

# ***PRACTICE QUESTIONS FOR THE FINAL***

## **Important comment:**

***The sample questions below focus on the second half of the course. The final exam is however comprehensive. For sample questions regarding the midterm material please refer to the posted practice midterm questions.***

### **Question 1**

Evaluate the following statements:

- I. Firm's debt-holders are the residual claimants to the firm's cash flows. **(FALSE)**
- II. All else equal, a firm's P/E ratio is decreasing in the dividend payout ratio. **(FALSE)**
- III. If a project has an IRR of 15 % and a required cost of capital of 8% then it must have a positive NPV. **(FALSE)**
- IV. Shareholders are corporation's residual claimants. **(TRUE)**

### **Question 2**

Consider the following statements:

- I. Debt-holders are corporation's residual claimants. **(FALSE)**
- II. Debt-holders are entitled to vote for the board of directors. **(FALSE)**
- III. Shareholders are corporation's residual claimants. **(TRUE)**
- IV. Zero coupon bonds sell at a premium. **(FALSE)**

### **Question 3**

The rate at which the stock price is expected to appreciate (or depreciate) is the:

- a. The risk-free rate.
- b. Total yield.
- c. Dividend yield.
- d. **Capital gains yield.**
- e. The coupon rate

#### **Question 4**

Dot.com Technologies' dividend has been growing at a rate of 10% per year in recent years. This growth rate is expected to last for another nine years. After these nine years dividend is expected to grow at a 7% annually. If the equity cost of capital is 12%.

Calculate the capital gains yield between years 14 and 15.

- a. 10%
- b. 7%
- c. 5%
- d. 12%
- e. 2%

#### **Solution**

$$P_{14} = \frac{Div_{15}}{r - g} \quad \text{and} \quad P_{15} = \frac{Div_{16}}{r - g} = \frac{(1 + g)Div_{15}}{r - g} = (1 + g)P_{14}. \quad \text{Therefore:}$$

$$\text{Capital Gains Yield} = \frac{P_{15} - P_{14}}{P_{14}} = g = 7\%$$

#### **Comment**

- By year 14 the future dividends behave like in the constant dividend growth model (i.e., in year 15 and thereafter, future dividends behave like a growing perpetuity). In the constant dividend growth model the capital gains yield is equal to the dividend growth rate.

### Question 5

The following are the FCF for Dot.com in year 1. These cash flows depend on the state of the economy (i.e. poor, normal, good, and super good). The probability of these economic states is given below.

State	Probability	FCF (\$)
Bad	1/4	1,000
Normal	1/2	3,000
Good	1/8	6,000
Super Good	1/8	7,000

Dot.com. closes down at the end of period 1 and has no assets other than the FCF generated in the period. The company has the following stakeholders: senior debt-holders with a claim of \$4,000, junior debt-holders with a claim of \$2,000 and shareholders. Assuming a 0% discount rate for all financial assets, calculate the current value of Dot.com's junior debt.

- a. **\$ 500**
- b. **\$ 2,000**
- c. **\$ 1,000**
- d. **\$ 125**
- e. **\$ 1,750**

### Solution

$$\text{Value}(\text{Junior Debt}) = \frac{1}{4} \times 0 + \frac{1}{2} \times 0 + \frac{1}{8} \times 2,000 + \frac{1}{8} \times 2,000 = \$500$$

### Comment

- The value of the different securities is as follows:

State	Probability	FCF (\$)	Senior Debt	Junior Debt	Equity
Bad	1/4	1,000	1,000	0	0
Normal	1/2	3,000	3,000	0	0
Good	1/8	6,000	4,000	2,000	0
Super Good	1/8	7,000	4,000	2,000	1,000
		3,375	2,750	<b>500</b>	125

### **Question 6**

Dot.Com has just paid a \$5 dividend and the required return on its equity is 10%. The dividend is expected to grow at 25% per year during the first year, at 9% per year during the following eight years, and at 2% per year thereafter. Calculate the current share price.

- a. \$ 86
- b. \$ 106
- c. **\$ 117**
- d. \$ 123
- e. \$ 100

### **Solution**

$$P = \frac{5 \times 1.25}{0.1 - 0.09} \left( 1 - \left( \frac{1.09}{1.1} \right)^9 \right) + \frac{1}{1.1^9} \frac{5 \times 1.25 \times 1.09^8 \times 1.02}{0.1 - 0.02} = \$117$$

### **Question 7**

Consider a firm with a cost of equity of 8% and 5 million shares outstanding. In year one the firm will not pay any dividends but it will repurchase \$10 million worth of shares. After year one, the firm will pay a total dividend of \$25 million each year forever. Calculate the price per share in year zero.

- a. **\$ 60**
- b. \$ 20
- c. \$ 80
- d. \$ 40
- e. \$ 90

### **Solution**

$$\text{Equity}_0 = PV(\text{Future Dividends \& Repurchases}) = \frac{10 + \frac{25}{0.08}}{1.08} = \$298.611M$$

$$P_0 = \frac{\text{Equity}_0}{\text{Number of Shares}_0} = \frac{298.611}{5} = \$60 \text{ per share}$$

### **Question 8**

Consider a firm with a cost of equity of 10%. The firm will only start paying dividends in three years but it plans to repurchase shares during the next two years. If the current price per share is \$77, calculate the price per share in year one (after the shares have been repurchased).

- a. **\$ 84.7**
- b. **\$ 68.2**
- c. **\$ 70.3**
- d. **\$ 77.0**
- e. **\$ 770.0**

### **Solution**

$$\text{Capital Gains Yield}_0 = r_e - \text{Dividend Yield}_0 = 10\% - 0\% = 10\%$$

$$10\% = \text{Capital Gains Yield}_0 = \frac{P_1 - P_0}{P_0} = \frac{P_1 - 77}{77} \xrightarrow{\text{Solving}} P_1 = \$84.7$$

### **Question 9**

Evaluate the following statements:

- I. The declaration of dividend is at the discretion of the board of directors. **(TRUE)**
- II. The payment of dividends by the corporation is a tax deductible business expense. **(FALSE)**
- III. A dividend on common stock, whether declared or no by the board of directors, is not a legal liability of the firm. **(FALSE)**

### Question 10

Evaluate the following statements:

- I. The IRR is insensitive to the scale of the project. **(TRUE)**
- II. The profitability index is insensitive to the scale of the project. **(TRUE)**
- III. The IRR and the profitability index methods are both insensitive to the scale of the project, therefore, for the case of independent projects the two methods are equivalent. **(FALSE)**

### Question 11

Dot.com must install a machine that costs \$700,000. The machine will require \$50,000 of maintenance each year and it must be replaced every 25 years. The appropriate discount rate is 10%. Calculate the equivalent annual annuity, *i.e.*, EAA, of the machine. (*Notice* that some of the magnitudes below, that is, options *b* to *e* below, are negative.)

- a. \$ 27,118
- b. \$ -246,148
- c. \$ -27,118
- d. \$ -1,153,852
- e. \$ -127,118

$$PV = -700,000 - 50,000 \frac{1}{0.1} \left( 1 - \frac{1}{(1+0.1)^{25}} \right) = -\$1,153,852$$

$$EAA = \frac{-1,153,852}{\frac{1}{0.1} \left( 1 - \frac{1}{(1+0.1)^{25}} \right)} = -\$127,118$$

## Question 12

Punto.com must decide whether to install machine *A* or machine *B*. Both machines cost \$100,000. Machine *A* generates \$50,000 each year and it must be replaced every 17 years. Machine *B* generates \$45,000 each year and it must be replaced every 27 years. The appropriate discount rate is 10%. Which machine should Punto.com install?

- a. Machine B because it has an NPV of \$315,675
- b. Machine A because it has an NPV of \$301,077
- c. Machine B because it has an EAA of \$34,174
- d. **Machine A because it has an EAA of \$37,534**
- e. Machine B because it has an EAA of \$38,255

$$NPV_A = -100,000 + 50,000 \frac{1}{0.1} \left( 1 - \frac{1}{(1+0.1)^{17}} \right) = \$301,078$$

$$EAA_A = \frac{301,077}{\frac{1}{0.1} \left( 1 - \frac{1}{(1+0.1)^{17}} \right)} = \$37,534$$

$$NPV_B = -100,000 + 45,000 \frac{1}{0.1} \left( 1 - \frac{1}{(1+0.1)^{27}} \right) = \$315,675$$

$$EAA_B = \frac{315,675}{\frac{1}{0.1} \left( 1 - \frac{1}{(1+0.1)^{27}} \right)} = \$34,174$$

### **Question 13**

Dot.com is considering investing in a project with the following expected free cash flows:

Year 1	Year 2	Year 3
37,500	-86,250	49,500

Which of the following statements is correct?

- a. **The IRR of the project is 2% and if the cost of capital is 3% the project should be undertaken because it creates value.**
  - b. **The IRR of the project is 20% and if the cost of capital is 19% the project should be undertaken because it creates value.**
  - c. **The IRR of the project is 6% and if the cost of capital is 5% the project should be undertaken because it creates value.**
  - d. **The IRR of the project is 10% and if the cost of capital is 11% the project should be undertaken because it creates value.**
  - e. **The IRR of the project is 10% and if the cost of capital is 9% the project should be undertaken because it creates value.**
- There are two IRR (10% and 20%) but if the cost of capital is 19% or 11% the project destroys value (NPV < 0) while if the cost of capital is 9% the project creates value (NPV > 0).

### **Question 14**

BestBuy must decide whether to install vending machine *A* or vending machine *B*. Machine *A* costs \$200,000, generates a revenue of \$28,000 per year, and it must be replaced every 20 years. Machine *B* costs \$100,000, generates a revenue of \$14,000 per year and it must be replaced every 10 years. The appropriate discount rate is 12%. Which machine should BestBuy install?

- a. Machine A because it has an EAA of \$9,144.42
- b. **Machine A because it has an EAA of \$1,224.24**
- c. Machine B because it has an EAA of \$3,698.42
- d. Machine B because it has an EAA of \$1,320.33
- e. BestBuy is indifferent between installing machine A or B.

$$PV_A = -200,000 + 28,000 \frac{1}{0.12} \left( 1 - \frac{1}{(1+0.12)^{20}} \right) = \$9,144.42$$

$$EAA_A = \frac{9,144.42}{\frac{1}{0.12} \left( 1 - \frac{1}{(1+0.12)^{20}} \right)} = \$1,224.24$$

$$PV_B = -100,000 + 14,000 \frac{1}{0.12} \left( 1 - \frac{1}{(1+0.12)^{10}} \right) = -\$20,896.88 < 0$$

$$EAA_B = \frac{-20,896.88}{\frac{1}{0.12} \left( 1 - \frac{1}{(1+0.12)^{10}} \right)} = -\$3,698.42 < 0$$

[Note: Installing machine B is negative NPV.]

### **Question 15**

Dixon Inc. is considering investing in a project with the following expected free cash flows:

<b>Year 0</b>	<b>Year 1</b>	<b>Year 2</b>
10,000	-22,000	12,084

Which of the following statements is correct?

- a. **The IRR of the project is 17% and if the cost of capital is 14% the project should be undertaken because it creates value.**
- b. **The IRR of the project is 14% and if the cost of capital is 11% the project should be undertaken because it creates value.**
- c. **The IRR of the project is 11% and if the cost of capital is 6% the project should be undertaken because it creates value.**
- d. **The IRR of the project is 6% and if the cost of capital is 3% the project should be undertaken because it creates value.**
- e. **The IRR of the project is 3% and if the cost of capital is 0% the project should be undertaken because it creates value.**

#### Comment

There are two IRR (6% and 14%) but if the cost of capital is 11% the project destroys value (NPV < 0) while if the cost of capital is 3% the project creates value (NPV > 0).

### **Question 16**

Dot.com is a private company founded more than ten years ago that has a marginal tax rate of 40%, a firm cost of capital of 7% and the following information:

	<b>Year 0</b>	<b>Year 1</b>	<b>Year 2</b>
Operating Revenues		90,000	110,000
Operating Costs		42,000	42,000
Depreciation		3,000	3,500
Interest Payments		2,000	6,000
CAPX		10,000	20,000
Inventory	1,000	1200	3000
Account Receivables	850	325	400
Account Payable	100	120	140

After year 2, the firm's free cash-flows are expected to grow at 2% per year indefinitely.

- I. Estimate the value of Dot.com
- II. If comparable firms have forward P/E ratios of 9, estimate the current value of Dot.com's debt

### **Solution**

#### ***I. Estimate the value of Dot.com***

$$\text{NWC (0)} = 1,000 + 850 - 100 = 1,750$$

$$\text{NWC (1)} = 1,200 + 325 - 120 = 1,405$$

$$\text{NWC (2)} = 3,000 + 400 - 140 = 3,260$$

$$\text{FCF (1)} = (1 - 0.4) (90,000 - 42,000) + 0.4 \times 3,000 - 10,000 - (1,405 - 1,750) = 20,345$$

$$\text{FCF (2)} = (1 - 0.4) (110,000 - 42,000) + 0.4 \times 3,500 - 20,000 - (3,260 - 1,405) = 20,345$$

$$\text{TV(2)} = \frac{20,345 \times (1 + 0.02)}{0.07 - 0.02} = 415,038$$

$$\text{Firm Value (V}_0) = \frac{20,345}{1.07} + \frac{20,345 + 415,038}{(1.07)^2} = \$399.294$$

## ***II. Estimate the current value of Dot.com's debt***

$$\text{Net Income (1)} = (1 - 0.4) (90,000 - 42,000 - 3,000 - 2,000) = 25,800$$

Since the (P/E) ratio is equal to the value of equity divided by the net income then:

$$\text{Equity (0)} = 9 \times 25,800 = 232,200$$

$$\text{Debt (0)} = \text{Firm Value} - \text{Equity (0)} = 399,294 - 232,200 = \mathbf{\$167,094}$$

### Comments

- The firm is more than 10 years old hence the net working capital (NWC) already in place in year zero, i.e., \$1,750, reflects the investment in NWC since the firm was founded. Dot.com's firm value is the present value of all future cash-flows
- The (P/E) ratio is the price per share divided by the earnings per share or equivalently the value of equity divided by the net income.

### **Question 17**

*Taco-Taco* has an equity beta of 1.5 and a target debt to value ratio of 30%, and its debt is virtually risk-free. *Taco-Taco* is considering investing in a new line of Mexican pre-cooked food. Launching this new line would require today (i.e., year 2014) an investment of \$5 million in CAPX, and of \$1 million in inventory. In the *table below* you will find the investment's projections for the next 3 years (i.e., 2015-2017). After the year 2017, the firm's cash-flows will continue growing at 3% indefinitely.

<b>Year (in thousands of \$)</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>
Sales		\$10,000	\$12,000	\$14,000
Manufacturing Costs		\$3,000	\$4,000	\$5,000
Marketing Costs		\$2,000	\$0	\$0
Depreciation		\$400	\$400	\$400
Inventory	\$1,000	\$1,200	\$1,400	\$1,600
Accounts Receivables		\$1,000	\$1,200	\$800
CAPX	\$5,000	\$1,000	\$1,000	\$1,000

*All data is in thousands of dollars*

Currently, the government interest rate is 5% and the marginal tax rate is 40%. Below you will find historical information on annual holding-period securities returns for selected securities and market indexes:

<b>Years</b>	<b>S&amp;P 500 Index</b>	<b>Government Bonds</b>
2000-2014	8%	4%
1929-2014	13%	6%

***Calculate the NPV of the project.***

## Solution

- *First* we calculate the FCF associated to the new line of pre-cooked food:

Year (in thousands of \$)	2014	2015	2016	2017
Sales		\$10,000	\$12,000	\$14,000
Manufacturing Costs		\$3,000	\$4,000	\$5,000
Marketing Costs		\$2,000	\$0	\$0
EBITD		\$5,000	\$8,000	\$9,000
<b>EBITD (1-T)</b>		<b>\$3,000</b>	<b>\$4,800</b>	<b>\$5,400</b>
Depreciation		\$400	\$400	\$400
<b>Depreciation x T</b>		<b>\$160</b>	<b>\$160</b>	<b>\$160</b>
Inventory	\$1,000	\$1,200	\$1,400	\$1,600
Accounts Receivables		\$1,000	\$1,200	\$800
NWC	\$1,000	\$2,200	\$2,600	\$2,400
<b>Change in NWC</b>	<b>\$1,000</b>	<b>\$1,200</b>	<b>\$400</b>	<b>-\$200</b>
<b>CAPX</b>	<b>\$5,000</b>	<b>\$1,000</b>	<b>\$1,000</b>	<b>\$1,000</b>
<b>FCF</b>	<b>-\$6,000</b>	<b>\$960</b>	<b>\$3,560</b>	<b>\$4,760</b>

- *Second* we calculate *Taco-Taco*'s cost of capital:

$$r_E = r_f + \beta_E(r_M - r_f) = 0.05 + 1.5 \times (0.13 - 0.06) = 15.5\%$$

$$r_{WACC} = r_E \times \frac{E}{V} + r_D(1 - T_C) \times \frac{D}{V} = 0.155 \times 0.7 + 0.05 \cdot (1 - 0.4) \times 0.3 = 11.75\%$$

- *Third* we calculate the TV in 2012:

$$TV_{2017} = \frac{FCF_{2017}(1+g)}{r_{WACC} - g} = \frac{4,760K \times (1+0.03)}{0.1175 - 0.03} = \$56,032 K$$

- *Finally* we calculate NPV of the project:

$$NPV = -6,000K + \frac{960K}{1.1175} + \frac{3,560K}{1.1175^2} + \frac{4,760K}{1.1175^3} + \frac{56,032K}{1.1175^3} = \$41,271K$$

***Therefore, Taco-Taco should launch the new line of pre-cooked food.***

### **Question 18**

In one year *Dot.com* firm value will be either \$1,090 with probability 0.5 or \$3,270 with probability 0.5. *Dot.com* has outstanding debt with a face value of \$1,500 due in one year. *Punto.com*, a company in a similar business as *Dot.com*, has a current value of \$1,100 and generates an annual free cash flow of \$99 in perpetuity. The risk-free rate is 5%. Calculate the current value of *Dot.com*'s debt.

### **Solution**

- *First* we need to find the discount rate using the comparable firm (*i.e.*, *Punto.com*):

$$1,100 = \frac{99}{r_{WACC}} \Rightarrow r_{WACC} = \frac{99}{1,100} = 9\%$$

- *Second* we need to find the current value of the firm (*i.e.*, the underlying asset):

$$V_0^{\text{Dot.com}} = \frac{1,090 \times 0.5 + 3,270 \times 0.5}{1 + 0.09} = \$2,000$$

- *Third* we calculate the value of equity taking into account that equity is a call option on the value of the firm (*i.e.*, underlying asset) with strike price equal to the FVD:

$$\begin{array}{lll} S_0 = 2,000 & S_U = 3,270 & S_D = 1,090 \\ C_0 = ? & C_U = \max \{3,270 - 1,500, 0\} = 1,770 & C_D = \max \{1,090 - 1,500, 0\} = 0 \end{array}$$

Using the binomial formula:

$$\begin{aligned} C_0 &= \frac{C_U - C_D}{S_U - S_D} \times S_0 - \frac{C_U S_D - C_D S_U}{(1 + r_f)^T \times (S_U - S_D)} = \\ &= \frac{1770 - 0}{3270 - 1090} \times 2000 - \frac{1770 \times 1090 - 0 \times 3,270}{(1 + 0.05) \times (3270 - 1090)} = \$781 \end{aligned}$$

- *Fourth* we calculate the value of the debt at  $t = 0$ :

$$\text{Debt} = \text{Firm Value} - \text{Equity Value} = 2,000 - 781 = \mathbf{\$1,219}$$

### **Question 19**

Punto.com currently has FCF of \$40,000. This state of affairs is expected to continue for seven years. After seven years FCF will start to decrease at a rate of 3% per year. If Punto.com cost of capital is 10%, the value of its debt is \$150,000, and there are 2,000 shares outstanding, calculate Punto.com's current share price.

- a. \$ 86
- b. \$ 99**
- c. \$ 106
- d. \$ 123
- e. \$ 174

### **Solution**

$$\text{Firm Value} = \frac{40K}{0.1} \left( 1 - \frac{1}{1.1^7} \right) + \frac{1}{1.1^7} \frac{40K \cdot (1 - 0.03)}{0.1 - (-0.03)} = 347,895$$

$$\text{Equity Value} = 347,895 - 150,000 = 197,895$$

$$\text{Share Price} = \frac{197,895}{2,000} = \$99$$

### **Question 20**

A stock's beta measures:

- a. the systematic risk of the stock. **(TRUE)**
- b. the difference between the return of the stock and the return of the market portfolio. **(FALSE)**
- c. the risk premium of the stock. **(FALSE)**
- d. the systematic risk of the market portfolio. **(FALSE)**

### **Question 21**

Mary has \$25,000 in IBM equity, \$8,000 in Dell equity and a loan of \$13,000 from the bank at the risk-free rate of 5%. If IBM equity has a beta of 2 and Dell equity has a beta of 1.5, calculate the beta of Mary's portfolio.

- a. 2.82
- b. **3.10**
- c. 1.85
- d. 3.50
- e. 1.80

### **Solution**

Total Value of Mary's Portfolio (V) = 25,000 + 8,000 – 13,000 = 20,000

$$w_{IBM} = \frac{25,000}{20,000} = 1.25 \quad w_{Dell} = \frac{8,000}{20,000} = 0.4 \quad w_{Risk-Free} = \frac{-13,000}{20,000} = -0.65$$

$$\beta_{Portfolio} = w_{IBM} \times \beta_{IBM} + w_{Dell} \times \beta_{Dell} + w_{Risk-Free} \times \beta_{Risk-Free} = 1.25 \times 2 + 0.4 \times 1.5 - 0.65 \times 0 = 3.10$$

### **Question 22**

Your portfolio is worth \$1 million and has a beta of 1.8. *Stock A* contributes 10 percent of the dollar value of your portfolio and has a beta of 2. If you sell all your holdings in *Stock A* and replace it with a \$50,000 investment in *Stock W* with a beta of 0.5 and another \$50,000 investment in *Stock Z* with a beta of 1.5, what is the beta of the new portfolio?

- a. 1.00
- b. 1.64
- c. **1.70**
- d. 1.75
- e. 1.82

### **Solution**

Before:

$$1.8 = 0.1 \times 2 + 0.9 \beta^{\text{Remain}} \Rightarrow \beta^{\text{Remain}} = \frac{1.8 - 0.1 \times 2}{0.9} = 1.7778$$

After selling A and including W and Z:

$$\beta_{\text{Portfolio}}^{\text{New}} = 0.05 \times 0.5 + 0.05 \times 1.5 + 0.9 \times \beta^{\text{Remain}} = 0.05 \times 0.5 + 0.05 \times 1.5 + 0.9 \times 1.7778 = 1.70$$

### Question 23

*Dot.com* is currently worth \$700, and in one year, it will be worth either \$500 or \$1300. The risk-free interest rate is 5%. *Dot.com*'s equity is currently worth \$174.85 and its debt matures in one-year. Calculate the face value of *Dot.com*'s debt.

- a. \$ 625
- b. **\$ 675**
- c. \$ 725
- d. \$ 775
- e. \$ 825

### Solution

$$\begin{array}{lll} S_0 = 700 & S_U = 1,300 & S_D = 500 \\ C_0 = 174.85 & C_U = \max \{1300 - K, 0\} = 1300 - K & C_D = \max \{500 - K, 0\} = 0 \end{array}$$

Using the binomial formula:

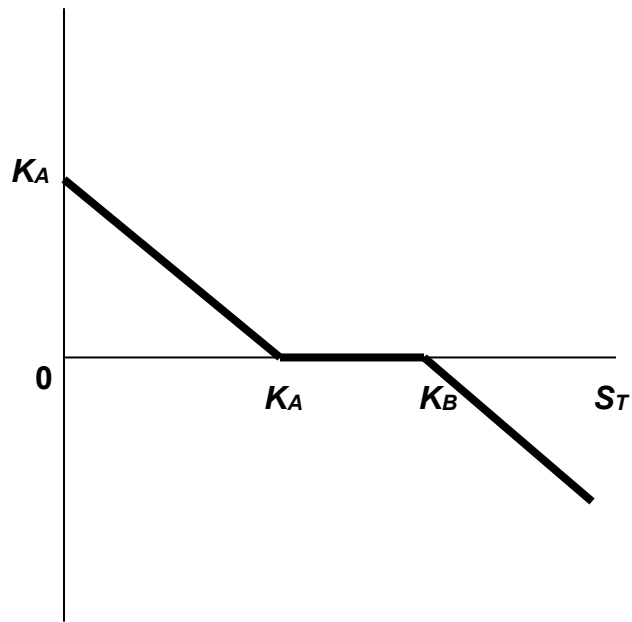
$$\begin{aligned} C_0 &= \frac{C_U - C_D}{S_U - S_D} \times S_0 - \frac{C_U S_D - C_D S_U}{(1 + r_f)^T \times (S_U - S_D)} = \\ &= \frac{1300 - K}{1300 - 500} \times 700 - \frac{(1300 - K) \times 500 - 0 \times 1300}{(1 + 0.05) \times (1300 - 500)} = \$174.85 \end{aligned}$$

Solving the above equation we get **K=\$675**

### Question 24

Below is a graph of the value of a portfolio at maturity as a function of the price of the underlying stock ( $S_T$ ).

*Value of Portfolio at Maturity*



To which portfolio does the above graph correspond?

- a. Buy a call option with strike price  $K_A$  and short a put option with strike price  $K_B$ .
- b. Buy a call option with strike price  $K_B$  and short a put option with strike price  $K_A$ .
- c. Short a call option with strike price  $K_A$  and buy a put option with strike price  $K_B$ .
- d. **Short a call option with strike price  $K_B$  and buy a put option with strike price  $K_A$ .**

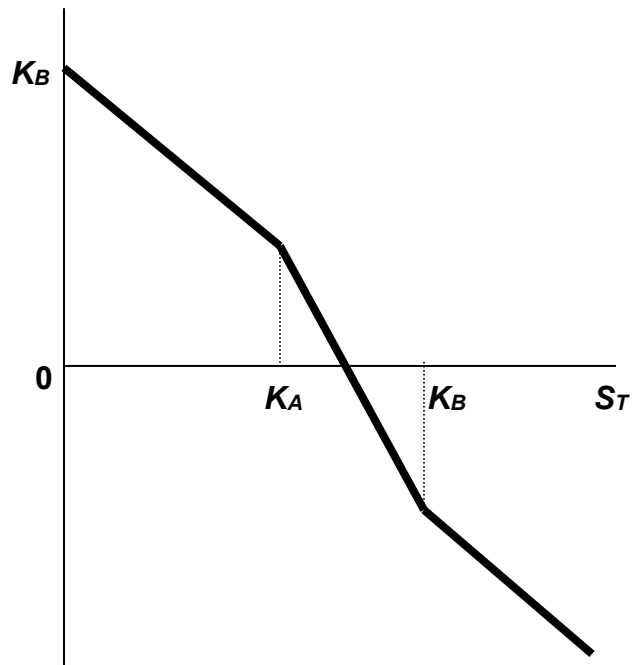
### Solution

Short a call option with strike price  $K_B$  and buy a put option with strike price  $K_A$ .

### Question 25

Below is a graph of the value of a portfolio at maturity as a function of the price of the underlying stock ( $S_T$ ).

*Value of Portfolio at Maturity*



To which portfolio does the above graph correspond?

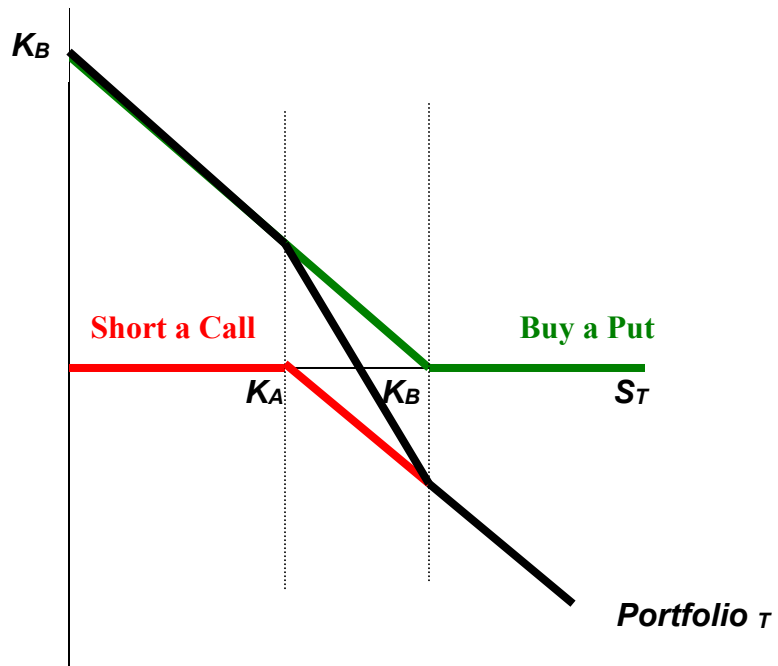
- a. Buy a call option with strike price  $K_A$  and buy a put option with strike price  $K_B$ .
- b. Buy a call option with strike price  $K_A$  and short a put option with strike price  $K_B$ .
- c. Buy a call option with strike price  $K_B$  and short a put option with strike price  $K_A$ .
- d. Short a call option with strike price  $K_A$  and short a put option with strike price  $K_B$ .
- e. **Short a call option with strike price  $K_A$  and buy a put option with strike price  $K_B$ .**

### Solution

Short a call option with strike price  $K_A$  and buy a put option with strike price  $K_B$ .

(SEE GRAPH BELOW)

*Value of Portfolio  
at Maturity*



## Question 26

One-year European call options are available on *Springtime Corporation* stock with the exercise price of \$100. *Springtime* stock is now selling at \$90 per share. Assume that on exercise day *Springtime* shares sell at one of two possible prices: \$80 or \$120. If the Treasury bill rate is 4%, how much would you pay for one call option on *Springtime* stock?

- a. **\$6.54**
- b. \$10.00
- c. \$13.08
- d. \$19.23
- e. \$23.14

$$S_0 = 90 \\ C_0 = ?$$

$$S_U = 120 \\ C_U = \max \{120 - 100, 0\} = 20$$

$$S_D = 80 \\ C_D = \max \{80 - 100, 0\} = 0$$

## Solution

Using the binomial formula:

$$\begin{aligned} C_0 &= \frac{C_U - C_D}{S_U - S_D} \times S_0 - \frac{C_U S_D - C_D S_U}{(1 + r_f)^T \times (S_U - S_D)} = \\ &= \frac{20 - 0}{120 - 80} \times 90 - \frac{20 \times 80 - 0 \times 120}{(1 + 0.04) \times (120 - 80)} = \$6.54 \end{aligned}$$

### Question 27

*Dot.com* stock is now selling at \$110 per share. In two years *Dot.com* shares will sell at one of two possible prices: \$90 or \$180. If the Treasury bill rate is 8%. How much would you pay for a two-year European put option on *Dot.com* stock with an exercise price of \$120?

- a. **\$ 14.77**
- b. \$ 18.89
- c. \$ 17.78
- d. \$ 21.89
- e. \$ 7.63

### Solution

$$\begin{array}{lll} S_0 = 110 & S_U = 180 & S_D = 90 \\ C_0 = ? & C_U = \max \{180 - 120, 0\} = 60 & C_D = \max \{90 - 120, 0\} = 0 \end{array}$$

Using the binomial formula:

$$\begin{aligned} C_0 &= \frac{C_U - C_D}{S_U - S_D} \times S_0 - \frac{C_U S_D - C_D S_U}{(1 + r_f)^T \times (S_U - S_D)} = \\ &= \frac{60}{180 - 90} \times 110 - \frac{60 \times 90 - 0 \times 180}{(1 + 0.08)^2 \times (180 - 90)} = \$21.89 \end{aligned}$$

Using the put-call parity relation:

$$P_0 = C_0 - S_0 + \frac{K}{(1 + r_f)^T} = 21.89 - 110 + \frac{120}{1.08^2} = \$14.77$$

### **Question 28**

Evaluate the following statements:

- I- If a stock has a beta greater than one, its return must have a positive correlation with the return of the market portfolio. **(TRUE)**
- II- If a stock has a beta smaller than one, its return must have a negative or a zero correlation with the return of the market portfolio. **(FALSE)**
- III- With *Dot.com* stock and the risk-free asset an investor can form up to three different portfolios. **(FALSE)**

### **Question 29**

Evaluate the following statements about diversification:

- I- Diversifiable risk is the only risk that matters to a diversified investor. **(FALSE)**
- II- Diversification is the process of reducing the market risk associated with individual assets by spreading the investment across numerous assets. **(FALSE)**

### **Question 30**

The current stock price of *Dot.com* is \$40. The price of the stock in one year from today will be either \$30 or \$90. The risk free interest rate is 5%. How many shares of *Dot.com* do you need to replicate 50 European call options with a strike price of \$60? (Note: Each call option gives the right to buy one share of the stock one year from today at \$60).

- a. **25 shares**
- b. **0.5 shares**
- c. **20 shares**
- d. **1 share**
- e. **50 shares**

### **Solution**

$$C_U = 90 - 60 = \$30$$

$$C_D = \$0$$

$$\text{Number of shares needed to replicate one call} = \frac{C_U - C_D}{S_U - S_D} = \frac{30 - 0}{90 - 30} = 0.5$$

$$\text{Number of shares needed to replicate 50 calls} = 50 \times 0.5 = 25$$

### Question 31

*Dell* has an expected return of 20% and *GE* has an expected return of 12%. The beta of *Dell* is twice the beta of *GE*. Assuming that the CAPM holds what is the risk-free rate?

- a. 2%
- b. 4%**
- c. 6%
- d. 8%
- e. 10%

### Solution

If CAPM holds:

$$r_{Dell} = r_f + \beta_{Dell}(r_{Mkt} - r_f) \Rightarrow (r_{Mkt} - r_f) = \frac{r_{Dell} - r_f}{\beta_{Dell}} = \frac{0.20 - r_f}{2 \times \beta_{GE}}$$

$$r_{GE} = r_f + \beta_{GE}(r_{Mkt} - r_f) \Rightarrow (r_{Mkt} - r_f) = \frac{r_{GE} - r_f}{\beta_{GE}} = \frac{0.12 - r_f}{\beta_{GE}}$$

Hence:

$$\frac{0.20 - r_f}{2 \times \beta_{GE}} = \frac{0.12 - r_f}{\beta_{GE}} \Rightarrow 0.20 - r_f = 0.24 - 2r_f \Rightarrow r_f = 4\%$$

### Question 32

Calculate the FCF in year 2 assuming that the firm's corporate tax rate is 40%.

	<u>Year 1</u>	<u>Year 2</u>
Net Income	260,400	259,800
Depreciation	7,000	8,000
Interest Payments	9,000	9,000
CAPX	25,000	30,000
Inventory	2,500	2,500
Account Receivables	800	800
Account Payable	100	800

### Solution

FCF = Net Income + (1-Tc) x Interest Paid + Depreciation - CAPX - Change in NWC

Hence:

$$\begin{aligned} FCF_2 &= 259,800 + 9,000(1 - 0.4) + 8,000 - 30,000 \\ &\quad - [(2,500 + 800 - 800) - (2,500 + 800 - 100)] = \\ &= 259,800 + 5,400 + 8,000 - 30,000 + 700 = \$243,900 \end{aligned}$$

### **Question 33**

Dot.com is considering replacing its existing machine. You are given the following facts:

- The firm has spent \$5,000 studying the compatibility of the new machines and the experts have reached the conclusion that the machine is indeed compatible with the rest of the production line.
- The new machine costs \$300,000 and would replace the existing machine. The new machine would be depreciated in straight line at the rate of \$20,000 per year and would be sold for \$70,000 after 10 years.
- The new machine would increase before-tax annual sales by \$100,000. The new machine would also increase before-tax annual operating costs by \$30,000. These changes in sales and costs would occur at year-end during the 10 years that the new machine would be operating.
- The new requires \$15,000 in working capital while the old machine only requires \$14,000 in working capital.
- The old machine was acquired 5 years ago for \$90,000 and it has a current market value of \$40,000. The old machine could last for another 10 years, and after 10 years would be worth \$10,000.
- The current book value of the old machine is \$50,000 and it would be depreciated in straight line at the rate of \$3,000 per year.
- Dot.com's marginal tax rate is 40%.

- I. Calculate the incremental FCF in year 0 of buying the new machine
- II. Calculate the incremental FCF in year 5 of buying the new machine
- III. Calculate the incremental FCF in year 10 of buying the new machine

### **Solution**

**I. Incremental FCF in year 0**

$$\text{FCF (0)} = -300,000 - 1,000 + 40,000 - 0.4 \times (40,000 - 50,000) = -257,000$$

**II. Incremental FCF in year 5**

$$\text{FCF (5)} = (1 - 0.4) (100,000 - 30,000) + 0.4 \times (20,000 - 3,000) = 48,800$$

**III. Incremental FCF in year 10**

$$\begin{aligned} \text{FCF (10)} &= (1 - 0.4) (100,000 - 30,000) + 0.4 \times (20,000 - 3,000) + 70,000 \\ &\quad - 0.4 \times (70,000 - 100,000) - 10,000 + 0.4 \times (10,000 - 20,000) + 1,000 = \\ &= 117,800 \end{aligned}$$

### Question 34

Calculate the FCF in year 2 assuming that the firm's marginal tax rate is 35%.

	<u>Year 1</u>	<u>Year 2</u>	<u>Year 3</u>
Operating Revenues	120,000	140,000	160,000
Operating Costs	50,000	50,000	50,000
Depreciation	6,000	8,000	10,000
Interest Payments	10,000	10,000	10,000
CAPX	25,000	30,000	35,000
Inventory	2,500	3,200	4,800
Account Receivables	320	500	400
Account Payable	120	800	900

- a. \$ 24,600
- b. \$ 28,400
- c. **\$ 31,100**
- d. \$ 31,500
- e. \$ 36,300

### Solution

	<u>Year 0</u>	<u>Year 1</u>	<u>Year 2</u>	<u>Year 3</u>
Operating Revenues		120,000	140,000	160,000
Operating Costs		50,000	50,000	50,000
EBITDA		70,000	90,000	110,000
EBITDA (1-T)		<b>45,500</b>	<b>58,500</b>	<b>71,500</b>
Depreciation		6,000	8,000	10,000
Interest Payments		10,000	10,000	10,000
Depreciation Tax Shield		<b>2,100</b>	<b>2,800</b>	<b>3,500</b>
CAPX		<b>25,000</b>	<b>30,000</b>	<b>35,000</b>
Inventory	1,000	2,500	3,200	4,800
Account Receivables	850	320	500	400
Account Payable	100	120	800	900
NWC	1,750	2,700	2,900	4,000
Change in NWC		<b>950</b>	<b>200</b>	<b>1,100</b>
<b>FCF</b>		<b>21,650</b>	<b>31,100</b>	<b>38,900</b>

**The following problem applies to the next two questions.**

Punto.com which has a marginal tax rate of 40% is considering replacing its existing machine. You are given the following facts:

- The new machine costs \$1,000,000 and would replace the existing machine. The new machine would be depreciated in straight line at the rate of \$75,000 per year and would be sold for \$200,000 after 10 years.
- The new machine would increase before-tax annual sales by \$250,000. The new machine would also increase before-tax annual operating costs by \$125,000. These changes in sales and costs would occur at year-end during the 10 years that the new machine would be operating.
- The old machine was acquired 6 years ago for \$750,000 and it has a current market value of \$500,000. The old machine could last for another 10 years, and after 10 years would be worth \$70,000. The current book value of the old machine is \$500,000 and it would be depreciated in straight line at the rate of \$50,000 per year.

**Question 35**

Calculate the incremental FCF in year 0 of buying the new machine.

- a. - \$ 1,000,000
- b. - \$ 700,000
- c. **- \$ 500,000**
- d. - \$ 300,000
- e. - \$ 200,000

**Solution**

$$\text{FCF (0)} = -1,000\text{K} + 500\text{K} - 0.4 \times (500\text{K} - 500\text{K}) = -500\text{K}$$

**Question 36**

Calculate the incremental FCF in year 10 of buying the new machine.

- a. \$ 163,000
- b. \$ 223,000
- c. **\$ 263,000**
- d. \$ 278,000
- e. \$ 283,000

**Solution**

$$\begin{aligned} \text{FCF (10)} &= (1 - 0.4) (250,000 - 125,000) + 0.4 \times (75,000 - 50,000) + 200,000 \\ &\quad - 0.4 \times (200,000 - 250,000) - 70,000 + 0.4 \times (70,000 - 0) = 263,000 \end{aligned}$$

### **Question 37**

Apple must decide whether to install vending machine *A* or vending machine *B* in the Airport. Machine *A* costs \$300,000, generates a revenue of \$45,000 per year, and it must be replaced every 15 years. Machine *B* costs \$100,000, generates a revenue of \$24,000 per year, and it must be replaced every 10 years. The appropriate discount rate is 10%. Which machine should Apple install and what is the EAA of installing this machine?

- a. Apple is indifferent between installing machine A or B.
- b. Should install Machine A, which generates an EAA of \$9,244.42
- c. Should install Machine A, which generates an EAA of \$5,557.87
- d. Should install Machine B, which generates an EAA of \$3,223.32
- e. **Should install Machine B, which generates an EAA of \$7,725.46**

### **Solution**

$$NPV_A = -300,000 + \frac{45,000}{0.1} \left( 1 - \frac{1}{(1+0.1)^{15}} \right) = \$42,273.58$$

$$EAA_A = \frac{42,273.58}{\frac{1}{0.1} \left( 1 - \frac{1}{(1+0.1)^{15}} \right)} = \$5,557.87$$

$$NPV_B = -100,000 + \frac{24,000}{0.1} \left( 1 - \frac{1}{(1+0.1)^{10}} \right) = \$47,469.61$$

$$EAA_B = \frac{47,469.61}{\frac{1}{0.1} \left( 1 - \frac{1}{(1+0.1)^{10}} \right)} = \$7,725.46$$

### **Question 38**

Becks Inc. is considering investing in a project with the following expected free cash flows:

<b>Year 0</b>	<b>Year 1</b>	<b>Year 2</b>
10,000	-39,000	30,629

Which of the following statements is correct?

- a. The IRR of the project is 5% and if the cost of capital is 12% the project should be undertaken because it has a positive NPV.
- b. The IRR of the project is 12% and if the cost of capital is 10% the project should be undertaken because it has a positive NPV.
- c. The IRR of the project is 5% and if the cost of capital is 9% the project should be undertaken because it has a positive NPV.
- d. The IRR of the project is 9% and if the cost of capital is 3% the project should be undertaken because it has a positive NPV.**
- e. The IRR of the project is 4% and if the cost of capital is 6% the project should be undertaken because it has a positive NPV.

### **Solution**

The Project has an IRR of 9% and if the cost of capital is 3% it is NPV positive. (Note: 4%, 5%, and 12% are not IRR).

**Question 39**

Calculate the FCF in year 2 assuming that the firm's corporate tax rate is 40%.

	<u>Year 1</u>	<u>Year 2</u>
Net Income	260,400	259,800
Depreciation	7,000	8,000
Interest Payments	9,000	9,000
CAPX	25,000	30,000
Inventory	2,500	2,500
Account Receivables	800	800
Account Payable	100	800

**Solution**

$FCF = \text{Net Income} + (1 - T_c) \times \text{Interest Paid} + \text{Depreciation} - \text{CAPX} - \text{Change in NWC}$

Hence:

$$\begin{aligned} FCF_2 &= 259,800 + 9,000(1 - 0.4) + 8,000 - 30,000 \\ &\quad - [(2,500 + 800 - 800) - (2,500 + 800 - 100)] = \\ &= 259,800 + 5,400 + 8,000 - 30,000 + 700 = \$243,900 \end{aligned}$$