

**AFM 272**

**Midterm Examination #1**

**Friday June 04, 2010**

**Professor J. Thompson**

**Name:** \_\_\_\_\_

**Student Number:** \_\_\_\_\_ **Section Number:** \_\_\_\_\_

**Duration: 2 hours**

**Instructions:**

- 1. Answer all questions in the space provided.**
- 2. Show all of your calculations.**
- 3. The examination has 11 pages (not including this cover page). Verify that your copy is complete.**
- 4. Materials allowed: calculator.**
- 5. Unless specifically instructed otherwise, provide final answers relating to percentage rates to four decimal places (e.g. 6.27% or .0627) and provide final answers involving dollar amounts to two decimal places (e.g. \$98.27).**
- 6. To have your exam considered for re-grading, the exam must be written in ink.**

**Mark Distribution** 1. \_\_\_\_\_/26   a. \_\_\_\_\_/4   b. \_\_\_\_\_/8   c. \_\_\_\_\_/7   d.

\_\_\_\_\_/7

2. \_\_\_\_\_/9

3. \_\_\_\_\_/7

4. \_\_\_\_\_/10

5. \_\_\_\_\_/8

6. \_\_\_\_\_/6

**Total:** \_\_\_\_\_/66

Question 1: 26 marks.

(a) (4 marks) Suppose that you deposit \$6,000 today. How much will your investment be worth after 30 years if your deposit earns:

- (i) simple interest at an annual rate of 5%;
- (ii) semi-annually compounded interest at a stated annual rate (i.e., APR or quoted rate) of 5%;
- (iii) quarterly compounded interest at a effective annual rate of 5%?

(i)  $\$6,000 \times (1 + 30(.05)) = \$15,000$  (1 mark)

(ii)  $\$6,000 \times (1 + .05/2)^{2 \times 30} = \$26,398.74$  (2 marks)

(iii)  $\$6,000 \times (1 + .05)^{30} = \$25,931.65$  (1 mark)

(b) (8 marks) Creative Securities Inc. is marketing a new financial security. The security will make payments every six months over the next ten years. The first payment will be six months from today. In the odd-numbered years (i.e. years 1, 3, 5, 7, and 9), the amount paid will be \$50 halfway through each year and \$50 at the end of each year. In the even-numbered years (i.e. years 2, 4, 6, 8, and 10), the amount paid will be \$100 halfway through each year and \$100 at the end of each year. In other words, there are two payments of \$50, followed by two payments of \$100, followed by two payments of \$50, followed by two payments of \$100, etc., over the ten year life of the security. If the stated annual interest rate is 8% compounded quarterly, what is the present value of this security?

This security can be decomposed into three annuities: (i) an annuity paying \$50 every six months for the next ten years, with the first payment in six months; (ii) an annuity paying \$50 every two years for the next ten years, with the first payment in two years; and (iii) an annuity paying \$50 every two years for the next ten years, with the first payment in 1.5 years.

The rate per six month period is  $(1 + .08/4)^2 - 1 = 4.04\%$ . (1.5 mark)

The rate per two year period is  $(1 + .08/4)^8 - 1 = 17.17\%$ . (1.5 mark)

$$\begin{aligned} \Rightarrow PV &= \$50A_{.0404}^{20} + \$50A_{.1717}^5 + \$50_{.1717}^5 \times 1.0404 \\ &= \$677.12 + \$159.36 + \$165.80 \\ &= \$1,002.28 \quad (5 \text{ marks}) \end{aligned}$$

(c) (7 marks) You have just purchased a \$42,000 car. You have financed your purchase with a downpayment of \$12,000 and a \$30,000 bank loan at an interest rate of 5% compounded annually. The car loan is to be amortized over 5 years. Payments are to be made on a monthly basis (at the end of each month). The first payment will be one month from today.

(i) Calculate the monthly payment on the car loan.

(ii) Calculate the interest portion and the principal portion of the 20th payment.

(i) The monthly interest rate is

$$(1 + r)^{12} = 1.05 \Rightarrow r = 1.05^{1/12} - 1 = .00407412378. \quad (1 \text{ mark})$$

The monthly payment is then:

$$\begin{aligned} \$30,000 &= C \times \left[ \frac{1 - 1.00407412378^{-60}}{0.00407412378} \right] \\ \Rightarrow C &= \$564.61. \quad (2.5 \text{ marks}) \end{aligned}$$

(ii) The balance owing after the 19th payment is:

$$\$564.61 \times \left[ \frac{1 - 1.00407412378^{-41}}{0.00407412378} \right] = \$21,279.12. \quad (1.5 \text{ marks})$$

The interest portion of the 20th payment is:

$$\$21,279.12 \times .00407412378 = \$86.69. \quad (1 \text{ mark})$$

The principal portion of the 20th payment is:

$$\$564.61 - \$86.69 = \$477.92. \quad (1 \text{ marks})$$

(d) (7 marks)

Today is your 25th birthday. You want to start saving for retirement and you can afford to deposit \$3,000 once per year into a savings account (starting today). Suppose that the savings account pays interest of 8% per year compounded annually and you want a retirement income of \$50,000 per year for 15 years with the first payment on your 65th birthday. How long do you have to make deposits in order to obtain your desired retirement income?

We have:

$$\begin{aligned} \$3,000 + \$3,000 \times \left[ \frac{1 - 1.08^{-T}}{.08} \right] &= \$50,000 \left[ \frac{1 - 1.08^{-15}}{.08} \right] \div 1.08^{64-25} && (5 \text{ marks}) \\ &= \$21,276.04 \end{aligned}$$

$$\Rightarrow 1 - 1.08^{-T} = \$21,276.04 \times \frac{.08}{\$3,000} = .487361$$

$$\Rightarrow 1.08^{-T} = 1 - .487361 = .512639$$

$$\Rightarrow -T \ln(1.08) = \ln(.512639)$$

$$\Rightarrow T = 8.69 \text{ years.} \quad (2 \text{ marks})$$

Question 2: 9 marks.

Cloned Petz r Us Ltd. (CPU Ltd.) sold 10,000 bonds to investors at par. The bonds carried a 7% coupon rate and had five years until maturity.

*\*\*note: although i announced during the exam that these were to be semi-annual compounded bonds, there were a number of people who still did it annually. I did not deduct marks for doing it this way, however it did make the question more difficult (but still possible) because of the timing. As a consequence, there were some that received full marks doing it annually, while others did not.\*\**

(a) One year after the bonds were issued by Cloned Petz, their yield-to-maturity was 8% and the bonds were selling for **less** (circle one!) than their original issue price. Briefly explain. (2 marks)

As the bond was issued at par value, the only return for the original purchaser was the 7 % coupon. Thus, the YTM was 7%. Given that YTM is now 8%, the YTM has increased which means the price must have decreased.

(b) Three and a half (3.5) years have passed since the above bonds were originally issued by Cloned Petz and today their yield-to-maturity is 6%. What is the current price of the above CPU bonds? (Calculate price for a single bond)

$5 - 3.5 = 1.5$  years remaining.

Coupon is  $\frac{.07 \times 1000}{2} = 35$  semi-annually. (1 mark)

Discount rate is  $\frac{0.06}{2} = 0.03$  (1 mark)

$P_0 = \frac{35}{1.03} + \frac{35}{(1.03)^2} + \frac{1035}{(1.03)^3} = \$1014.14$ . (2 marks)

Note that students may solve for the price with a 3 year annuity which is fine too.

(c) What is the duration of the above CPU bonds today (i.e. 3.5 years after they were originally issued)? Use your results from part b (i.e. the new yield-to-maturity and new price) and calculate the duration for a single bond!

$$D = \frac{\frac{35}{1.03} \times 1 + \frac{35}{(1.03)^2} \times 2 + \frac{1035}{(1.03)^3} \times 3}{1014.14} = 2.906\text{-month periods (3 marks)}$$

This means that durations is 1.45 years. (If answer left at 2.9, then one mark deduction).

Question 3: 10 marks.

Today we have the following government bonds trading:

Bond	Price	Coupon Rate	Maturity
A	\$995.39	4%	2 years
B	\$1,039.11	6%	3 years
C	\$873.79	0%	3 years

Assume that each bond has a par value of \$1,000 and that coupon payments are made annually. The next coupon payment for bonds A and B will be made exactly one year from today. Bond C pays its par value back exactly three years from today.

(a) (6 marks) Calculate the one year spot interest rate  $r_1$ , the two year spot interest rate  $r_2$ , and the three year spot interest rate  $r_3$ .

$$r_3 = \left( \frac{\$1,000}{\$873.79} \right)^{1/3} - 1 = 4.60\% \quad (1 \text{ mark})$$

$$3 \text{ of A: } \$2,986.17 = \frac{\$120}{(1+r_1)} + \frac{\$3,120}{(1+r_2)^2}$$

$$2 \text{ of B: } \$2,078.22 = \frac{\$120}{(1+r_1)} + \frac{\$120}{(1+r_2)^2} + \frac{\$2,120}{1.046^3}$$

$$\Rightarrow \$225.79 = \frac{\$120}{(1+r_1)} + \frac{\$120}{(1+r_2)^2}$$

$$\Rightarrow \$2,760.38 = \frac{\$3,120}{(1+r_2)^2}$$

$$\Rightarrow r_2 = \left( \frac{\$3,000}{\$2,760.38} \right)^{1/2} - 1 = 4.25\% \quad (3 \text{ marks})$$

$$\$995.39 = \frac{\$40}{(1+r_1)} + \frac{\$1,040}{1.0425^2}$$

$$\Rightarrow \frac{\$40}{(1+r_1)} = \$38.46$$

$$r_1 = \left( \frac{\$40}{\$38.46} \right) - 1 = 4.01\% \quad (2 \text{ marks})$$

Note that  $r_1$  can also be found using bond B instead of bond A:

$$\$225.79 = \frac{\$120}{(1+r_1)} + \frac{\$120}{1.0425^2}$$

$$\Rightarrow \frac{\$120}{(1+r_1)} = \$115.37$$

$$r_1 = \frac{\$120}{\$115.37} - 1 = 4.01\%$$

(b) (4 marks) Calculate the yield to maturity for bond A.<sup>1</sup>

$$995.39 = \frac{40}{1+r} + \frac{1040}{(1+r)^2} \quad (1.5 \text{ marks})$$

$$995.39r^2 + 1950.78r - 84.61 = 0 \quad (1.5 \text{ marks})$$

$$r = 4.25\% \quad (1 \text{ mark})$$

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<sup>1</sup>I bet there is someone writing this exam who did not write down the quadratic formula on their formula sheet. If needed for this question, the quadratic formula is:  $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ . When you are out in the working world making millions and looking to donate money for a chaired professorship, remember that I did this for you.

Question 4: 7 marks.

Eagle Inc. has just reported EPS of \$3.50 and is just about to pay a dividend of \$2.10 per share. The firm has growth prospects over the next six years, but it will not have any growth opportunities thereafter. It will maintain its current payout ratio until the end of year 6, at which point it will switch to a payout ratio of 100%. In other words, the first time at which the payout ratio is different is year 7. Assume that the firm pays dividends annually and that the opportunity cost of capital is 10%. Also assume that the firm will earn a rate of return of 15% on its retained earnings over the next 6 years.

(a) (5 marks) What is the current price per share of Eagle Inc.'s stock?

$$\begin{aligned}g &= [1 - \$2.10/\$3.50] \times 15\% = 6\% && (1 \text{ mark}) \\P_0 &= \$2.10 + \$2.10(1.06) \left[ \frac{(1 - (1.06/1.10)^6)}{.10 - .06} \right] + \frac{\$3.50(1.06^7)/.10}{1.10^6} && (3 \text{ mark}) \\&= \$2.10 + \$11.09 + \$29.71 \\&= \$42.90 && (1 \text{ mark})\end{aligned}$$

(b) (2 marks) What is the net present value (per share) of the firm's growth opportunity?

$$\text{NPVGO} = \$42.90 - \$3.50 - \$3.50/.10 = \$4.40 \quad (2 \text{ marks})$$

Question 5: 8 marks.

Assess whether each of the following statements is true, false, or uncertain. Justify your answer. All marks are based on the quality of your argument supporting your answer.

(a) (4 marks) An investor who purchases a zero coupon government bond today will receive a rate of return equal to the bond's yield to maturity today.

Uncertain. If the investor holds the bond until maturity, the statement is true. For example, if a two year zero coupon bond with a par value of \$1,000 is selling for \$826.45, the yield to maturity is  $(\$1,000/\$826.45)^{1/2} - 1 = 10\%$ , which is equal to the annual rate of return per year received by investing \$826.45 now in exchange for \$1,000 in two years. However, the statement might not be true if the investor does not hold the bond until maturity. Suppose, for example, that the investor sells the bond one year from today and that the one year spot risk free rate at that time is 9%. Then the price received would be  $\$1,000/1.09 = \$917.43$ , and the rate of return earned by the investor would be  $\$917.43/\$826.45 - 1 = 10.65\%$ . The only way that an investor who sells the bond before maturity will earn a return equal to today's yield to maturity is if the one year spot risk free rate is 10% in one year's time. In that case, the bond price then would be  $\$1,000/1.1 = \$909.09$ , and the rate of return on the investment would be  $\$909.09/\$826.45 - 1 = 10\%$ . (4 marks)

(b) (4 marks) If the constant growth model holds, then a firm which increases the growth rate of its dividends will increase its share price.

Uncertain. In the case of the constant growth model, the growth rate depends on the firm's retention ratio and its return on retained earnings. Growth is valuable to shareholders only if the return on retained earnings exceeds the opportunity cost of capital. This is because the firm's internal investments are generating higher returns than shareholders could obtain on their own in financial markets. If the return on retained earnings is lower than the opportunity cost of capital, then shareholders are made worse off by the firm's retention of earnings for internal investment, and the share price will fall. (4 marks)

Question 6: 6 marks.

Multiple Choice: Choose only the most correct answer and write it below the choices.

(a) (2 marks) Which of the following characteristics of Money Market Instruments are true:

- a. Sold on a discount basis
- b. Mature in less than one year
- c. Most important risk is default risk
- d. Coupon payments are constant
- e. A,B and D
- f. A and B
- g. A, B and C

Enter your above selection here:     f (2 marks)    

(b) (2 marks) A small investor has just purchased 100 common shares of an oil and gas corporation on the Toronto Stock Exchange. This is the first time the investor has purchased this stock. This transaction is an example of:

- a. a primary market transaction because this is the first time the investor has bought the stock
- b. a primary market transaction because the purchase was made on a major stock exchange
- c. a primary market transaction because the proceeds of the sale will go directly to the corporation
- d. a secondary market transaction because the investor has bought the stock from another investor
- e. None of the above, this is a large block trade and will be done using the OTC market (“the third market”)

Enter your above selection here:     d (2 marks)    

(c) (2 marks) Rank the following assets in terms of liquidity (from highest to lowest): 1) a ten dollar bill, 2) a 2008 Harley Davidson motorcycle, 3) A share of Andina Minerals trading on the TSX, and 4) a 6 month US Treasury Bill for \$1000.

- a. 1, 2, 3, 4
- b. 4, 1, 2, 3
- c. 1, 4, 3, 2
- d. 2, 3, 1, 4
- e. 4, 2, 1, 3
- f. 4, 1, 3, 2

Enter your above selection here:     c (2 marks)