Solutions to E120 Spring 2001 Final Exam **by Wen-Yu Liao**

Problem 1: How much invested now at an annual interest rate of 3.7137% would be just enough to provide for four lump sum payments of $6000 at the end of years 5, 10, 15 and 20?

r = rate for a 5-yr period = (1.037137)^5-1 = 0.2
PV = 6,000*[1-1/1.2^4]/0.2 = 15,532.41

Problem 2: Now that you are graduating, you will have to pay back your student loans! You will not start making payments for another 6 months. Assume you borrowed money only through subsidized loans (no interest accrued while in school or during the first six months after graduation). Your loans total $20,000. The nominal interest rate charged by the government is 3%, compounded quarterly. You would like to pay your loans back in 15 years, making monthly payments.

a) Calculate the amount of each monthly payment

Assuming payments are made at the end of the month:
r = monthly rate = (1+3%/4)^(1/3) -1= 0.00249 (or (1+r)^3 =1+3%/4)
20,000 = C*[1-1/1.00249^(15*12)]/0.00249 ; C = 138

b) Calculate the effective annual rate (EAR)

EAR = (1+3%/4)^4-1 = 0.0303

c) Calculate the interest paid in the 25th payment

Balance right after 24th payment = 138[1-1/1.00249^(180-24)]/0.00249 = 17,821.32
Interest paid in the 25th payment = 17,821.32*0.00249 = 44.38

d) Calculate the total interest paid on the debt by the end of the 10th year

By the end of 10th year, 120 payments have been made.
Balance after 10th year =138[1-1/1.00249^(180-120)]/0.00249 = 7,682.31
Principal paid during the first ten years = 20000-7682.31 =12,317.69
Interest paid for the first 10 years
= total payments made for the first 10 years- total principal paid during the first 10 years
= 120*138 – 12,317.69 = 4,242.31

Or

Total interest paid for the loan = 180*138 -20,000 = 4,840
Total interest paid for the last 5 years = 60*128 - 138[1-1/1.00249^(180-120)]/0.00249
=597.69
Interest paid for the first 10 years = 4,840-597.69 =4,242.31

Problem 3: Consider the following securities:

State	Probability	Return A	Return B
Boom	0.60	0.25	0.10
Bust	0.40	0.08	0.30

a) What is the expected return on Security B?

$E[R_B] = 0.6*0.1+0.4*0.3 = 0.18$

b) What is the expected return on a portfolio that is equally weighted amongst A, B, and the risk-free asset? The expected return on the risk-free asset is 5%.

$E[R_A] = 0.6*0.25+0.4*0.08 = 0.182$
$E[R_P] = (1/3)*0.182+(1/3)*0.18+(1/3)*0.05 = 0.137$

Problem 4: Suppose IEOR Corporation's common stock dividend yield is 5%, and that the corporation just paid a dividend of $10, and is expected to pay a dividend of $10.80 one year from now. Dividends are expected to continue to grow at the same constant rate indefinitely. What is the required return of ABC stock?

Dividend yield = $D_1 / P_0 = 10.8/P_0 = 0.05$; $P_0 = 216$

g = (10.8/10)-1=0.08

$P_0 = 216 = 10.8/(R-0.08)$; R = 0.13

Or

$R = g + D_1 / P_0 = 0.08 + 0.05 = 0.13$

Problem 5: SesameSweet Inc. has 220,000 shares outstanding with a par value of $1 per share and a market price of $12.00 per share. On the balance sheet, additional paid-in capital is $540,000, while retained earnings is $275,000. There is no treasury stock and there are no transaction costs.

a) What is the total owners' equity for SesameSweet?

Total owners' equity = common stock & additional paid-in capital + retained earnings
= 220,000*1 +540,000+275,000 = 1,035,000

b) Suppose Sesame Sweet declares a 10% stock dividend. What is the new retained earnings account value on the balance sheet?

(Skip! Not included in the final)

275,000-220,000*10%*(12-1) = 33,000

c) Suppose SesameSweet declares a 2-for-1 stock split. What is the new par value?

(Skip! Not included in the final)

After 2-for-1 stock split , total outstanding shares = 220,000*2 = 440,000

Par = (220,000*1)/440,000 = 0.5

What happens to the total owners' equity on the balance sheet?

(Skip! Not included in the final)

Owners' equity stays the same.

Problem 6. Suppose you own 100 shares of Microsoft stock, with the current share price being $50. You believe the price of Microsoft's stock will go down in the future. Show how you can use call options and forward contracts to hedge against losses of more than $20, if no put options contracts are available in the market.

Need to buy put options to protect your downside risk (against losses of more than $20 for each share of stocks you own).

Buy 100 calls with strike price of 30 + short 100 forward contracts at forward price of 30
= buy 100 puts with strike price of 30

Check future payoffs:

ST	from stock	from calls	from forward	total
50	5,000	100*(50-30) = 2,000	-100*(50-30) = -2,000	5,000
45	4,500	100*(45-30) = 1,500	-100*(45-30) = -1,500	4,500
40	4,000	100*(40-30) = 1,000	-100*(40-30) = -1,000	4,000
35	3,500	100*(35-30) =500	-100*(35-30) = -500	3,500
30	3,000	0	0	3,000
25	2,500	0	100*(30-25) = 500	3,000