MARR **12%**

N	(F/P, i, N)	(P/F, i, N)	(F/A, i, N)	(A/F, i, N)	(P/A, i, N)	(A/P, i, N)
1	1.1200	0.8929	1.0000	1.0000	0.8929	1.1200
2	1.2544	0.7972	2.1200	0.4717	1.6901	0.5917
3	1.4049	0.7118	3.3744	0.2963	2.4018	0.4163
4	1.5735	0.6355	4.7793	0.2092	3.0373	0.3292
5	1.7623	0.5674	6.3528	0.1574	3.6048	0.2774
6	1.9738	0.5066	8.1152	0.1232	4.1114	0.2432
7	2.2107	0.4523	10.0890	0.0991	4.5638	0.2191
8	2.4760	0.4039	12.2997	0.0813	4.9676	0.2013
9	2.7731	0.3606	14.7757	0.0677	5.3282	0.1877
10	3.1058	0.3220	17.5487	0.0570	5.6502	0.1770

N	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
(F/P, i, N)	1.1200	1.2544	1.4049	1.5735	1.7623	1.9738	2.2107	2.4760	2.7731	3.1058
(P/F, i, N)	0.8929	0.7972	0.7118	0.6355	0.5674	0.5066	0.4523	0.4039	0.3606	0.3220
(F/A, i, N)	1.0000	2.1200	3.3744	4.7793	6.3528	8.1152	10.0890	12.2997	14.7757	17.5487
(A/F, i, N)	1.0000	0.4717	0.2963	0.2092	0.1574	0.1232	0.0991	0.0813	0.0677	0.0570
(P/A, i, N)	0.8929	1.6901	2.4018	3.0373	3.6048	4.1114	4.5638	4.9676	5.3282	5.6502
(A/P, i, N)	1.1200	0.5917	0.4163	0.3292	0.2774	0.2432	0.2191	0.2013	0.1877	0.1770

Recovery Year	3-Year Property	5-Year Property	7-Year Property	10-Year Property	15-Year Property	20-Year Property
1	33.33%	20.00%	14.29%	10.00%	5.00%	3.75%
2	44.45%	32.00%	24.49%	18.00%	9.50%	7.22%
3	14.81%	19.20%	17.49%	14.40%	8.55%	6.68%
4	7.41%	11.52%	12.49%	11.52%	7.70%	6.18%
5		11.52%	8.93%	9.22%	6.93%	5.71%
6		5.76%	8.92%	7.37%	6.23%	5.29%
7			8.93%	6.55%	5.90%	4.89%
8			4.46%	6.55%	5.90%	4.52%
9				6.56%	5.91%	4.46%
10				6.55%	5.90%	4.46%
11				3.28%	5.91%	4.46%
12					5.90%	4.46%
13					5.91%	4.46%
14					5.90%	4.46%
15					5.91%	4.46%
16					2.95%	4.46%
17						4.46%
18						4.46%
19						4.46%
20						4.46%
21						2.23%

LECTURE 10

Consider the following 6 investment opportunities:

Project	Required Investment	Annual Savings over 10 years
A	$160	$130
B	$170	$105
C	$180	$140
D	$220	$160
E	$250	$180
F	$260	$200

Projects A and B are mutually exclusive.
Project C is contingent upon Project A.
Projects D and E are also mutually exclusive.
Project F is contingent upon Project D.

a. How many mutually exclusive decision alternatives are in the problem including the do-nothing alternatives? [6 points]

	Project					
Alternative	**A**	**B**	**C**	**D**	**E**	**F**
1	0	0	0	0	0	0
2	1	0	0	0	0	0
3	1	0	1	0	0	0
4	1	0	0	1	0	0
5	1	0	0	1	0	1
6	1	0	0	0	1	0
7	1	0	1	1	0	0
8	1	0	1	1	0	1
9	1	0	1	0	1	0
10	0	1	0	0	0	0
11	0	1	0	1	0	0
12	0	1	0	1	0	1
13	0	1	0	0	1	0
14	0	0	0	1	0	0
15	0	0	0	1	0	1
16	0	0	0	0	1	0

16 alternatives exist as shown above.

b. What is the total required investment for each alternative? [2 points]

	Project						
Alternative	**A**	**B**	**C**	**D**	**E**	**F**	**Required Investment**
1	0	0	0	0	0	0	$0
2	1	0	0	0	0	0	$160
3	1	0	1	0	0	0	$340
4	1	0	0	1	0	0	$380
5	1	0	0	1	0	1	$640
6	1	0	0	0	1	0	$410
7	1	0	1	1	0	0	$560
8	1	0	1	1	0	1	$820
9	1	0	1	0	1	0	$590
10	0	1	0	0	0	0	$170
11	0	1	0	1	0	0	$390
12	0	1	0	1	0	1	$650
13	0	1	0	0	1	0	$420
14	0	0	0	1	0	0	$220
15	0	0	0	1	0	1	$480
16	0	0	0	0	1	0	$250

c. What is the total annual savings for each alternative? [2 points]

	Project						
Alternative	**A**	**B**	**C**	**D**	**E**	**F**	**Annual Savings**
1	0	0	0	0	0	0	$0
2	1	0	0	0	0	0	$130
3	1	0	1	0	0	0	$270
4	1	0	0	1	0	0	$290
5	1	0	0	1	0	1	$490
6	1	0	0	0	1	0	$310
7	1	0	1	1	0	0	$430
8	1	0	1	1	0	1	$630
9	1	0	1	0	1	0	$450
10	0	1	0	0	0	0	$105
11	0	1	0	1	0	0	$265
12	0	1	0	1	0	1	$465
13	0	1	0	0	1	0	$285
14	0	0	0	1	0	0	$160
15	0	0	0	1	0	1	$360
16	0	0	0	0	1	0	$180

LECTURE 10

Pinkman Pharmaceuticals is a new company that will manufacture and deliver generic drugs to residents of Albuquerque, New Mexico. They need to raise $20,000,000 in order to build their new manufacturing plant and distribution center. The Pharmacy Depot's target capital structure calls for a debt ratio of 50%. Therefore, $10,000,000 needs to be financed from equity from the following sources:

Sources	Amount
Retained earnings	$4,000,000
New Common Stock	$4,000,000
Preferred Stock	$2,000,000

The following details the financial data for both the common stock and preferred stock options:

	Common Stock	Preferred Stock
Market Price	$100	$160
Annual Cash Dividend	**$15**	$23
Ann Cash Div Growth Rate	10.5%	-
Issue Price	$90	$140
Flotation Costs	18.00%	**10%**

EOY 1
Market Price

a. Calculate the cost of equity required to finance the new process unit. [10 points]

I **$20,000,000**

Debt Ratio **50%**

			Source	Amount	Fraction	Mkt Price	Dividend	Div Growth	Sale Price	(Mkt Price) Flotation Cost
Equity	**$10,000,000**	**=**	Ret Earnings	$4,000,000	0.4000					
			Common St	$4,000,000	0.4000	$100	$15	10.50%	$90	18.00%
			Preferred St	$2,000,000	0.2000	$160	$23		$140	10%

1. Cost of retained earnings **2.5 points**

$$k_r = \frac{D_1}{P_0} + g \qquad \text{where,}$$

k_r = rate of return required by shareholders; D_1 = first year dividend;

P_0 = market price; g = annual growth rate

D1	$15
P0	$100
g	10.50%
kr	**25.500%**

2. Flotation costs for common stock **2.5 points**

$$k_e = \frac{D_1}{P_0(1 - f_c)} + g \quad \text{where,}$$

k_e = cost of common equity; D_1 = first year dividend;

P_0 = market price; f_c = flotation cost as a percentage of the st

g = annual growth rate

D1	$15
P0	$100
g	11%
fc	18.00%
ke	**28.79%**

3. Flotation costs for preferred stock **2.5 points**

$$k_p = \frac{D^*}{P^*(1 - f_c)} \quad \text{where,}$$

k_p = cost of preferred equity; D^* = fixed annual dividend;

P^* = issuing price; f_c = flotation cost as a percentage of the stock price

D*	$23
P*	$140
fc	10%
kp	**18.25%**

4. Cost of Equity **2.5 points**

$$i_e = \left(\frac{c_r}{c_e}\right)k_r + \left(\frac{c_c}{c_e}\right)k_e + \left(\frac{c_p}{c_e}\right)k_p$$ where,

i_e = weighted average cost of equity for a project;

c_r = amount of equity financed from retained earnir

c_c = amount of equity financed from issuing new st

c_p = amount of equity financed from issuing preferr

k_r = rate of return required by shareholders;

k_e = cost of common equity

k_p = cost of preferred equity;

Note

$c_r + c_c + c_p = c_e$

cr	$4,000,000
cc	$4,000,000
cp	$2,000,000
ce	$10,000,000
cr/ce	0.4000
cc/ce	0.4000
cp/ce	0.2000
kr	25.50%
ke	28.79%
kp	18.25%
ie	**25.37%**

LECTURE 11

Embraer Aircrafts needs to raise $24,000,000 in order to build a new training facility for their employees.
The following table lists 4 critical input variables for the financial analysis and the associated limits of uncertainty:

Embraer Aircrafts needs to raise $24,000,000 in order to build a new training facility for their employees.The following table lists 4 critical input variables for the financial analysis and the associated limits of uncertainty:

Input	Lower Limit	Base Case	Upper Limit
Building Cost	**90%**	**$10,000,000**	**110%**
Equipment Cost	**85%**	**$8,000,000**	**120%**
Annual Revenue	**90%**	**$16,000,000**	**115%**
Annual O&M Costs	**80%**	**$6,000,000**	**120%**

With a MARR of 8% and a project life of 5 years, perform a sensitivity analysis on the data using PW as the figure of merit assessed.
a. Present the data in tabular format as shown in the lecture. [6 points]
b. Present the data in a spiderplot format. [3 points]
c. Which input has the biggest impact on the PW? [1 point]

MARR	**7%**
N	**4**

a. Present the data in tabular format as shown in the lecture. [6 points]

MARR	7%
N	4
(P/F, i, N)	0.7629
(P/A, i, N)	3.3872

INPUT VALUES

Input	Lower Limit	Base Case	Upper Limit	
Building Cost	90%	$9,000,000	$10,000,000	$11,000,000	110%
Equipment Cost	85%	$6,800,000	$8,000,000	$9,600,000	120%
Annual Revenue	90%	$14,400,000	$16,000,000	$18,400,000	115%
Annual O&M Costs	80%	$4,800,000	$6,000,000	$7,200,000	120%

PRESENT WORTH

Input	Lower Limit	Base Case	Upper Limit	
Building Cost	90%	$16,872,113	$15,872,113	$14,872,113	110%
Equipment Cost	85%	$17,072,113	$15,872,113	$14,272,113	120%
Annual Revenue	90%	$10,452,575	$15,872,113	$24,001,420	115%
Annual O&M Costs	80%	$19,936,766	$15,872,113	$11,807,459	120%

INPUT VALUES (FULL RANGE FOR SPIDER PLOT)

Input	Lower Range	Base Case	Upper Range	
Building Cost	90%	$9,000,000	$10,000,000	$11,000,000	110%
Building Cost	85%	$8,500,000	$10,000,000	$11,500,000	115%
Building Cost	90%	$9,000,000	$10,000,000	$11,000,000	110%
Equipment Cost	85%	$6,800,000	$8,000,000	$9,600,000	120%
Equipment Cost	90%	$7,200,000	$8,000,000	$8,800,000	110%
Annual Revenue	85%	$13,600,000	$16,000,000	$18,400,000	115%
Annual Revenue	90%	$14,400,000	$16,000,000	$17,600,000	110%
Annual O&M Costs	80%	$4,800,000	$6,000,000	$6,900,000	115%
Annual O&M Costs	90%	$5,400,000	$6,000,000	$7,200,000	120%

PRESENT WORTH (FULL RANGE FOR SPIDER PLOT)

Input	Lower Range	Base Case	Upper Range	
Building Cost	90%	$16,872,113	$15,872,113	$14,872,113	110%
Building Cost	85%	$17,372,113	$15,872,113	$14,372,113	115%
Building Cost	90%	$16,872,113	$15,872,113	$14,872,113	110%
Equipment Cost	85%	$17,072,113	$15,872,113	$14,272,113	120%
Equipment Cost	90%	$16,672,113	$15,872,113	$15,072,113	110%
Annual Revenue	85%	$7,742,806	$15,872,113	$24,001,420	115%
Annual Revenue	90%	$10,452,575	$15,872,113	$21,291,651	110%
Annual O&M Costs	80%	$19,936,766	$15,872,113	$12,823,622	115%
Annual O&M Costs	90%	$17,904,439	$15,872,113	$11,807,459	120%

		Building Cost			Equipment Cost			Annual Revenue			Annual O&M		
% of Base	% Deviation	PW	% Change PW	Ratio	PW	% Change PW	Ratio	PW	% Change PW	Ratio	PW	% Change PW	Ratio
80%	-20.00%				-	-	-	-	-	-	$19,936,766	25.61%	1.28
85%	-15.00%				$17,072,113	7.56%	0.50	$7,742,806	-51.22%	3.41			
90%	-10.00%	$16,872,113	6.30%	0.63	$16,672,113	5.04%	0.50	$10,452,575	-34.15%	3.41	$17,904,439	12.80%	1.28
100%	0.00%	$15,872,113	0.00%	-	$15,872,113	0.00%	-	$15,872,113	0.00%		$15,872,113		
110%	10.00%	$14,872,113	-6.30%	0.63	$15,072,113	-5.04%	0.50						
115%	15.00%	$14,372,113	-9.45%	0.63	-			$24,001,420	51.22%	3.41	$12,823,622	-19.21%	1.28
120%	20.00%				$14,272,113	-10.08%	0.50	-	-	-	$11,807,459	-25.61%	1.28

b. Present the data in a spiderplot format. [3 points]

	PRESENT WORTH			
% of Base	**Building Cost**	**Equipment Cos**	**Annual Revenue**	**Annual O&M**
80%	$0	-		$19,936,766
85%	$0	$17,072,113	$7,742,806	$0
90%	$16,872,113	$16,672,113	$10,452,575	$17,904,439
100%	$15,872,113	$15,872,113	$15,872,113	$15,872,113
110%	$14,872,113	$15,072,113	$0	$0
115%	$14,372,113	-	$24,001,420	$12,823,622
120%	$0	$14,272,113	-	$11,807,459