

AFM 271

Midterm Examination #1

Friday June 04, 2010

001-003: Professor B. Phillips

004: Professor J. Thompson

Name: Solution Key

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 10 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. \_\_\_\_\_/27 a. \_\_\_\_\_/4 b. \_\_\_\_\_/8 c. \_\_\_\_\_/8 d. \_\_\_\_\_/7

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

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

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

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

6. \_\_\_\_\_/4

Total: \_\_\_\_\_/59

Question 1: 30 marks.

4  
(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)  $FV = P_0 + t(P_0 \times r)$  1 mark  
 $= 6000 + 30(6000 \times 0.05) = \$15,000.00$

ii)  $EAR = \left(1 + \frac{APR}{m}\right)^m - 1 = \left(1 + \frac{0.05}{2}\right)^2 - 1 = 0.050625$

$$FV = P_0 (1 + EAR)^t = 6000 (1 + 0.050625)^{30} = \$26,398.74$$

2 marks

iii)  $FV = P_0 (1 + EAR)^t = 6000 (1 + 0.05)^{30} = \$25,931.65$

1 mark

(b) (8 marks) Alex and Jill are newlyweds and have recently both started new jobs as financial analysts for Big Bad Funds (BBF). Given that both Alex and Jill work for BBF there are two pension plan options available to the couple:

Option 1:

Jill and Alex maintain separate pension plans which will pay out 80% of their salary at retirement for the lifetime of Alex and Jill individually. Once either Jill or Alex die, the surviving member would then only receive their individual personal pension (i.e. at the time that either Alex or Jill die, the combined pension payment would decrease by 50%).

Option 2:

Jill and Alex enter into a joint pension which will pay out 60% of their combined salaries at retirement for as long as either Jill OR Alex live. (i.e. as long as either Jill or Alex are alive the pension payment will be the same). Assume the following: Jill expects to live for 30 years after retirement, both Jill and Alex's salary will be \$150,000 per year at retirement, pension payments will be received at the end of each year, starting one year from retirement and a discount rate of 8% APR (quoted rate) with annual compounding.

How long after retirement must Alex live for the two pension options to have the same present value? HINT: option 1 can be considered as two annuities that sum to the total pension while option 2 can be considered as one annuity.

$$\text{joint pension} = (150,000 \times 2) \times .6 = 180,000$$

$$\text{individual pension} = 150,000 \times .8 = 120,000$$

1 mark

$$\text{Option 1 Annuity} = \text{Option 2 annuity}$$

2 marks setup  
3 marks equations

$$\frac{120,000}{0.08} \left[ 1 - \frac{1}{(1.08)^{30}} \right] + \frac{120,000}{0.08} \left[ 1 - \frac{1}{1.08^t} \right] = \frac{180,000}{0.08} \left[ 1 - \frac{1}{1.08^{30}} \right]$$

$$1,350,934.00118 + 1,500,000 - \frac{1,500,000}{1.08^t} = 2,026,401.00176$$

$$\frac{1,500,000}{1.08^t} = 824,532.9994$$

$$1.08^t = 1.8192$$

$$t = 7.78 \text{ years}$$

2 marks solution

(c) (8 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.

$$i) \quad EMR = (1 + EAR)^{1/12} - 1 = (1 + 0.05)^{1/12} - 1 = 0.0040741$$

1 mark

$$30,000 = \frac{C}{0.0040741} \left[ 1 - \frac{1}{(1 + 0.0040741)^{60}} \right]$$

2 marks

$$122,2237 = C(0.002163)$$

$$C = \$ 564.99$$

1 mark

$$ii) \quad 60 - 19 = 41 \text{ payments remain}$$

1 mark

$$\text{principal after } 19^{\text{th}} \text{ payment} = \frac{564.99}{0.0040741} \left[ 1 - \frac{1}{(1 + 0.0040741)^{41}} \right]$$

$$= \$21,293.4481$$

2 marks

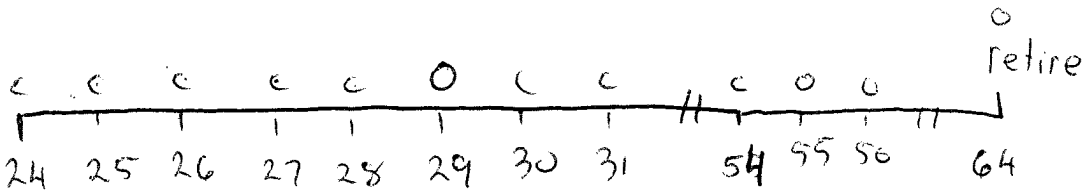
$$\text{interest on } 20^{\text{th}} \text{ payment} = 21,293.4481 \times 0.0040741 = \$ 86.75$$

$$\text{principal portion} = 564.99 - 86.75 = \$ 478.24$$

1 mark

(d) (7 marks)

Today is your 25th birthday. You plan on making bank deposits, starting today and once a year thereafter for 30 years, with the exception of your 30th birthday when you plan on taking a vacation to Fiji (and thus you will skip making a deposit for that year only). Suppose that your savings account pays interest of 8% per year compounded annually and you want retirement savings of \$ 2,000,000 on your 65th birthday. How much do you need to deposit each year to reach your retirement goal?



Discount 2,000,000 to  $P_{23}$

$$= \frac{2,000,000}{1.08^{41}} = 85,242.4691$$

2 marks

$$P_{23} = 85,242.4691 = \frac{C}{r} \left[ 1 - \frac{1}{(1+r)^t} \right] - \frac{C}{(1+r)^6}$$

$$= \frac{C}{.08} \left[ 1 - \frac{1}{1.08^{31}} \right] - \frac{C}{1.08^6}$$

$$= C[11.3498] - C[.6302]$$

2 marks setup

2 marks equation

$$C = \$7952.00$$

1 mark

or

$$P_{23} = \frac{C}{0.08} \left[ 1 - \frac{1}{(1.08)^5} \right] + \frac{C}{0.08} \left[ 1 - \frac{1}{1.08^{25}} \right] \left[ \frac{1}{1.08^6} \right]$$

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, compounded semi-annually (and paid out semi-annually) and had five years until maturity.

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

As the bond was issued at par value  $YTM = r_c = 7\%$   
Given that  $YTM$  now is 8%.  $YTM \uparrow \Rightarrow$  value  $\downarrow$

2 marks

(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 remain to maturity

Coupon =  $\frac{7\% \times 1000}{2} = \$35$  semi-annually 1 mark

(Some students might just call this the discount rate)

ESR =  $0.06/2 = 0.03$  1 mark

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

or

2 marks

$$P_0 = \frac{35}{0.03} \left[ 1 - \frac{1}{1.03^3} \right] + \frac{1000}{1.03^3} = \$1014.14$$

(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!

$$\text{Duration} = \frac{35}{1.03} \times 1 + \frac{35}{1.03^2} \times 2 + \frac{1035}{1.03^3} \times 3$$

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$$1014.14$$

$$= 2.90 \text{ 6 month periods} = 1.45 \text{ years}$$

3 marks

Question 3: 7 marks.

Today we have the following government bonds trading (they both contain no risk i.e., they are equally risky):

Bond	Price	Coupon Rate	Maturity
A	\$922.56	10%	2 years
B	\$775.75	1%	2 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.

(a) (5 marks) Calculate the one year spot interest rate  $r_1$ , and the two year spot interest rate  $r_2$ .

$$1 \text{ of } A \Rightarrow \frac{100}{1+r_1} + \frac{1100}{(1+r_2)^2} = 922.56$$

setup 3 marks

$$10 \text{ of } B \Rightarrow \frac{100}{1+r_1} + \frac{10,100}{(1+r_2)^2} = 7,757.50$$

$$\frac{9000}{(1+r_2)^2} = 6834.94 \Rightarrow \left( \frac{9000}{6834.94} \right)^{1/2} - 1 = 14.75\%$$

$$r_1 \Rightarrow \frac{100}{1+r_1} + \frac{1100}{(1.1475)^2} = 922.56$$

solve 2 marks

$$r_1 = 14.71\%$$

(b) (2 marks) Why can spot rates be different across maturities?

variation in spot rates across maturities reflects variation in future expectations of interest rates

→ uncertainty,  
→ inflation  
etc...

2 marks



Question 4: 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

(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

(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

Question 5: 6 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 always receive a rate of return equal to the bond's yield to maturity today.

Not true, only if the YTM remains constant <sup>or</sup> ~~and~~ the bond is held to maturity will  $YTM = \text{rate of return}$ .

(b) (2 marks) The bondholders in a firm have both higher priority if the firm is bankrupt and voting capabilities if the firm is solvent.

False, bondholders do have priority for liquidation cash flows but at no time do they have voting rights.

(A Savvy student may mention that in certain cases, when a bond payment is missed, the bondholder may get a vote... this is not required for the answer, but no marks should be deducted if discussed)

Question 6: 4 marks.

Short Answer Questions: Please provide brief answers to the following:

(a) (1.5 marks) What three features are typically specified in a Forward Contract?

- 1) quantity of underlying asset
- 2) delivery logistics (time, date, place)
- 3) price at time of delivery

(b) (2.5 marks) You are the holder of a put option on IBM stock. At the end of the contract IBM stock is selling at \$10 below the strike price. Describe the sequence of transaction you should undertake and any necessary assumptions you need to make.

- 1) Purchase IBM stock at spot price via exchange
- 2) Exercise option contract to sell stock at the ~~strike~~ strike price
- 3) profit = strike - stock price = \$10 (less commissions)  
↑  
(not required)