Assignment-1

1. Given 12% MARR

$$NPV_S = P_0 + P_1 + P_2 + P_3 + P_4$$

$$= P_0 + \frac{F_1}{(1+i)^1} + \frac{F_2}{(1+i)^2} + \frac{F_3}{(1+i)^3} + \frac{F_4}{(1+i)^4}$$

$$= -8000 + \frac{4000}{(1+.12)^1} + \frac{2500}{(1+.12)^2} + \frac{3000}{(1+.12)^3} + \frac{500}{(1+.12)^4}$$

$$= 17.51 > 0$$

$$NPV_L = P_0 + P_1 + P_2 + P_3 + P_4$$

$$= P_0 + \frac{F_1}{(1+i)^1} + \frac{F_2}{(1+i)^2} + \frac{F_3}{(1+i)^3} + \frac{F_4}{(1+i)^4}$$

$$= -7000 + \frac{3000}{(1+.12)^1} + \frac{2000}{(1+.12)^2} + \frac{2000}{(1+.12)^3} + \frac{2000}{(1+.12)^4}$$

$= -32.44 < 0$, so it can't be selected.

Projects are independent and $NPV_S > 0$, so Project S is selected.

Problem-2:

Project-P

$r = 15\%$

	0	1	2	3	4	5
Cash:	7000	3000	2000	1010	750	1500
B :	0	3500	4607	3787	2600	1500

$NPV_e = P_0 + P_1 + P_2 + P_3 + P_4 + P_4$

$= 7000 + \frac{3000}{(1.15)^1} + \frac{2000}{(1.15)^2} + \frac{1010}{(1.15)^3} + \frac{750}{(1.15)^4} + \frac{1500}{(1.15)^5}$

$= 7000 + 2608.695 + 1512.28 + 664.09 + 428.81 + 745.76$

$= 12959.65$

$NPV_B = P_0 + P_1 + P_2 + P_3 + P_4 + P_5$

$= 0 + \frac{3500}{(1.15)^1} + \frac{4607}{(1.15)^2} + \frac{3787}{(1.15)^3} + \frac{2600}{(1.15)^4} + \frac{1500}{(1.15)^5}$

$= 11249.36$

Benefit cost ratio $= \frac{11249.36}{12959.65}$

$= 0.868 < 1$

Project-Q

	0	1	2	3	4	5
B:	0	5000	4000	2500	2200	1800
C:	6000	1500	1700	2000	4000	1500

$NPV_B = P_0 + P_1 + P_2 + P_3 + P_4 + P_5$

$= 11168.97$

Ben

$$NPV_c = P_0 + P_1 + P_2 + P_3 + P_4 + P_5$$

$$= 12937.60$$

$$\text{Benefit cost ratio} = \frac{11168.97}{12937.60}$$

$$= 0.863 < 1$$

Both project are independent. but both project benefit-cost ratio < 1. so both project are not selected.

3.

$$\text{Benefit}_N = P_0 + P_1 + P_2 + P_3 + P_4 + P_5$$

$$= P_0 + \frac{F_1}{(1+i)^1} + \frac{F_2}{(1+i)^2} + \frac{F_3}{(1+i)^3} + \frac{F_4}{(1+i)^4} + \frac{F_5}{(1+i)^5}$$

$$= 0 + \frac{10000}{(1.03)^1} + \frac{12000}{(1.03)^2} + \frac{5000}{(1.03)^3} + \frac{2500}{(1.03)^4} + \frac{0}{(1.03)^5}$$

$$= 26784.11$$

$$\text{Cost}_N = P_0 + P_1 + P_2 + P_3 + P_4 + P_5$$

$$= P_0 + \frac{F_1}{(1+i)^1} + \frac{F_2}{(1+i)^2} + \frac{F_3}{(1+i)^3} + \frac{F_4}{(1+i)^4} + \frac{F_5}{(1+i)^5}$$

$$= 15000 + \frac{3000}{(1.03)^1} + \frac{2000}{(1.03)^2} + \frac{1010}{(1.03)^3} + \frac{1500}{(1.03)^4} + \frac{2000}{(1.03)^5}$$

$$= 23344.78$$

$$NPV_N = \text{Benefit} - \text{Cost}$$

$$= 26784.11 - 23344.78$$

$$= 3439.32470$$

[Because Benefit is the (+) value positive cashflow and cost is the (−) negative cashflow]

$\boxed{\text{Tips: } \uparrow \text{ no need to write this}}$

Now,

$$\text{Benefit}_R = 0 + \frac{6000}{(1.03)^1} + \frac{5000}{(1.03)^2} + \frac{1500}{(1.03)^3} + \frac{2200}{(1.03)^4} + \frac{1800}{(1.03)^5}$$

$$= 14765.48$$

$$\text{Cost}_R = 6000 + \frac{1500}{(1.03)^1} + \frac{1700}{(1.03)^2} + \frac{2000}{(1.03)^3} + \frac{4000}{(1.03)^4} + \frac{1500}{(1.03)^5}$$

$$= 15164.3 \cancel{70}$$

So, $NPV_R = \text{Benefit}_R - \text{Cost}_R$

$$= 14765.48 - 15164.3$$

$$= -398.814 < 0$$

Projects are mutually exclusive and only NPV of Project N has positive value. So project N will be selected.

4. Return rate 20% given.

In Irr method, NPV will be 0 for irr%.

for Project N.

$$NPV = P_0 + P_1 + P_2 + P_3 + P_4 + P_5$$

$$\Rightarrow 0 = P_0 + \frac{F_1}{(1+i)^1} + \frac{F_2}{(1+i)^2} + \frac{F_3}{(1+i)^3} + \frac{F_4}{(1+i)^4} + \frac{F_5}{(1+i)^5}$$

$$\Rightarrow 0 = -4000 + \frac{2000}{(1+i)^1} + \frac{1500}{(1+i)^2} + \frac{1000}{(1+i)^3} + \frac{2042}{(1+i)^4} + \frac{1500}{(1+i)^5}$$

let $1+i = x$

Then,

$$0 = -4000 + \frac{2000}{x} + \frac{1500}{x^2} + \frac{1000}{x^3} + \frac{2042}{x^4} + \frac{1500}{x^5}$$

$$\Rightarrow -4000x^5 + 2000x^4 + 1500x^3 + 1000x^2 + 2042x + 1500 = 0 \quad \text{——— (1)}$$

if $x = 1.2$ we get from eq^n (1) $\longrightarrow$ 2176.31

$x = 1.3$ " " " (1) $\longrightarrow$ 0.58 (very close to 0)

so, $x = 1.3$

$\Rightarrow 1+i = 1.3$

$\Rightarrow i = .3$

$= 30\% > $ ~~MA~~RR (Return Rate)

Now, Project M.

$$NPV = P_0 + P_1 + P_2 + P_3 + P_4 + P_5$$

$$\Rightarrow 0 = P_0 + \frac{F_1}{(1+i)^1} + \frac{F_2}{(1+i)^2} + \frac{F_3}{(1+i)^3} + \frac{F_4}{(1+i)^4} + \frac{F_5}{(1+i)^5}$$

$$\Rightarrow 0 = -5000 + \frac{2500}{(1+i)} + \frac{1200}{(1+i)^2} + \frac{1500}{(1+i)^3} + \frac{2000}{(1+i)^4} + \frac{1200}{(1+i)^5}$$

$$\Rightarrow -5000x^5 + 2500x^4 + 1200x^3 + 1500x^2 + 2000x + 1200 = 0 \quad \text{——(2)}$$

if $x = 1.2$, we get from eq^n(2) $\longrightarrow$ 576

$x = 1.3$ " " " " " $\longrightarrow$ -2453

$x = 1.25$ " $\longrightarrow$ -767.7

$x = 1.23$ $\longrightarrow$ -191.92

$x = 1.21$ $\longrightarrow$ 332.28

0.02   524.25 (taking difference value only)

for 524.25 differce we get 0.02

so for 332.28 " " $\dfrac{0.02 \times 332.28}{524.25}$

$= 0.0126$

so $x = 1.21 + 0.0126$

$1+i = 1.2226 \Rightarrow i = 0.2226$

$\Rightarrow i = 22.26\% >$ ~~M~~RR (Return Rate)

As the projects are independent and both projects IRR% is greater than given Return rate 20%, both Projects can be selected.

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5. MARR 20%

pay back period need to be less than 4 years.

Project A:

Year	0	1	2	3	4	5
Cash Flow	-7000	4000	2500	3000	500	
Discounted cash Flow	-7000	3333.33	1736.11	1736.11	241.12	
Cumulative Discounted cash flow	-7000	3666.67	-1930.56	-194.45	46.67	

$$\text{Pay Back period} = 3 + \frac{194.45}{241.12} = 3.80 \text{ years.}$$

[Formula: Pay Back period

$$= \text{~~Last~~ year befor full recover} + \frac{\text{Last unrecovered di cumulative discounted cash Flow}}{\text{Discounted cashflow of full recovery year}}$$]

Project B:

Year	0	1	2	3	4
Cash Flow	-7000	4500	2000	1700	2000
Discounted cash Flow	-7000	3750	1388.88	983.79	964.51
Cumulative Discounted cash Flow	-7000	-3250	-1861.12	-877.33	87.176.

$$\text{Pay Back period} = 3 + \frac{877.33}{964.51} = 3.90 \text{ years.}$$

Both projects pay Back period is less than 4. But projects are mutually exclusive, so Projects A with less payback period time will be selected.

If the projects are independent, both projects can be selected because both projects have pay back period less than 4. So my answer will be changed.

For NVP:

$NVP_A = P_0 + P_1 + P_2 + P_3 + P_4 = 46.67 > 0$

$NVP_B = P_0 + P_1 + P_2 + P_3 + P_4 = 87.176 > 0.$

Both project have NVP greater than 0. So If projects are independent, both can be selected. But if mutually exclusive, project B with higher positive value will be selected.

For IRR

$$NPVA = -7000 + \frac{4000}{(1+i)} + \frac{2500}{(1+i)^2} + \frac{3000}{(1+i)^3} + \frac{500}{(1+i)^4}$$

let $1+i = x$

$$\Rightarrow -7000x^4 + 4000x^3 + 2500x^2 + 3000x + 500 = 0 \quad \text{——— (1)}$$

let, $x = 1.2$, we get from eq^n (1) $\longrightarrow$ 96.8

$x = 1.3$ " " " (1) $\longrightarrow$ -2579.7

$x = 1.22$ " " " (1) $\Longrightarrow$ -362.95

$x = 1.21$ " " " (1) $\longrightarrow$ -128.63

Now, taking difference between $x = 1.20$ and 1.21 we get that.

225.43 difference for 0.01

128.63 " " $\dfrac{0.01 \times 128.63}{225.43} = 0.0057$

value of x is less than 1.21 so this portion will be reduced from 1.21

so, $x = 1.21 - 0.0057$

$\Rightarrow 1+i = 1.2043$.

$\Rightarrow i = .2043 = 20.43\% > 20\%$

$$NVP_B = -7000 + \frac{4500}{(1+i)^1} + \frac{2000}{(1+i)^2} + \frac{1700}{(1+i)^3} + \frac{2000}{(1+i)^4}$$

$$\Rightarrow 0 = -7000 + \frac{4500}{x} + \frac{2000}{x^2} + \frac{1700}{x^3} + \frac{2000}{x^4}$$

$$\Rightarrow -7000x^4 + 4500x^3 + 2000x^2 + 1700x + 2000 = 0 \longrightarrow (2)$$

let $x = 1.2$ and we get from equation (2) $\longrightarrow$ 180.8

$x = 1.25$ " " " " $\longrightarrow$ -1050.78.

$x = 1.21$ " " " " $\longrightarrow$ -47.89

so value of x is between $x = 1.20$ and $x = 1.21$
and taking their differnce we get,

228.69 difference for 0.01

47.89 " " $\frac{0.01 \times 47.89}{228.69} = .002094$

$so, x = 1.21 - .002094$

$1+i = 1.2079$

$\Rightarrow i = .2079 = 20.79\% > 20.$

Both project have IRR > 20%.
If the projects are independent, both can be selected. If both projects are mutually exclusive only project B with higher IRR will be selected.