1. You are an analyst trying to value company ABC. Today is year 0. You expect that from year 1 to year 3, ABC will pay an annual dividend of $5 per share. The appropriate discount rate (cost of equity) over this period is 12%. Every year after that, you expect ABC to pay an annual dividend of $8 per share. The appropriate discount rate (cost of equity) over this period is 8%. What should the stock price of ABC be today? (Choose the answer below that is closest to the value you computed.)

(A) 67

(B) 71

(C) 75

(D) 83

(E) 90

Answer: (D)

P=5/1.12 + 5/1.12^2 + 5/1.12^3 + 8/(1.12)^3(1.08) + ...

P=5/1.12 + 5/1.12^2 + 5/1.12^3 + 1/1.12^3*8/0.08

P=83

2. XYZ bond has a face value of $1000 and an annual coupon payment of $50. XYZ matures in 2 years, and is currently trading at a price of $1000. The yield to maturity on a 2 year zero-coupon treasury bond is currently 2%. What is the yield to maturity of the XYZ bond? (Choose the answer below that is closest to the value you computed.)

(A) 2%

(B) 3%

(C) 4%

(D) 5%

(E) 7%

Answer: (D)

The bond is trading at par, hence the YTM = the coupon rate = 50/1000 = 5%.

3. A bond has face value of $100,000 and yearly coupon rate of 10% (its first coupon will be paid one year from now), its maturity date is 3 years from now and its yield-to-maturity is 5%. Using duration concept, what is the percent change in the price of the bond if its yield-to-maturity jumps to 10%? (Choose the answer below that is closest to the value you computed.)

(A) –9%

(B) –10%

(C) –11%

(D) –12%

(E) –13%

Answer: (E)

price of the bond = 10000/1.05 + 10000/1.05^2 + 110000/1.05^3 = 113616.2

duration =

1*(10000/1.05)/113616.2 + 2*(10000/1.05^2)/113616.2 + 3*(110000/1.05^3)/113616.2

= 2.7525

modified duration = 2.7525/1.05 = 2.62

percentage change in price = –5%*2.62 = –13%

4. Firm A has an equity cost of capital of 6%. Firm B has an equity cost of capital of 9%. Firm A's equity beta is 0.5, while Firm B's equity beta is 4 times of that of Firm A. According to CAPM, what is the expected market return based on this information?

(A) 5%

(B) 6%

(C) 7%

(D) 8%

(E) 9%

Answer: (C)

solve r_f and (r_mkt – r_f) from the following two equations:

6% = r_f + 0.5*(r_mkt – r_f)

9% = r_f + 2*(r_mkt – r_f)

we get (r_mkt – r_f) = 2%, r_f = 5%. Hence r_mkt = 7%.

5. Suppose we have the following YTMs of zero-coupon bonds with maturity

$$1yr = 1\%,\ \ 2yr = 2\%,\ \ 3yr = 3\%,\ \ 4yr = 3.5\%$$

What is the 2-year forward rate at year 2 (i.e. 2-year forward rate from year 2 to year 4)? (Choose the answer below that is closest to the value you computed.)

(A) 3%

(B) 4%

(C) 5%

(D) 6%

(E) 7%

Answer: (C)

2-year forward rate at year 2 = $\sqrt{(1.035^4 / 1.02^2)} - 1 = 5\%$

6. Coke has an earnings per share (EPS) of $2.97 this year (year 0) and a total payout rate of 68%. The risk-free rate is 4.5%, market risk premium is 4% and Coke's equity Beta is 0.62. In the next year (year 1), Coke's EPS will be 5% higher than its EPS this year. After next year, the earnings of Coke will grow at the constant rate of 3% a year. Coke's total payout rate does not change and is always 68%. What should be Coke's stock price right now (at year 0)?

(A) 46

(B) 53

(C) 60

(D) 68

(E) 75

Answer: (B)

equity cost of capital for Coke = 4.5% + 4%*0.62 = 7%

EPS_1 of Coke in year 1 = 2.97*(1.05) = 3.12

P_0 of Coke at year 0

= EPS_1*[Total Payout Rate]/(r_e - g_e) = 3.12*68%/(7% - 3%) = $52.87

7. Which of the following statements is the ***least*** plausible explanation for why IPOs are underpriced? (**For this question only**, just pick the right answer. You do not need to explain why.)

(A) To increase the likelihood of a successful IPO

(B) To make future equity issuances easier

(C) To encourage uninformed investors to participate

(D) To let clients make a quick profit by buying at the offer price and selling at a higher price at the end of the day

(E) To increase the positive publicity for the firm

Answer: (D)

Investment banks actually want their clients to hold on to their shares, to make sure price does not collapse. Other choices have all been discussed in the lecture notes (see page 25 of Lecture Notes 11).

8. Suppose company TX has an after-tax WACC of 10% and its debt cost of capital is 5%. It has a market capitalization of $8 billion, an enterprise value of $10 billion, and $2 billion in cash. Suppose the corporate tax rate is 30%. What is TX's equity cost of capital? (Choose the answer below that is closest to the value you computed.)

(A) 10.25%

(B) 11.25%

(C) 12.25%

(D) 13.25%

(E) 14.25%

Answer: (D)

debt value = 10 + 2 – 8 = $4 billion

after-tax WACC = 10% = 8/12 * r_e + 4/12 * (1–0.3)*5%

solving for r_e, we get r_e = (30% – 3.5%)/2 = 13.25%

9. You are given the following information on company ZZZ:

- Equity beta is 0.59. 10-year risk-free rate is 3.23%. Market risk premium is 4%.
- ZZZ's corporate bonds are rated A. You have the following tables of corporate bond yields and default premia (1Y stands for 1-year in the first table and so on):

	% of Trades	Median Yield, %							
		1Y	2Y	3Y	5Y	7Y	10Y	15Y	20Y
AAA	0.7	-	0.6	1.5	2.1	3.3	3.6	4.2	4.9
AA	4	0.5	1.1	1.6	2.3	3.5	3.9	4.8	5.1
A	5	0.6	1.1	1.8	2.6	3.8	3.9	5.4	5.3
BBB	11	1.3	1.9	2.7	3.5	4.7	4.8	6.2	6.5
BB	3	2.5	3.2	3.9	5.5	5.8	6.2	6.7	7.7
B	5	5.7	6.9	7.3	7.8	6.7	6.9	8.0	9.7
C	3	46.9	6.0	10.3	10.1	11.0	7.6	12.6	7.8

Spread due to Default Premium (Based on Historical Data)

Rating	Maturity									
	1-year	2-year	3-year	4-year	5-year	6-year	7-year	8-year	9-year	10-year
AAA/Aaa	0.00%	0.00%	0.00%	0.00%	0.01%	0.01%	0.02%	0.02%	0.02%	0.03%
AA/Aa	0.01%	0.01%	0.01%	0.02%	0.03%	0.03%	0.03%	0.03%	0.04%	0.04%
A	0.01%	0.01%	0.03%	0.03%	0.04%	0.04%	0.05%	0.05%	0.06%	0.06%
BBB/Baa	0.08%	0.12%	0.15%	0.18%	0.20%	0.22%	0.23%	0.24%	0.25%	0.26%
BB/Ba	0.78%	1.11%	1.29%	1.39%	1.45%	1.47%	1.44%	1.43%	1.41%	1.40%
B	4.34%	4.68%	4.68%	4.53%	4.40%	4.22%	4.08%	3.89%	3.71%	3.59%
CCC/Caa	15.78%	12.87%	11.31%	10.18%	9.07%	8.43%	7.90%	7.55%	7.14%	6.74%

- Total debt of ZZZ: $65 billion. Market cap of ZZZ: $185 billion. Tax rate: 35%.

Estimate the after-tax WACC of ZZZ based on the above information? (Choose the answer below that is closest to the value you computed.)

(A) 3.9%

(B) 4.3%

(C) 4.8%

(D) 5.3%

(E) 5.7%

Answer: (C)

cost of equity = 3.23 + 4*0.59 =5.59%

cost of debt = 3.9 – 0.06 = 3.84%

after-tax WACC = 5.59% * 185/(65 + 185) + 3.84% * 0.65 * 65/(65 + 185) = 4.78%

10. Pear Corporation is considering an investment in a new project with an unlevered cost of capital of 10%. Pear's corporate tax rate is 50%, and its debt cost of capital is 4%. Pear adjusts its debt continuously to maintain a constant debt-equity ratio of 50%. Suppose the new project has free cash flows of $10 million in year 1, which are expected to increase by 2% per year afterwards. **Using the WACC method**, what is the enterprise value of the new project for Pear? (Choose the answer below that is closest to the value you computed. You will NOT get any credit if you do not use the WACC method.)

(A) $136 million

(B) $146 million

(C) $156 million

(D) $166 million

(E) $176 million

Answer: (A)

unlevered cost of capital = 10% = r_e*2/3 + 4%*1/3, hence cost of equity r_e = 13%

after-tax WACC = 13%*2/3 + 4%*0.5*1/3 = 9.333%

EV of the new project = 10 / (9.333% – 2%) = $136.4 million

11. JX Corporation is expected to generate constant free cash flows of $10 million per year, starting from year 1. JX has **permanent debt** value of $50 million (i.e. the debt is perpetually rolled over), a tax rate of 30%, and an unlevered cost of capital of 8%. JX's debt is fairly priced. There is no cash. What is the intrinsic equity value of JX Corporation? (Choose the answer below that is closest to the value you computed.)

(A) 82

(B) 92

(C) 102

(D) 112

(E) 122

Answer: (B)

This is actually on page 32 of Lecture Notes 6.

Permanent debt $50 million is fairly priced, thus PV(all interest tax shields) = $50 million

Using the APV method, enterprise value = 10/0.08 + 50*0.3 = 125 + 15 = $140 million

Hence intrinsic equity value = 140 – 50 = $90 million

12. *Products Inc.* is currently an all equity firm, with a Beta of 0.8. Its current equity value is 1 billion dollars. The management of *Products Inc.* decides to repurchase shares by issuing debt, in order to benefit from the tax advantages of debt. The target leverage ratio is D/(D+E) = 0.2, the corporate tax rate is 40%, the risk-free rate is 5% and the market risk premium is 4%. Assume that the cost of debt at the target leverage ratio is 5.5%. What is the after-tax cost of capital of *Products Inc* at the target leverage ratio? (Choose the answer below that is closest to the value you computed.)
[**Hint:** you need to use the unlevering and relevering beta method to get the cost of equity first at the target leverage ratio]

(A) 5.5%

(B) 6.5%

(C) 7.5%

(D) 8.5%

(E) 9.5%

Answer: (C)

Target D/E = 0.2/0.8 = 0.25

β_{New} = 0.8*(1 + (1 – 0.4)*0.25) = 0.92

after-tax WACC = 5.5%*(1–0.4)*0.2 + (5% + 0.92*4%)*0.8 =7.6%

13. You have an arrangement with your broker to request 100 shares of all available IPOs. Suppose that 60% of the time, the IPO is "hugely successful" and the stock price rises by 20% on the first trading day (after the IPO), 30% of the time the IPO is “moderately successful” and the stock price rises by 10%, and 10% of the time the IPO "fails miserably" and the stock price falls by 30% on the first day. Suppose you expect to receive 20 shares when the IPO is “hugely successful”, 50 shares when it is “moderately successful”, and 100 shares when it “fails miserably”. Assume the IPO price is $50 per share. What is your expected one-day (first-day) return on your IPO investments? (Choose the answer below that is closest to the value you computed.)

(A) 0.1%

(B) 0.5%

(C) 1.5%

(D) 2.5%

(E) 3.5%

Answer: (D)

expected investment cost = 0.6*20*50 + 0.3*50*50 + 0.1*100*50 = 1850

expected value post IPO = 0.6*20*50*1.2 + 0.3*50*50*1.1 + 0.1*100*50*0.7 = 1895

expected return = 1895/1850 – 1 = 2.43%

14. You have the following information about the yearly financials, and future projections, for *Example Inc.* in 2010 (year 0):

- Sales (revenue) in 2010 were 2000 million and EBIT is 15% of sales every year
- Sales are expected to grow at the rate of 15% every year until 2015, and then at the rate of 3% from 2015 onwards. To generate this sales growth, every year the net capital expenditure is expected to be 33.33% of the sales increase next year (i.e. the net capex in year *t* is 33.33% of the sales increase from year *t* to year *t+1*)
- The tax rate is 33.33%
- Net working capital is 10% of next year's sales
- Also, you have estimated the firm's after-tax WACC as 10%

Compute the enterprise value of *Example Inc.* in 2010 using this information? (Choose the answer below that is closest to the value you computed.)

[Hint: the FCFs would be growing at 3% forever after 2015]

(A) 3430 million

(B) 3530 million

(C) 3630 million

(D) 3730 million

(E) 3830 million

Answer: (D)

Example Inc

	2010	2011	2012	2013	2014	2015
Sales	2000	2300	2645	3042	3498	4023
EBIT	300	345	397	456	525	603
EBIT*(1 - T)	10% of sales					
NWC	10% of 2300	10% of 2645				
Change NWC		10% of 15% of 2300			10% of 15% of 3498	10% of 3% of 4022
Net Capex		33.3% of 15% of 2300				33.3% of 3% of 4022
FCF	10% - 1.5% - 5% of sales = 3.5% of sales					10% - 0.3% - 1% of sales = 8.7% of sales
		81	93	106	122	350

EV = NPV(10%, 81, 93, 106, 122) + 350/(0.1 - 0.03)/1.1^4 = 3730

15. (Question 15 is a continuation of Question14 from the previous page)

Example is looking at another company in the same industry, *Model Inc*, for a possible acquisition. To estimate the stand-alone value of *Model*, the managers of *Example* collected the following information and projections about *Model*, in 2010 (year 0):

- Sales of *Model* in 2010 were 1000 million and EBIT is 7.5% of sales every year
- Sales are expected to grow at the rate of 15% every year until 2015, and then at the rate of 3% from 2015 onwards. To generate this sales growth, every year net capital expenditure is expected to be 33.33% of the sales increase next year (i.e. the sales increase from year *t* to year *t+1*)
- The tax rate is 33.33%
- Net working capital is 40% of <u>next year</u>'s sales
- Also, you have estimated the after-tax WACC of *Model Inc.* as 10%

The managers of *Example* think that, if *Example* acquires *Model*, then the combined firm would have a synergy value of $200 million in 2010. What is the enterprise value of the combined firm in 2010 after we take into account of synergy? (Choose the answer below that is closest to the value you computed.) [Hint: compute the enterprise value of *Model* in 2010 first]

(A) 4000 million

(B) 4100 million

(C) 4200 million

(D) 4300 million

(E) 4400 million

Answer: (C)

Model Inc

	2010	2011	2012	2013	2014	2015
Sales	1000	1150	1323	1521	1749	2011
EBIT	75	86.2	99	114	131	151
EBIT*(1 - T)	5% of sales					
NWC	40% of 1150	40% of 1322				
Change NWC		40% of 15% of 1150			40% of 15% of 1749	40% of 3% of 2011
Net Capex		33.3% of 15% of 1150				33.3% of 3% of 2011
FCF	5% - 6% - 5% of sales = minus 6% of sales					5% - 1.2% - 1% of sales = 2.8% of sales
		-69	-79	-91	-105	56

EV of Model = NPV(10%, -69, -79, -91, -105) + 56/(0.1–0.03)/1.1^4 = 280

<u>EV of combined firm = 3730 + 280 + 200 = 4210 million</u>

16. The price of a European call option that expires in two years and has a strike price of $100 is $10. The underlying stock price is $80 and a dividend of $30 will be paid in year one. Risk-free rate is 20% per year. What's the price of a European put option that expires in two years and has a strike price of $100? (Choose the answer below that is closest to the value you computed.)

(A) $16

(B) $20

(C) $24

(D) $28

(E) $32

Answer: (C)

from put-call parity,

p = 10 + 100/1.2^2 + 30/1.2 – 80 = 24.444

17. Suppose one ounce of gold is trading at $500 right now (year 0). Gold depreciates every year, so one ounce of gold has a dividend yield of –1% per year, and the risk-free interest rate is 3% per year. What is the price of a forward contract at year 0 that delivers one ounce of gold two years from now? (Choose the answer below that is closest to the value you computed. Do not use continuous compounding)

(A) $510

(B) $520

(C) $530

(D) $540

(E) $550

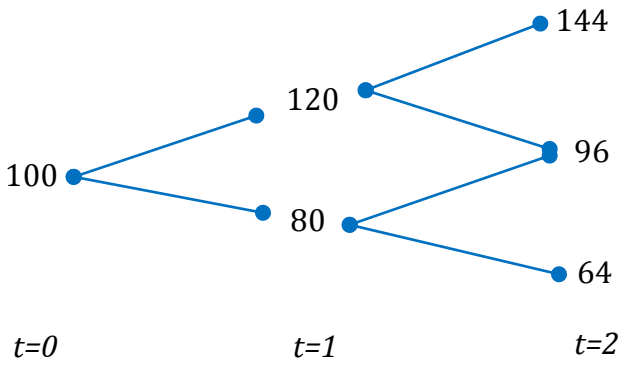
Answer: (D)

from the cash and carry relationship for forward,

price of this forward contract = 500*(1 + 3% – (–1%))^2 = 500*1.04^2 = 540.8

(Question 18 and 19 use the same information below)

Consider the following binomial tree for a stock. The stock does not pay any dividend. Assume the risk-free interest rate r =0.1



An Asian option is a type of option in which the payoff is determined by the ***average*** underlying price of the stock throughout its history. For example, an Asian put option with strike price K on the stock shown above would have a payoff of max(K-A,0) at maturity t=2, where A is the average price over all three time periods in its history. For instance, if the price of the stock at t=2 is 64, then A = (100+80+64)/3 = 81.333, and the payoff of the Asian put option is max(K-81.333,0). (Notice that the payoff of the Asian put option at t=2 is <u>different</u> for the history "up, down" and for the history "down, up"). If exercised early, then A is just the average price of the preceding time periods in the stock's history up to and including the exercise point, so if exercised at t=1 when the price was 80, then A=(100+80)/2 = 90 and the payoff from early exercise is max(K-90,0).

18. What is the price of this Asian **put** option at t=0 with strike price K=104 and with **no** early exercise allowed? (Choose the answer below that is closest to the value you computed.)

(A) 3.01

(B) 3.18

(C) 4.01

(D) 4.58

(E) 6.71

Answer: (A)

Let "U" denote up and "D" denote down

The payoffs of the Asian put option at t=2 are:

0 for the history "U,U", 0 for "U,D", 104 – 276/3 = 12 for "D,U", and 104 – 244/3 = 22.67 for "D,D".

replicating portfolio at t=1:

in the "U" state, $\theta_S = 0,\ \theta_B = 0$, hence the price of the option = 0

in the "D" state, $96\theta_S + \theta_B = 12,\ 64\theta_S + \theta_B = 22.67$. Hence $\theta_S = -1/3,\ \theta_B = 44$, and the price of the option = $-1/3*80 + 44/1.1 = 13.33$.

replicating portfolio at t=0:

$120\theta_S + \theta_B = 0,\ 80\theta_S + \theta_B = 13.33$. Hence $\theta_S = -1/3,\ \theta_B = 40$, and the price of the option at t=0 is $-1/3*100 + 40/1.1$ = **3.03**

The price of the Asian put option at t=0 with no early exercise allowed is 3.03

19. What is the price of this Asian **put** option at t=0 with strike price K=104 and **with** early exercise allowed? (Choose the answer below that is closest to the value you computed.)

(A) 3.01

(B) 3.18

(C) 4.01

(D) 4.58

(E) 6.71

Answer: (C)

Let "U" denote up and "D" denote down.

As before in the previous question, the payoffs of the Asian put option at t=2 are:

0 for the history "U,U", 0 for "U,D", 104 – 276/3 = 12 for "D,U", and 104 – 244/3 = 22.67 for "D,D".

replicating portfolio at t=1:

in the "U" state, $\theta_S = 0,\ \theta_B = 0$, hence the price of the option = 0 (no early exercise)

in the "D" state, $96\theta_S + \theta_B = 12,\ 64\theta_S + \theta_B = 22.67$. Hence $\theta_S = -1/3,\ \theta_B = 44$, and the value of the option based on the replicating portfolio = $-1/3*80 + 44/1.1 = 13.33$. **<u>However</u>,** if we exercise the put option early at this point, we get a payoff = 104 – (100+80)/2 = 14 which is > 13.33. Therefore, **we exercise the put option early in the "D" state at t=1 and the price of the option is 14 at this point.**

replicating portfolio at t=0:

$120\theta_S + \theta_B = 0,\ 80\theta_S + \theta_B = 14$. Hence $\theta_S = -0.35,\ \theta_B = 42$, and the value of the option based on the replicating portfolio is –0.35*100 + 42/1.1 = 3.18. **<u>However</u>,** if we exercise the put option early at this point, we get a payoff = 104 – 100 = 4 which is > 3.18. Therefore, **we exercise the put option early at t=0 and the price of the put option at t=0 is 4.**

The price of the Asian put option at t=0 with early exercise allowed is 4

20. You are the CEO of a **leveraged** buyout firm and are evaluating a potential buyout of DAB Company. DAB's stock price is $10, and it has 5 million shares outstanding. The company currently has no debt, nor does it have any cash. You believe that if you buy the company and replace its management, its total (enterprise) value will increase by 80%. You are planning on doing a **leveraged** buyout of DAB (i.e. through borrowing money/using debt). You need to obtain 50% control for the buyout to succeed. This means that if you offer a buyout price of $\$X$ per share, at least 50% of the shareholders must be willing to tender (sell) their shares to you at the price of $\$X$. You will finance the purchase of shares by borrowing the necessary amount of money. After the leveraged buyout (if it succeeds), you took the debt (i.e. the money you borrowed for the buyout) onto the company DAB's balance sheet.

What is the **minimum** buyout price $\$X$ you can offer such that at least 50% of the shareholders are willing to tender (sell) their shares to you?

[Hint: You need to consider what happens to the share price of the company after the leverage buyout if it succeeds (There will still be 5 million shares outstanding if the buyout succeeds). Remember shareholders are only willing to tender their shares to you if your buyout offer price is at least as large as the share price of the company after the successful buyout.]

(A) $10.5

(B) $11.1

(C) $11.5

(D) $12.1

(E) $13.1

Answer: (D)

enterprise value after successful buyout = 10*5*1.8 = $90 million

total equity value after successful buyout = $90 - 50\%*5*X = 90 - 2.5X$

share price after successful buyout = $(90 - 2.5X) / 5 = 18 - 0.5X$

For shareholders to be willing to tender, we must have

$$X \geq 18 - 0.5X$$

this implies that we must have $X \geq 12$, hence the choice (D) [choice (E) is too big].