AW (~~Actual~~ Annual Worth)

• PW → Present Worth
• FW → Future Worth

Life	4 years Tech 1	12 years Tech 2
(PW) Initial cost	15,000	20,000
Annual operation and maintenance cost	6,000	9,000
~~Refreshment~~ (F) Refurbishment cost	0	2,000 (Every 4 years)
(FW) Trade in Value (% P.W)	20%	40%

MARR = 8%

F.W: 4th yr $\xrightarrow{}$ 2000, 8th yr $\xrightarrow{}$ 2000, ~~12th yr~~ → not required

Tech 1

$$\underbrace{(\text{AW of } 15000)}_{4528.81} + 6000 - \underbrace{(\text{AW of } 0.2 \times 15000)}_{905.76 \text{ Trade in Value}}$$

$= 9623.05$ (Ans)

~~2016.7346~~

Initial Cost: $P(1+i)^n = A\left[\frac{(1+i)^n - 1}{i}\right]$

$\Rightarrow \cancel{18,000}$

$\Rightarrow \cancel{15000(6/5)^4 = A\left[\frac{5^4 - 1}{4}\right]}$

$$\Rightarrow 15000(1+0.08)^4 = A\left[\frac{(1+0.08)^4 - 1}{0.08}\right]$$

$\Rightarrow A = 4528.81$

Trade in Value (A) → $0.2 \times 15000(1+0.08)^4 = A\left[\frac{(1+i)^n - 1}{i}\right]$ → Solve A → 905.76

Tech 2

AW of 20,000 + 9000 + 2000 [find PW for 4 years $(1+i)^{-4}$

+ PW for 8 yrs $(1+i)^{-8}$]

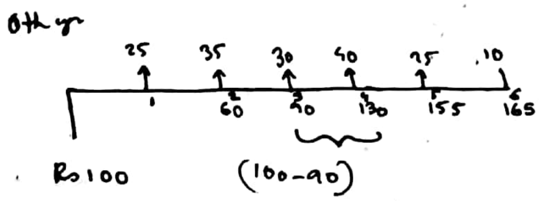
× AW of it for 12 yrs

− AW of 0.4 × 20,000

= 11,571

Pay back Period

If rate of interest is given → (discounted) Pay back period



(100−90)

$$3\text{ yrs} + \left(\frac{10}{40} \times 12 \text{ months}\right)$$

~~CF 25 35 30 40 25 10~~

Cash Flow CF	Cumulative CF
25	25
35	60
30	90
40	130
25	155

1. Suppose a machine requires an initial investment of Rs 25,000 against the returns of Rs 10,000, 8000, 6000, 4000, 2000 upto next 5 yrs respectively. ~~St~~ Find the ~~fast~~ payback period. 3yrs 3 months (Ans)

	CF	Cumulative Cash Flow
1	10,000	10,000
2	8000	18,000
3	6000	24,000
4	4000	28,000
5	2000	30,000

$$\therefore 3\text{ yrs} + \left(\frac{(25000-24000)}{(28000-24000)} \times 12 \text{ months}\right)$$

$$\cancel{3 + \left(\frac{1000}{4000} \times 12 \text{ months}\right) = 3 \text{ yrs } 3 \text{ months.}}$$

$$= 3\text{ yrs} + \frac{1000}{4000} \times 12 \text{ months}$$

$$= 3 \text{ yrs } 3 \text{ months (Ans)}$$

2.

yr	CF	PV CF	Cumulative CF
0	-1,00,000	~~100000~~	
1	$20,000 \xrightarrow{x} (1+i)^{-1}$	17857.14286	17857.14286
2	$30,000 \xrightarrow{x} (1+i)^{-2}$	23915.816	41772.95886
3	$40,000 \xrightarrow{x} (1+i)^{-3}$	28471.21	70244.16886
4	$50,000 \xrightarrow{x} (1+i)^{-4}$	31775.90	102020.0689
5	30,000	17022.81	119042.8746

$i = 12\%$

$$\cancel{\therefore P = 20,000 \times \left[\frac{(1+0.12)^{n}-1}{0.12}\right] \times \frac{1}{(1+0.12)^{n}}}$$

$$= ?$$

$$\left[\frac{(100000-70244.16886)}{(102020.0689-70244.16886)} \times 12\right]$$

$\therefore$ payback period

$$3\text{yrs} + \left(\frac{29755.83}{31775.90} \times 12 \text{ months}\right)$$

$$= 3.93 \text{ (Ans)}$$

3.

$i = 14\%$

Project	Cash ~~Outflow~~ Outflow (PW)	Annual Inflow (AW) → Convert to PW	Life
A	3 lacs	1,10,000	5
B	2.5	56,000	7
C	5	1,00,000	10
D	4	90,000	12
E	1.5	30,000	8

~~1.259~~

Find Benefit Cost Ratio (BCR) or the Profitability Index (PI).

$$\Rightarrow \frac{\text{PW of inflow}}{\text{PW of outflow}}$$

• A project will be selected if BCR > 1.

$$\boxed{P(1+i)^n = A\left[\frac{(1+i)^n - 1}{i}\right]}$$

Ans.

~~P / 18 68/0.3~~

A
1.259

B
0.961

C
1.043

D
1.274

E
0.928

Project A

$$\therefore \text{PW of inflow} = 110000\left[\frac{(1+0.14)^5 - 1}{0.14}\right] \times \frac{1}{(1+0.14)^5}$$

$$= 377638.91$$

$$\therefore \text{BCR} = \frac{377638.91}{300000}$$

$$= 1.259 \text{ (Ans)}$$

B

$$\therefore \text{PW of inflow} = 240145.071$$

$$\therefore \text{BCR} = \frac{240145.071}{250000}$$

$$= 0.961 \text{ (Ans)}$$

C

$\therefore$ PW of inflow = 521611.50646

$$\therefore BCR = \frac{521611.50646}{500000}$$

$$= 1.043 \text{ (Ans)}$$

D

$\therefore$ PW of inflow = 509426.2913

$$\therefore BCR = \frac{509426.2913}{400000}$$

$$= 1.274 \text{ (Ans)}$$

E

$\therefore$ PW of inflow = 139165.9168

$$\therefore BCR = \frac{139165.9168}{150000}$$

$$= 0.928 \text{ (Ans)}$$

11.

Yrs	A	B
1	–	60,000
2	30,000	84,000
3	1,32,000	96,000
4	84,000	1,02,000
5	88,000	90,000

Initial outlet is 135000 and 240000 respectively for the machine A and machine B, and no scrab values at the end.

The rate of interest is 16% per annum.

Find the net present values (58,254, 34812), benefit (1.43, 1.15), cost alternative and ~~discounted~~ discounted payback period.

A → 3.61

B → 4.19

Yr	A	B	(Discounting factor) Disfactor	PV_A	PV_B	Cumulative PV_A	Cumulative PV_B
1	–	60,000	$(1+i)^{-1} \to 0.862$	–	51720	–	51720
2	30,000	84,000	$(1+i)^{-2} \to 0.743$	22290	62412		
3	1,32,000	96,000	0.641	84612	61536		
4	84,000	1,02,000	0.552	46368	56304		
5	88,000	90,000	0.476	41888	42840	195158	274812
						− 135000	−240000
						60158	34812

$\underbrace{\quad 60158 \qquad 34812 \quad}_{\text{Net present values}}$

IRR → Internal Rate of Return

NPV = $\sum$ PV inflows − $\sum$ PV outflows

2.

yr	Cash flow
0	−1 lac
1	30k
2	30k
3	30k
4	30k
5	30k

• Find IRR.

$$P(1+i)^n = A\left[\frac{(1+i)^n-1}{i}\right]$$

$\therefore$ NPV = $\sum$ PV inflows − $\sum$ PV outflows

$$\Rightarrow 0 = 30{,}000\left[\frac{(1+i)^n-1}{(1+i)^n i}\right] - 1{,}000{,}000$$

$$\Rightarrow 0 = \left[\frac{(1+i)^n-1}{(1+i)^n i}\right] - 3.33$$

$$\Rightarrow \frac{(1+i)^n-1}{(1+i)^n i} = 3.33$$

$$\downarrow$$

$(P/A, i\%, n)$

564.65

−6184.87

−1771.19.

0.15

• Find i in the range i = 15%, 18%.

$\therefore$ for 15% → 564.65, for 18% → −6184.87

$$\therefore IRR = i_L + \frac{NPV_L}{NPV_L - NPV_H} \times (i_H - i_L)$$

Use →

$$NPV = 3000\left[\frac{(1+0.15)^5-1}{(1+0.15)^5 0.15}\right] - 100000$$

$= 0.1525$

$= 15.25\%$

- Distinguish between Net Present Value (NPV) and the internal rate of return (IRR). 2)

Both the methods NPV and IRR are very useful so as to evaluate a cross difference alternative, however there also lies a few points of distinction between the two methods —

1) NPV is known as the difference between the summation of the present value of all the cash inflows and present values of ~~to~~ all the cash outflows.

$$NPV = \sum_{i=1}^{n} CF_1 - \sum_{i=1}^{n} CF_0$$

where CF_1 indicates the inflows and CF_0 indicates the outflows.

Similarly ~~internal~~ IRR is that specific rate ~~of interest~~ at which NPV = 0.

In this case IRR ~~it~~ will be calculated by

$$IRR = i_L + \frac{NPV_L}{NPV_L - NPV_H} \times (i_H - i_L)$$

where i_L and i_H are the lower and the higher rate of interest respectively and NPV_L and NPV_H are the NPVs calculated on the basis of lower and higher rate of interests.

2) Under the NPV method, the present values are calculated after discounting the ~~fut~~ future cash flows at a specified or pre-determined discounting rate.

On the other hand side, IRR is calculated by a trial and error method which is used to find the present values of the cash inflows and the cash outflows.

3) Under the NPV method, only the positive values are selected.

On the other hand side, in case of IRR where the rate of interest is greater than the cost of capital will only be selected.

4) While ranking two or more number of the projects, NPV is a bit more realistic method than the IRR.

5) The NPV method is also quite realistic because the re-investment of the cash flows are possible which is not the case for IRR.