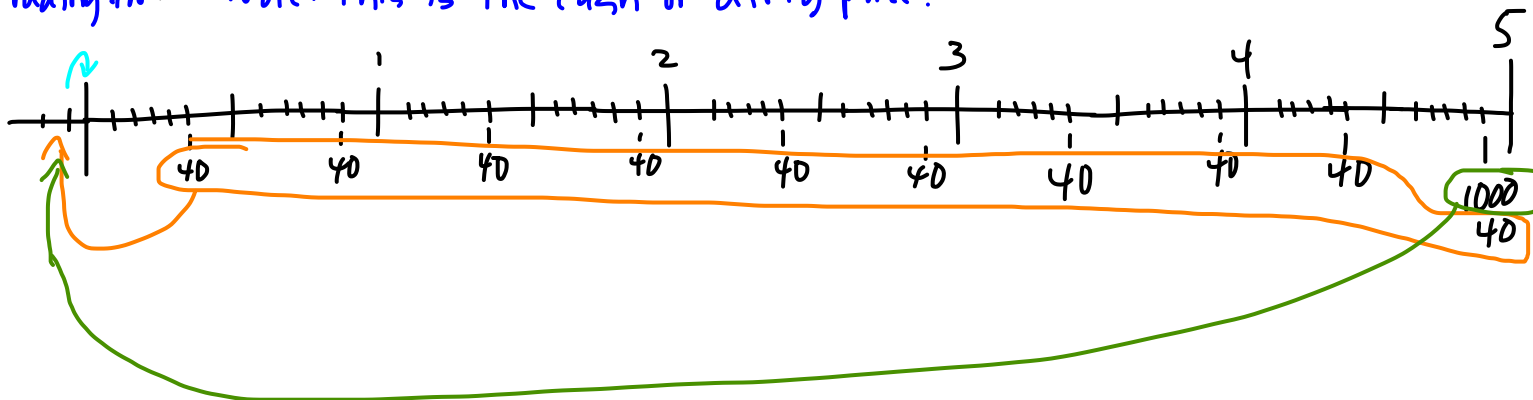
$$2000(1+r(\frac{1}{12}))^5 = \left(\frac{300}{r(\frac{1}{4})-g} \left(1 - \frac{1+g}{1+r(\frac{1}{4})} \right)^7 \right) \Rightarrow \text{set equal \& solve for } g$$

+22
+22
+9

$$r(\frac{1}{12}) = \frac{.05}{12} +11$$

$$r(\frac{1}{4}) = \left(1 + r(\frac{1}{12}) \right)^3 - 1 +11$$

3. A bond that matures four years and 11 months from today for \$1000 has a coupon rate of 8%. Coupons are paid semiannually. Set up the calculations needed to determine the yield to maturity on the bond if its clean price is \$900. ~~if it is trading for~~ *Note: this is the cash or dirty price.*



$$\left(\underbrace{\left(\frac{40}{r(\frac{1}{2})} \right)}_{+17} \left(1 - \left(\frac{1}{1+r(\frac{1}{2})} \right)^{10} \right) \right) + \underbrace{\left(\frac{1000}{(1+r(\frac{1}{2}))^{10}} \right)}_{+17} \underbrace{\left(1+r(\frac{1}{2}) \right)^{10}}_{+17} = 900 \Rightarrow \text{solve for } r(\frac{1}{2}) +6$$

$$YTM = r(\frac{1}{2}) \times 2 + 9$$

$$\text{COUPON} = \frac{.08 \times 1000}{2} + 9$$

4. Slamburger is considering investing \$3.75 million today in a new retail store. The new store will fall into the 10-year MACRS class and will be built on land Slamburger acquired a year ago for \$250,000. This land could be sold today for an after-tax cash flow of \$300,000. Slamburger expects revenues a year from today to equal \$60 million. In the following years, sales are expected to grow by 4% per year. Slamburger estimates that variable costs be the same as at existing stores and thus will equal 77.5% of revenues that and fixed costs associated with the store will equal \$10.5 million per year. Ten percent of the sales of the new Slamburger store would have occurred anyway at existing stores. Net working capital (in millions) associated with the store will be as follows:

Year	0	1	2	3	4	5
Cash	0.00	3.60	3.87	4.18	4.39	4.35
+ Acct. Receive	0.00	1.95	2.06	2.11	2.24	2.39
+ Inventory	0.00	7.65	8.27	8.87	9.40	9.37
- Acct. Payable	0.00	7.50	7.98	8.16	8.57	8.50

6.22 7

Set up the calculations needed to determine the new store's unlevered net income and free cash flow ~~today and~~ three years from today if Slamburger's marginal tax rate equals 35%.

$$UNI_3 = (R_3 - E_3 - D_3)(1 - .35) + 14$$

$$R_3 = 60(1.04)^2(1 - .1) + 11$$

$$E_3 = .775R_3 + 10.5 + 11$$

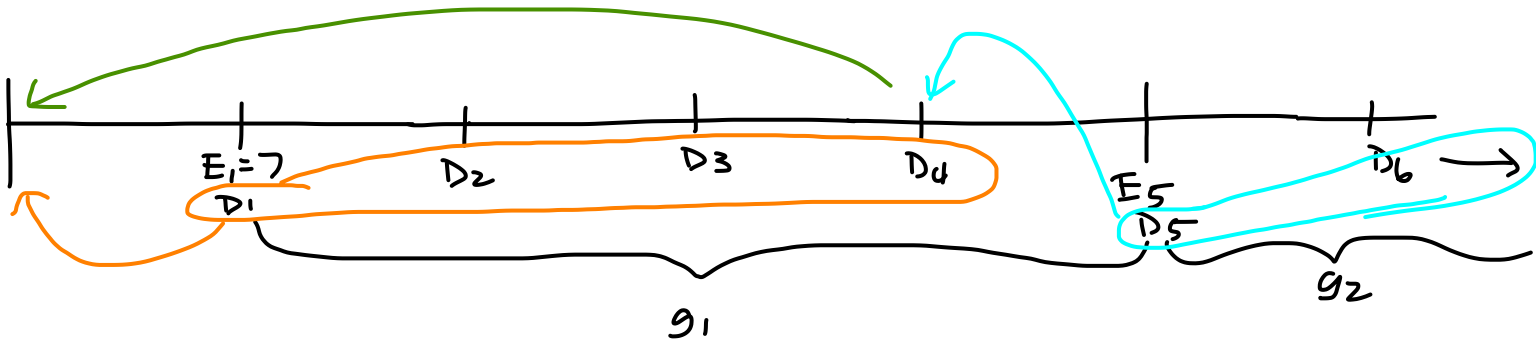
$$D_3 = 3.75(.1440) + 11$$

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

$$\Delta NWC_3 = 7 - 6.22 + 11$$

$$CE_3 = 0 + 3$$

5. Orchid Pharmaceuticals expects earnings a year from today of \$7 per share. Each year, Orchid expects to pay out 10% of earnings and invest the remaining earnings in projects earning a 40% return. This will change five years from today when the return on projects falls to 3% and Orchid begins to pay out 80% of its earnings. These new conditions will hold forever. What is the value of Orchid stock if Orchid's equity cost of capital equals 10%?



$$g_1 = .9(.4) + 5$$

$$g_2 = .2(.03) + 5$$

$$D_1 = .1(7) + 5$$

$$E_5 = 7(1+g_1)^4 + 7$$

$$D_5 = .8(E_5) + 5$$

$$P_0 = \underbrace{\left(\frac{D_1}{.1 - g_1} \right) \left(\frac{1}{1 - \left(\frac{1+g_1}{1.1} \right)^4} \right)}_{+16} + \underbrace{\left(\frac{D_5}{.1 - g_2} \right)}_{+16} \underbrace{\left(\frac{1}{1.1} \right)^4}_{+16}$$