

Keith Woodward, solutions  
29/5/12

SEAT NUMBER: ..... ROOM: .....

FAMILY NAME.....

OTHER NAMES.....

STUDENT NUMBER.....

This question paper must be returned. Candidates are not permitted to remove any part of it from the examination room.



## SESSION 1 EXAMINATIONS JUNE 2012

### Unit: AFIN253: Financial Management

**Time Allowed:** 2 hours plus 10 minutes reading time.

**Total Number of Questions:** 20 Multiple Choice Questions plus 6 full response questions.

#### Instructions:

- PART A (60 marks):** There are 20 multiple choice questions. Answers to these must be recorded on a red-coloured General Purpose Answer Sheet which will be marked by a computer. Please make sure your name is on this sheet.
- PART B (60 marks):** There are 6 questions. Attempt all questions. Show all workings. Write answers in the spaces provided. Illegible handwriting risks loss of marks.

#### Materials Allowed:

- No dictionaries are permitted.
- A non-programmable calculator (no text retrieval capacity) is permitted.
- Financial calculators may be used.
- Mobile telephones must be turned off and left at the front of the room.

Question:	A	1	2	3	4	5	6	Total
Out of:	60	6	12	8	12	13	9	120
Mark:								

## PART A (60 Marks)

There are **TWENTY (20)** multiple choice questions. Please select the most correct answer for each question. Each question in Part A is worth **3** marks. Record your answers on the computer readable answer sheet.

**Question 1:** Treasury bonds currently have a return of 5%. A stock has a beta of 0.5 and the market return is 10%. What is the expected return of the stock?

(a) 5%

(b) 7.5%

(c) 10%

(d) 12.5%

(e) 20%

$$r_i = 0.05 + 0.5(0.1 - 0.05) \\ = 0.075$$

**Question 2:** You want to buy an apartment worth \$500,000. You have saved a deposit of \$50,000.

The bank has agreed to lend you the \$450,000 as a fully amortising mortgage with a term of 25 years. The interest rate is 6% pa and is not expected to change. What will be your monthly payments?

(a) 1,500.00

(b) 2,250.00

(c) 2,855.79

(d) 2,899.36

(e) 35,202.02

$$r_{\text{eff, monthly}} = \frac{0.06}{12} = 0.005$$

$$450k = \frac{C_1}{0.005} \left( 1 - \frac{1}{(1+0.005)^{25 \times 12}} \right)$$

$$C_1 = 450k \div \frac{1}{0.005} \left( 1 - \frac{1}{(1+0.005)^{25 \times 12}} \right) \\ = 2.89936k$$

**Question 3:** A firm can issue 3 year annual coupon bonds at a yield of 10% pa and a coupon rate of 8% pa.

The beta of its levered equity is 2. The market's expected return is 10% pa and 3 year government bonds yield 6% pa with a coupon rate of 4% pa.

The market value of equity is \$1 million and the market value of debt is \$1 million. The corporate tax rate is 30%.

What is the firm's after-tax WACC? Assume a classical tax system.

(a) 8.40%

(b) 10.50%

(c) 10.80%

(d) 12.00%

(e) 21.00%

$$r_e = 0.06 + 2(0.1 - 0.06) = 0.14$$

$$r_{WACC \text{ after tax}} = \frac{1}{2} \times 0.1(1 - 0.3) + \frac{1}{2} \times 0.14 = 0.105$$

**Question 4:** A retail furniture company buys furniture wholesale and distributes it through its retail stores. The owner believes that she has some good ideas for making stylish new furniture. She is considering a project to buy a factory and employ workers to manufacture the new furniture she's designed. Furniture manufacturing has more systematic risk than furniture retailing.

Her furniture retailing firm's after-tax WACC is 20%. Furniture manufacturing firms have an after-tax WACC of 30%. Both firms are optimally geared. Assume a classical tax system.

Which method(s) will give the correct valuation of the new furniture-making project? Select the most correct answer.

(a) Discount the project's unlevered CFFA by the furniture manufacturing firms' 30% WACC after tax.

(b) Discount the project's unlevered CFFA by the company's 20% WACC after tax.

(c) Discount the project's levered CFFA by the company's 20% WACC after tax.

(d) Discount the project's levered CFFA by the furniture manufacturing firms' 30% WACC after tax.

(e) The methods outlined in a and c will give the same valuations, both are correct.

**Question 5:** According to the theory of the Capital Asset Pricing Model (CAPM), total risk can be broken into two components, systematic risk and idiosyncratic risk. Which of the following events would be considered diversifiable according to the theory of the CAPM?

- (a) Economic recession.
- (b) A major terrorist attack.
- (c) An increase in corporate tax rates.
- (d) The outbreak of world war.
- (e) A company's poor earnings announcement.

**Question 6:** A firm has a debt-to-assets ratio of 50%. The firm then issues a large amount of **equity** to raise money for new projects of similar risk to the company's existing projects. Assume a classical tax system. Which statement is correct?

- (a) The debt-to-assets ( $D/V$ ) ratio will increase.
- (b) The debt-to-equity ratio ( $D/E$ ) will increase.
- (c) Firm value is likely to have increased due to the higher amount of interest tax shields, assuming that there will not be any costs of financial distress.
- (d) The company's after-tax WACC is likely to stay the same.
- (e) The company's before-tax WACC is likely to stay the same.

**Question 7:** Which statement(s) are correct?

- ✓ (i) All stocks that plot on the Security Market Line (SML) are fairly priced.
- ✗ (ii) All stocks that plot above the Security Market Line (SML) are ~~overpriced~~. *underpriced,*
- ✓ (iii) All fairly priced stocks that plot on the Capital Market Line (CML) have zero idiosyncratic risk. *⊕ we alpha.*

**Select the most correct response:**

- (a) Only (i) is true.
- (b) Only (ii) is true.
- (c) Only (iii) is true.
- (d) All statements (i), (ii) and (iii) are true.
- ☒ (e) Only statements (i) and (iii) are true.

**Question 8:** A stock's correlation with the market portfolio increases. What will happen to the stock's expected return and systematic risk?

- ☒ (a) The stock will have a higher return and higher systematic risk.
- (b) The stock will have a lower return and higher systematic risk.
- (c) The stock will have a higher return and lower systematic risk.
- (d) The stock will have a lower return and lower systematic risk.
- (e) The stock's return and systematic risk will be unchanged.

$$\beta_i = \frac{\sigma_{i,m}}{\sigma_m^2} = \frac{\rho_{i,m} \cdot \sigma_i \cdot \sigma_m}{\sigma_m^2} = \frac{\rho_{i,m}}{\sigma_m}$$

**Question 9:** Your friend just bought a house for \$375,000. He financed it using a \$300,000 mortgage and a deposit of \$75,000.

In the context of residential housing and mortgages, the 'equity' tied up in the value of a person's house is the value of the house less the value of the mortgage. So the initial equity your friend has in his house is \$75,000. Let this amount be  $E$ , let the value of the mortgage be  $D$  and the value of the house be  $V$ . So  $V = D + E$ .

If house prices suddenly fall by 10%, what would be your friend's percentage change in equity ( $E$ )? Assume that the value of the mortgage is unchanged and that no income (rent) was received from the house during the short time over which house prices fell.

Remember that:

$$r_{0-1} = \frac{P_1 - P_0}{P_0}$$

where  $r_{0-1}$  is the return (percentage change) of an asset with price  $P_0$  initially and  $P_1$  one period later.

(a) -100%

(b) -50%

(c) -12.5%

(d) -10%

(e) -8%

$$V = D + E$$

$$\text{at } t=0, \quad 375k = 300k + 75k$$

$$\text{at } t=1, \quad 337.5k = 300k + 37.5k$$

$$r_{e, 0-1} = \frac{37.5k - 75k}{75k} = -0.5$$

**Question 10:** The equations for Net Income (NI) and Cash Flow From Assets (CFFA) per year are:

$$NI = (Rev - COGS - Depr - IntExp) \cdot (1 - t_c)$$

$$CFFA = NI + Depr - CapEx - \uparrow NWC + IntExp$$

For a firm with debt, what is the formula for the **present value** of interest tax shields if the tax shields occur in **perpetuity**? Note that  $D$  is the value of debt which is constant through time, and  $r_D$  is the cost of debt (yield on debt), so  $IntExp = D \times r_D$ .

(a)  $D \times t_c$

(b)  $D \times r_D / t_c$

(c)  $D \times r_D \times (1 - t_c)$

(d)  $D \times r_D / (1 - t_c)$

(e)  $D \times r_D \times (t_c - 1)$

$$\begin{aligned} PV(\text{tax shields}) &= \frac{\frac{C_1}{r - g}}{r_d - 0} \\ &= \frac{IntExp \times t_c}{r_d - 0} \\ &= \frac{D \times r_d \times t_c}{r_d} \\ &= D \cdot t_c \end{aligned}$$

**Question 11:** An Australian company just issued two bonds:

A 1 year zero coupon bond at a yield of 8% pa, and

A 2 year zero coupon bond at a yield of 10% pa.

What is the forward rate on the company's debt from years 1 to 2? Give your answer as an APR compounding every 6 months, which is how the above bond yields are quoted.

(a) ~~6.01%~~

(b) 6.02%

(c) 9.20%

(d) 12.02%

(e) 18.40%

$$\begin{aligned} \left(1 + \frac{0.1}{2}\right)^4 &= \left(1 + \frac{0.08}{2}\right)^2 \left(1 + \frac{r_{1-2}}{2}\right)^2 \\ r_{1-2} &= \left( \left( \frac{\left(1 + \frac{0.1}{2}\right)^4}{\left(1 + \frac{0.08}{2}\right)^2} \right)^{1/2} - 1 \right) \times 2 \\ &= 0.1202 \end{aligned}$$

**Question 12:** A company has:

- 10 million common shares outstanding, each trading at a price of \$90.
- 1 million preferred shares which have a face (or par) value of \$100 and pay a constant dividend of 9% of par. They currently trade at a price of \$120 each.
- Debentures that have a total face value of \$60,000,000 and a yield to maturity of 6% per annum. They are publicly traded and their market price is equal to 90% of their face value.

The risk-free rate is 5% and the market return is 10%.

Market analysts estimate that the company's common stock has a beta of 1.2.  
The corporate tax rate is 30%.

What is the company's after-tax Weighted Average Cost of Capital (WACC)?  
Assume a classical tax system.

(a) 10.27%

(b) 10.39%

(c) 10.43%

(d) 11.47%

(e) 17.22%

$$E_{\text{common}} = 10 \text{ m} \times \$90 \\ = \$900 \text{ m}$$

$$E_{\text{pref}} = 1 \text{ m} \times \$120 \\ = \$120$$

$$D = 0.9 \times \$60 \text{ m} \\ = \$54 \text{ m}$$

$$V = D + E_{\text{common}} + E_{\text{pref}} \\ = \$54 \text{ m} + \$900 \text{ m} + \$120 \text{ m} \\ = \$1074 \text{ m}$$

$$r_{e, \text{com.}} = 0.05 + 1.2(0.1 - 0.05) \\ = 0.11$$

$$P_{0, \text{pref}} = \frac{C_1}{r_{e, \text{pref}}}$$

$$120 = \frac{0.09 \times 100}{r_{e, \text{pref}}}$$

$$r_{e, \text{pref}} = 0.075$$

$$r_d = 0.06$$

$$r_{\text{wacc after tax}} = \frac{(54 \times 0.06 \times (1 - 0.3)) + (120 \times 0.075) + (900 \times 0.11)}{1074} \\ = 0.10267$$



**Question 13:** A firm changes its capital structure by issuing a large amount of debt and using the funds to repurchase shares. Its assets are unchanged.

According to the Capital Asset Pricing Model (CAPM), which statement is correct?

- (a) The beta of the firm's assets will increase.
- (b) The beta of the firm's assets will decrease.
- ☒ (c) The beta of the firm's equity will increase.
- (d) The beta of the firm's equity will decrease.
- (e) The beta of the firm's equity will be unchanged.

**Question 14:** A firm changes its capital structure by issuing a large amount of debt and using the funds to repurchase shares. Its assets are unchanged.

Assume that the firm and individual investors can borrow at the same rate and there are no market frictions relating to debt such as asymmetric information or transaction costs.

According to Miller and Modigliani's theory, which statement is correct?

- (a) The firm's share price will decrease. This is because the firm will have more debt and therefore more risk so the discount rate applied to its cash flows will be higher, decreasing the value of the firm and therefore the value of the firm's equity and share price.
- (b) The firm's share price will increase. This is because the firm will have more debt which will amplify the returns of equity investors. This will mean that returns on equity can be much higher and investors will pay a premium for this, leading to an increase in the stock price.
- ☒ (c) The firm's share price will not change because capital structure is irrelevant when investors can use home-made leverage to create tax-shields themselves.
- (d) The firm's share price will increase. This is because the cost of debt is cheaper than equity, leading to a lower (before and after tax) WACC. This lower WACC will lead to a higher value of the firm and a higher share price.
- (e) The value of the firm's share price will increase since it has more debt and therefore more tax shields.

**Question 15:** A company selling charting and technical analysis software claims that independent academic studies have shown that its software makes significantly positive abnormal returns. Assuming the claim is true, which statement(s) are correct?

- ✓ (i) Weak form market efficiency is broken.
- ✗ (ii) Semi-strong form market efficiency is broken.
- ✗ (iii) Strong form market efficiency is broken.
- ✓ (iv) The asset pricing model used to measure the abnormal returns (such as the CAPM) had mis-specification error so the returns may not be abnormal but rather fair for the level of risk.

**Select the most correct response:**

- (a) Only (i) is true.
- (b) Only (i) and (ii) are true.
- (c) Only (i), (ii) and (iii) are true.
- (d) Only (iv) is true.
- (e) Either (i) or (iv) could be true.

**Question 16:** An established mining firm announces that it expects large losses over the following year due to flooding which has temporarily stalled production at its mines. Which statement(s) are correct?

- ✓ (i) If the firm adheres to a full dividend payout policy it will not pay any dividends over the following year.
- ✓ (ii) If the firm wants to signal that the loss is temporary it will maintain the same level of dividends. It can do this so long as it has enough retained profits.
- ✗ (iii) By law, the firm will be unable to pay a dividend over the following year because it cannot pay a dividend when it makes a loss.

**Select the most correct response:**

- (a) Only (i) is true.
- (b) Only (ii) is true.
- (c) Only (iii) is true.
- ☒ (d) Only (i) and (ii) is true.
- (e) All statements (i), (ii) and (iii) are true.

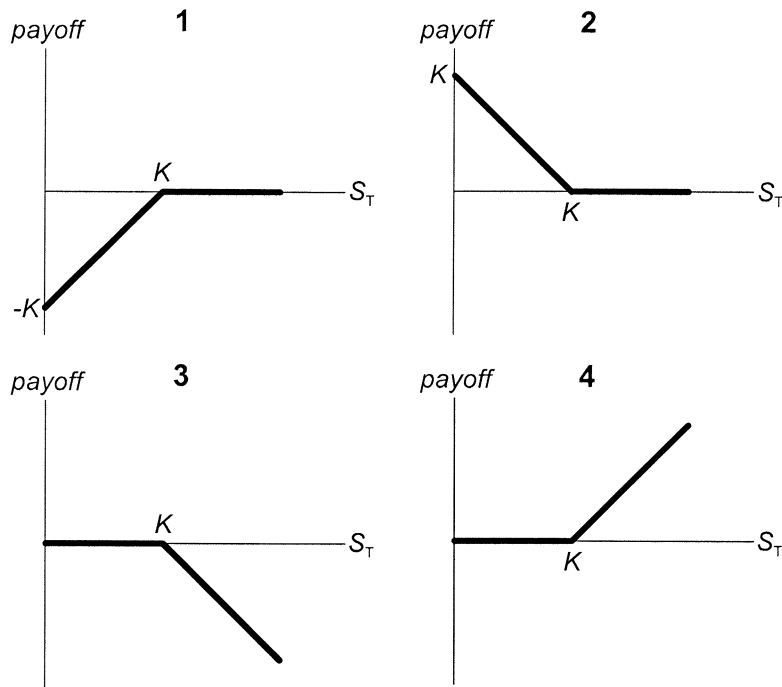
**Question 17:** A company runs a number of slaughterhouses which supply hamburger meat to McDonalds. The company is afraid that live cattle prices will increase over the next year, even though there is widespread belief in the market that they will be stable. What can the company do to hedge against the risk of increasing live cattle prices? Which statement(s) are correct?

- ✓ (i) buy call options on live cattle.
- ✗ (ii) buy put options on live cattle.
- ✗ (iii) sell call options on live cattle.

**Select the most correct response:**

- (a) Only (i) is true.
- (b) Only (ii) is true.
- (c) Only (iii) is true.
- (d) Only (i) and (ii) is true.
- (e) All statements (i), (ii) and (iii) are true.

**Question 18:** Below are 4 option graphs. Note that the y-axis is payoff at maturity (T). What options do they depict? List them in the order that they are numbered.



- (a) 1: short call, 2: long call, 3: short put, 4: long put.  
 (b) 1: long call, 2: long put, 3: short call, 4: short put.  
 (c) 1: short put, 2: long put, 3: short call, 4: long call.  
 (d) 1: long put, 2: short put, 3: long call, 4: short call.  
 (e) 1: short call, 2: long put, 3: short put, 4: long call.

**Question 19:** Assume that there exists a perfect world with no transaction costs, no asymmetric information, no taxes, no agency costs, equal borrowing rates for corporations and individual investors, the ability to short the risk free asset, semi-strong form efficient markets, the CAPM holds, investors are rational and risk-averse and there are no other market frictions.

For a firm operating in this perfect world, which statement(s) are correct?

- ✓ (i) When a firm changes its capital structure and/or payout policy, share holders' wealth is unaffected.
- ✓ (ii) When the idiosyncratic risk of a firm's assets increases, share holders do not expect higher returns.
- ✗ (iii) When the systematic risk of a firm's assets increases, share holders do not expect higher returns.

**Select the most correct response:**

- (a) Only (i) is true.
- (b) Only (ii) is true.
- (c) Only (iii) is true.
- ☒ (d) Only (i) and (ii) are true.
- (e) All statements (i), (ii) and (iii) are true.

**Question 20:** A person is thinking about borrowing \$100 from the bank at 7% pa and investing it in shares with an expected return of 10% pa. One year later the person will sell the shares and pay back the loan in full. Both the loan and the shares are fairly priced. Ignore taxes and interest tax shields.

*NPV of each is zero.*

What is the Net Present Value (NPV) of this one year investment? Note that you are asked to find the present value ( $V_0$ ), not the value in one year ( $V_1$ ).

- (a) \$10
- (b) \$3
- (c) \$2.8037
- (d) \$2.7273
- ☒ (e) \$0

**END OF PART A**

## PART B (60 Marks)

Answer each of the following questions in the space provided below the questions. Mark allocations are noted next to each question.

**Question 1** (total of 6 marks): A stock is priced at \$40 and just paid its annual dividend of \$5. The dividend is expected to increase by 2% every year. The beta of the stock is 1.5, the risk free rate is 5% and the market return is 10%.

**Question 1a** (3 marks): What is the cost of equity using the CAPM (or SML)?

$$\begin{aligned} r_e &= 0.05 + 1.5 \times (0.1 - 0.05) \\ &= 0.125 \end{aligned}$$

**Question 1b** (3 marks): What is the cost of equity using the Dividend Discount Model (or Gordon Growth Model)?

$$\begin{aligned} P_0 &= \frac{C_1}{r_e - g} \\ 40 &= \frac{5(1 + 0.02)}{r_e - 0.02} \\ r_e &= \frac{5(1 + 0.02)}{40} + 0.02 \\ &= 0.1475 \end{aligned}$$

**Question 2** (total of 12 marks): A firm is considering a project which is of similar risk to the rest of the firm's business.

The firm has:

- A target debt-to-equity ratio of 60%.
- A beta on equity of 2.
- Existing debt which yields 6%.
- A corporate tax rate of 30%.
- Also, the risk free rate is 5% and the market rate of return is 10%.

All rates are effective annual rates. Assume a classical tax system.

**Question 2a** (3 marks): Calculate the **cost of equity**.

$$r_e = 0.05 + 2(0.1 - 0.05) \\ = 0.15$$

**Question 2b** (3 marks): Calculate the **pre-tax WACC** (sometimes called the opportunity cost of capital, or the required return on assets,  $r_A$ ).

$$r_{WACC \text{ before tax}} = \frac{D}{V} \cdot r_D + \frac{E}{V} \cdot r_E$$

$$r_A = \frac{0.6}{1.6} \times 0.06 + \frac{1}{1.6} \times 0.15$$

$$= 0.11625$$

$$\frac{D}{E} = \frac{0.6}{1}$$

$$\frac{D}{V} = \frac{0.6}{1+0.6}$$

$$= \frac{0.6}{1.6}$$

$$\frac{E}{V} = \frac{1}{1.6}$$



**Question 2c** (3 marks): Calculate the **after-tax WACC**.

$$\begin{aligned} r_{WACC \text{ after tax}} &= r_d \cdot (1 - t_c) \cdot \frac{D}{V} + r_e \cdot \frac{E}{V} \\ &= 0.06 \times (1 - 0.3) \times \frac{0.6}{1.6} + 0.15 \times \frac{1}{1.6} \\ &= 0.1095 \end{aligned}$$

**Question 2d** (3 marks): The company has calculated the CFFA for each year in the project's life, assuming that the project is financed with the appropriate amount of debt and equity so its target debt-to-equity ratio is maintained. Interest expense is included in Net Income and CFFA. Considering this, which discount rate should the company use to discount its CFFA? Circle one of the following:

Risk-free rate, Cost of debt, Cost of equity, Pre-tax WACC, After-tax WACC

**Question 3** (total of 8 marks): For each of the following events, state the effect on the firm's equity (E), share price and number of shares. Draw an up arrow (↑) for an increase, a down arrow for a decrease (↓) and a blank space or dot for no change. Assume that all transactions are done at a fair price, that there are no transaction costs and no asymmetric information (so ignore signalling effects).

Remember:

$$V = D + E \quad \text{and} \quad E = n_{\text{shares}} \times P_{\text{share}}$$

	Equity (E)	Share price ( $P_{\text{share}}$ )	Number of shares ( $n_{\text{shares}}$ )
Positive NPV project	↑	↑	
Negative NPV project	↓	↓	
Rights issue	↑		↑
On-market share buy-back	↓		↓
Regular dividend	↓	↓	
Stock split		↓	↑
Seasoned Equity Offering	↑		↑
The sale of a large asset			

**Question 4** (total of 12 marks): A stock that has been trading on the ASX for the past 20 years has had the following historical total returns:

Year	Return
2007	0.3
2008	0.1
2009	-0.4
2010	0.28

**Question 4a** (1 marks): What is the stock's average return?

$$\mu = \frac{0.3 + 0.1 - 0.4 + 0.28}{4} = 0.07$$

**Question 4b** (5 marks): What is the stock's standard deviation of returns?

$$\begin{aligned} \text{variance} = \sigma^2 &= \left( (0.3 - 0.07)^2 + (0.1 - 0.07)^2 + (-0.4 - 0.07)^2 + (0.28 - 0.07)^2 \right) \div (4-1) \\ &= 0.106267 \end{aligned}$$

$$\begin{aligned} \text{standard deviation} = \sigma &= \sqrt{0.106267} \\ &= 0.325986 \end{aligned}$$

For the next two questions, assume that the market portfolio has a standard deviation of 20% and a correlation of returns with this stock of 0.8. What is the

**Question 4c** (3 marks): What is the **beta** of the stock?

$$\begin{aligned} \beta_i &= \frac{\sigma_{i,m}}{\sigma_m^2} = \frac{\rho_{i,m} \cdot \sigma_m \cdot \sigma_i}{\sigma_m^2} = \frac{\rho_i \sigma_i}{\sigma_m} \\ &= \frac{0.8 \times 0.325986}{0.2} \\ &= 1.30394 \end{aligned}$$

**Question 4d** (3 marks): What is the **systematic variance** of the stock?

$$\sigma_{i,\text{total}}^2 = \underbrace{\beta_i^2 \cdot \sigma_m^2}_{\text{syst variance}} + \sigma_{i,\text{idios.}}^2$$

$$\begin{aligned} \sigma_{i,\text{syst}}^2 &= \beta_i^2 \cdot \sigma_m^2 \\ &= 1.30394^2 \times 0.2^2 \\ &= 0.068011 \quad \checkmark \end{aligned}$$

$$\begin{aligned} \sigma_{i,\text{syst}} &= \sqrt{0.068011} \\ &= 0.260789 \end{aligned}$$

**Question 5** (total of 13 marks): Your client has \$2 million to invest. You advise her to invest in the market portfolio which has an expected return of 10% and government bonds which have an expected return of 5% pa. The market portfolio has a total standard deviation of 40% pa. She seeks a portfolio beta of 0.5.

**Question 5a** (4 marks): How much **money** should she invest in the market portfolio ( $V$ ) and government bonds ( $V_{rf}$ )? Note that you will need to find the weights in the market portfolio ( $x_m$ ) and government bonds ( $x_{rf}$ ) first.

$$\begin{aligned}
 B_{rf} &= 0 \\
 B_m &= 1 \\
 B_p &= x_{rf} \cdot B_{rf} + x_m \cdot B_m \\
 0.5 &= x_{rf} \times 0 + x_m \times 1 \\
 x_m &= 0.5 \\
 x_{rf} &= 1 - x_m = 0.5
 \end{aligned}$$

$\rightarrow V_m = 2m \times x_m$   
 $= 2m \times 0.5$   
 $= \$1m$   
 $V_{rf} = \$1m$

**Question 5b** (2 marks): What will be the expected return of the portfolio ( $\mu_p$ )?

$$\begin{aligned}
 \mu_p &= x_1 \cdot \mu_1 + x_2 \cdot \mu_2 + \dots + x_n \cdot \mu_n \\
 &= 0.5 \times 0.05 + 0.5 \times 0.1 \\
 &= 0.075
 \end{aligned}$$

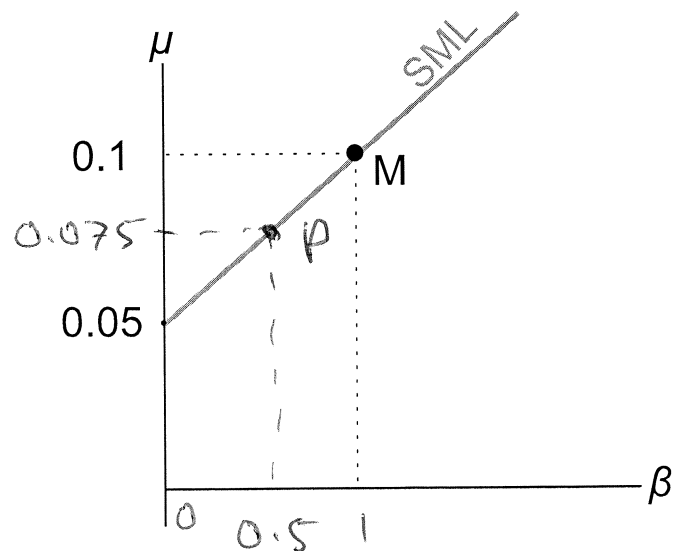
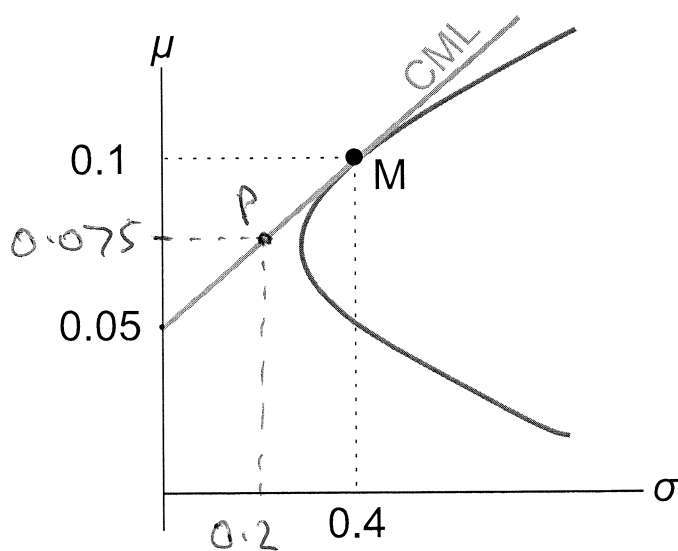
**Question 5c** (3 marks): What will be the total standard deviation of the portfolio ( $\sigma_p$ )?

$$\begin{aligned}\sigma_p^2 &= x_1^2 \cdot \sigma_1^2 + x_2^2 \cdot \sigma_2^2 + 2x_1x_2\rho_{1,2}\cdot\sigma_1\cdot\sigma_2 \\ \sigma_p^2 &= 0.5^2 \times 0^2 + 0.5^2 \times 0.4^2 + 2 \times 0.5 \times 0.5 \times 0 \times 0 \times 0.4 \\ &= 0.5^2 \times 0.4^2\end{aligned}$$

$$\sigma_p^2 = 0.04$$

$$\begin{aligned}\sigma_p &= \sqrt{0.04} \\ &= 0.2\end{aligned}$$

**Question 5d** (4 marks): On the below 2 graphs, mark where your client's portfolio is with a dot and a 'P' next to it. You should also mark its expected return, standard deviation and beta on the axes where appropriate.



**Question 6** (total of 9 marks):

Project Data	
Project life	2 yrs
Initial investment in equipment	\$6m
Depreciation of equipment per year for tax purposes	\$1m
Unit sales per year	4m
Sale price per unit	\$8
Variable cost per unit	\$3
Fixed costs per year, paid at the end of each year	\$1.5m
Tax rate	0.3

**Note 1:** The equipment will have a book value of \$4m at the end of the project for tax purposes. However, the equipment is expected to fetch \$0.9 million when it is sold at  $t=2$ .

**Note 2:** Due to the project, the firm will have to purchase \$0.8m of inventory initially. At the end of the project, the current assets can be sold at cost. The project will have no effect on the firm's current liabilities.

**Question 6a** (2 marks): Find the unlevered Cash Flow From Assets (CFFA) at time  $t = 0$ . You do not need to find the NPV.

$$\begin{aligned}
 C_0 &= NI + \text{Depr} - \text{CapEx} - \uparrow NWC + \text{IntExp} \\
 &= 0 + 0 - 6m - 0.8m + 0 \\
 &= -6.8m
 \end{aligned}$$

**Question 6b** (4 marks): Find the unlevered CFFA at time  $t = 1$ . You do not need to find the NPV.

$$\begin{aligned}
 NI_1 &= ((P - VC) \cdot Q - FC - \text{Depr} - \text{IntExp}) (1 - t_c) \\
 &= ((8 - 3) \times 4m - 1.5m - 1m - 0) (1 - 0.3) = 12.25m \\
 C_1 &= NI + \text{Depr} - \text{CapEx} - \uparrow NWC + \text{IntExp} \\
 &= 12.25m + 1m - 0 - 0 + 0 = 13.25m
 \end{aligned}$$

**Question 6c** (3 marks): Find the unlevered CFFA at time  $t = 2$ . You do not need to find the NPV.

$$\begin{aligned}
 C_2 &= 12.25m + 1m - \left( \overset{\substack{\uparrow \\ \text{sale price}}}{0.9m} - \left( \underbrace{0.9m - 4m}_{\substack{\text{capital gain}}} \times 0.3 \right) \right) - \overset{\substack{\uparrow NWC \\ \downarrow}}{0.8m} \\
 &= 12.25m + 1m + 0.9m - (0.9m - 4m) \times 0.3 + 0.8m \\
 &= 15.88m
 \end{aligned}$$

**END OF PART B**

**Spare Scribble Sheet**



## Formulas

$$PV(\text{single cash flow}) = V_0 = \frac{C_t}{(1 + r_{eff})^t}$$

$$PV(\text{annuity}) = V_0 = \frac{C_1}{r_{eff}} \left( 1 - \frac{1}{(1 + r_{eff})^T} \right)$$

$$PV(\text{perpetuity}) = V_0 = \frac{C_1}{r_{eff} - g_{eff}}$$

$$r_{eff,annual} = (1 + r_{eff,monthly})^{12} - 1$$

$$r_{eff,monthly} = \frac{r_{APR,comp\ monthly}}{12}$$

$$Price_{bill} = V_0 = \frac{F_t}{\left( 1 + r_{simple} \times \frac{t}{365} \right)}$$

$$Price_{bond} = PV(\text{annuity of coupons}) + PV(\text{principal})$$

$$= \frac{C_1}{r_{eff}} \left( 1 - \frac{1}{(1 + r_{eff})^T} \right) + \frac{Face}{(1 + r_{eff})^T}$$

$$CapEx = NFA_{now} - NFA_{before} + Depreciation$$

$$\uparrow NWC = (CA_{now} - CL_{now}) - (CA_{before} - CL_{before})$$

$$CFFA = NI + Depr - CapEx - \uparrow NWC + IntExp$$

$$CFFA = CF \text{ to equity holders} + CF \text{ to creditors}$$

$$r_{0-1} = \frac{p_1 - p_0}{p_0} = \frac{p_1}{p_0} - 1$$

$$\bar{r} = \frac{\sum_{i=1}^n (r_i)}{n} = \frac{r_1 + r_2 + \dots + r_n}{n}$$

$$var(r) = \sigma^2 = \frac{\sum_{i=1}^n [(r_i - \bar{r})^2]}{n - 1}$$

$$cov(r_1, r_2) = \sigma_{1,2} = \frac{\sum_{i=1}^n [(r_{1,i} - \bar{r}_1)(r_{2,i} - \bar{r}_2)]}{n - 1}$$

$$correl(r_1, r_2) = \rho_{1,2} = \frac{cov(r_1, r_2)}{sd(r_1) \cdot sd(r_2)} = \frac{\sigma_{1,2}}{\sigma_1 \cdot \sigma_2}$$

$$\bar{r} = \sum_{i=1}^n (p_i \cdot r_i) = p_1 \cdot r_1 + p_2 \cdot r_2 + \dots + p_n \cdot r_n$$

$$var(r) = \sigma^2 = \sum_{i=1}^n [p_i (r_i - \bar{r})^2]$$

$$cov(r_1, r_2) = \sigma_{1,2} = \sum_{i=1}^n [p_i (r_{1,i} - \bar{r}_1)(r_{2,i} - \bar{r}_2)]$$

$$r_P = x_1 \cdot r_1 + x_2 \cdot r_2 + \dots + x_n \cdot r_n = \sum_{i=1}^n (x_i \cdot r_i)$$

$$x_1 + x_2 + \dots + x_n = 1$$

$$\sigma_P^2 = x_1^2 \cdot \sigma_1^2 + x_2^2 \cdot \sigma_2^2 + 2 \cdot x_1 \cdot x_2 \cdot \sigma_{1,2}$$

$$\sigma_{1,2} = \rho_{1,2} \cdot \sigma_1 \cdot \sigma_2$$

$$\mu_i = r_f + \beta_i (\mu_M - r_f)$$

$$\beta_i = \frac{\sigma_{i,M}}{\sigma_M^2} = \frac{cov(r_i, r_M)}{var(r_M)}$$

$$\sigma_{i,total}^2 = \beta_i^2 \cdot \sigma_M^2 + \sigma_{i,\varepsilon}^2$$

$$\beta_P = x_1 \beta_1 + x_2 \beta_2 + \dots + x_n \beta_n$$

$$r_{WACC \text{ after tax}} = \frac{D}{V} \cdot r_D (1 - t_c) + \frac{E}{V} \cdot r_E$$

$$r_{WACC \text{ before tax}} = r_A = \frac{D}{V} \cdot r_D + \frac{E}{V} \cdot r_E$$

$$V = D + E$$

$$r_{total} = r_{capital} + r_{income}$$

$$r_{0-T} = \left( (1 + r_{0-1})(1 + r_{1-2})(1 + r_{2-3}) \dots (1 + r_{(T-1)-T}) \right)^{\frac{1}{T}} - 1$$

$$(1 + r_{0-T})^T = (1 + r_{0-1})(1 + r_{1-2})(1 + r_{2-3}) \dots (1 + r_{(T-1)-T})$$

$$P_{ex-rights} = \frac{n \times P_{cum-rights} + P_{subscription}}{n + 1}$$