Ex. 2.3.1

Calculating NPV and BCR Calculate the NPV and BCR of a project with a life span of 5 years and a real discount rate of 8%.

☑ **Soln. :**

$$\text{Discount Factor} = \frac{1}{(1+r)^t}$$

Where:

r = real discount rate

t = the year of the project

For e.g.: the discount factor for the second year will be calculated as:

$$\frac{1}{(1+0.08)^2} = 0.857$$

Table P. 2.3.1

Year	Cost (lakhs)	Benefit (lakhs)	Discount Factor (8%)	NPV of Costs = Costs × Discount Factor	NPV of Benefits = Benefits × Discount Factor
1	50	0	0.926	46.3	0
2	40	30	0.857	34.28	25.71
3	30	40	0.794	23.82	31.76
4	20	60	0.735	14.7	44.1
5	10	90	0.681	6.81	61.29
Total				125.91	162.86

Hence, the project is expected to generate a net benefit = NPV of Benefits – NPV of Costs

= 162.86 – 125.91 = 36.91

BCR Ratio can be represented as follows:

BCR = NPV of Benefits/ NPV of Costs

= 162.86/ 125.91 = 1.29

A ratio greater than 1 indicates that the project will generate profits.

Ex. 2.3.2

A company is thinking about investing Rs. 10 lakhs in a new project. According to budget analysis the company will generate the following cash flows. The rate of interest is 12% should the company invest in the new project ?

Table P. 2.3.2

Year	Cash flow in Rs.
1	2 lakhs
2	6 lakhs
3	8 lakhs
4	2 lakhs

☑ **Soln. :**

Initial investment = 10,00,000

i = 12 %

NPV method calculation

$$\text{NPV} = \sum_{t=1}^{n} \frac{C}{1+K^t} - \text{Initial investment}$$

$$= \left[\frac{2,00,000}{(1+0.12)^1} + \frac{6,00,000}{(1+0.12)^2} + \frac{8,00,000}{(1+0.12)^3} + \frac{2,00,000}{(1+0.12)^4} \right] - 10,00,000$$

= [178571.42 + 478316.32 + 569424.19 + 127103.61]

– 1000000 = 353415.54 Rs.

∴ NPV > 0, company should invest in new project.

Ex. 2.3.3

Excel Constructions wants to buy a mixer with a cost of Rs. 35,000 and annual cash savings of Rs. 11,000 for each of 5 years. The cost of capital is 12%.

☑ **Soln. :**

With uniform cash flows, the present value (PV) is computed using the present value of and annuity of 5 payments of Rs. 11,000 each at 12 percent, the NPV is calculated as follows:

PV of Cash inflows = 11,000 (PV 1 – 5 years @ 12%)

= Rs. 39,634

Less : Present Value of Cash outflows 35,0000

Net present value of the project 4634

Since NPV is positive the project is acceptable since the net value of earnings exceed by Rs. 4634 the amount paid for the use of the funds to finance the investment.

Ex. 2.3.4

The cost of a project is Rs 100000/- and has regular cash flows of Rs 25000/- for a period of 5 years. What is the NPV if the firm expects 12% per annum? Is the project financially feasible?

☑ **Soln. :**

$$NPV = \sum_{t=1}^{n} = \frac{B_t}{(1+r)^t} - \text{Initial investment}$$

Where

B_t = Benefit at time t

h = Life of project

r = discount rate

t = year

$$= \frac{25,000}{(1+0.12)^1} + \frac{25,000}{(1+0.12)^2} + \frac{25,000}{(1+0.12)^3} + \frac{25,000}{(1+0.12)^4} + \frac{25,000}{(1+0.12)^5} - 11,00,000$$

$$= 22,321 + 19,936 + 17857 + 15,923 + 14,204 - 1,00,000$$

$$= 90,241 - 1,00,000 = -9759$$

As NPV < 0 the project is not acceptable

Ex. 2.3.5

Excel construction has the resources to implement one of the two projects that has been offered to it. Using NPV suggest the one project the company should accept. The firm expects returns of 12 % per announce

☑ **Soln. :**

Table P. 2.3.5

	Project A	Project B
Estimated cost	3,00,000	4,00,000
Estimated life	5	5
Annual benefits		
1	1,25,000	1,50,000
2	1,50,000	1,70,000
3	1,00,000	1,25,000
4	90,000	1,00,000
5	80,000	90,000

$$NPV = \sum_{t=1}^{n} = \frac{B_t}{(1+r)^t} - \text{Initial investment}$$

Project A

$$NPV = \frac{1,25,000}{(1+0.12)^1} + \frac{1,50,000}{(1+0.12)^2} + \frac{1,00,000}{(1+0.12)^3} + \frac{90,000}{(1+0.12)^4} + \frac{80,000}{(1+0.12)^5} - 3,00,000$$

$$= 111607 + 1,19,617 + 71,428 + 57334 + 45454 - 3,00,000$$

$$= 4,05,430 - 3,00,000 = 1,05,430$$

Project B

$$NPV = \frac{1,50,000}{(1+0.12)^1} + \frac{1,70,000}{(1+0.12)^2} + \frac{1,25,000}{(1+0.12)^3} + \frac{1,00,000}{(1+0.12)^4} + \frac{90,000}{(1+0.12)^5} - 4,00,000$$

$$= 1,33,928 + 1,35,566 + 89285 + 63694 + 51136$$

$$= 4,73,609 - 4,00,000$$

$$= 73,609$$

Although both the projects have a positive NPV or NPV > 0 they both are feasible. However, as the firm has resources for only one project, Project A should be selected as it has a better NPV.

The Net Present Value relies on the time value of money and the timings of cash flows in evaluating projects. All cash flows are discounted at the cost of capital and NPV assumes that all cash inflows from projects are re-invested at the cost of capital.

As a decision criterion, this method can be used to make a choice between mutually exclusive projects. The project with the highest NPV would be assigned the first rank, followed by others in the descending order.

Ex. 2.3.6

Following data pertains to two projects. Rank the projects based on B/C ratio and NPV value.

Table P. 2.3.6

Particulars	Project X	Project Y
Investment in Rs.	110000	110000
Cash inflow in Rs Year 1	31000	71000
Year 2	40000	40000
Year 3	50000	40000
Year 4	70000	20000
Interest Rate (%)	14	14

☑ **Soln. :**

Calculation of benefit cost ratio

Project X

$$BCR = \frac{\frac{31,000}{(1+0.14)^1} + \frac{40,000}{(1+0.14)^2} + \frac{50,000}{(1+0.14)^3} + \frac{70,000}{(1+0.14)^4}}{1,10,000}$$

$$= \frac{27192.98 + 30778.70 + 33748.57 + 41445.61}{1,\ 10,000}$$

$$= 1.21$$

Project Y

$$BCR = \frac{\frac{71,000}{(1+0.14)^1} + \frac{40,000}{(1+0.14)^2} + \frac{40,000}{(1+0.14)^3} + \frac{20,000}{(1+0.14)^4}}{1,10,000}$$

$$= \frac{62280.70 + 30778.70 + 26998.88 + 11841.60}{1,\ 10,000}$$

$$= 1.199$$

Thus, project X has Rank I and project Y has Rank II

Calculation of net present value

Project X

$$NPV = \sum_{t=1}^{n} \frac{C}{1+K^t} - \text{Initial investment}$$

$$= 1,33,665 - 1,10,000 = 23,165$$

Project X = Rank I

Project Y

NPV = 1,31,899 – 1,10,000 = 21,899.88

Project Y = Rank II

Ex. 2.3.7

Following are the details of project A and B. Suggest which one is to be accepted by using

1. NPV 2. BCR (i = 8%)

Table P. 2.3.7

Years	Project A	Project B
0	4,00,000	4,50,000
1	1,20,000	1,40,000
2	1,25,000	1,45,000
3	78,000	76,000
4	80,000	65,000
5	75,000	60,000
6	–	90,000

☑ **Soln. :**

Calculation of net present value

Project A

$$NPV = \frac{12,000}{(1+0.8)^1} + \frac{1,25,000}{(1+0.8)^2} + \frac{78,000}{(1+0.8)^3} + \frac{80,000}{(1+0.8)^4} + \frac{75,000}{(1+0.8)^5} - 4,00,000$$

$$= -9956.5 \text{ Rs.}$$

Project B

$$NPV = \frac{140{,}000}{(1+0.8)^1} + \frac{145{,}000}{(1+0.8)^2} + \frac{70{,}000}{(1+0.8)^3} + \frac{65{,}000}{(1+0.8)^4} + \frac{60{,}000}{(1+0.8)^5} + \frac{90{,}000}{(1+0.8)^6} - 4{,}50{,}000$$

$$= 9602 \text{ Rs.}$$

Thus, project B is to be selected.

Calculation of benefit lost ratio

Project A $BCR = \frac{390044}{4{,}00{,}000} = 0.975$

Project B : $BCR = \frac{459602}{4{,}50{,}000} = 1.02$

Thus, project B is to be selected.

Ex. 2.3.8

Following data pertains to project A and B has a net cash flow as follows.

Which project is to be selected by using NPV and B/C ratio method ? Consider rate of interest $i = 10\%$.

Table P. 2.3.8

Proposal	End of years				
	Initial Investment	Annual Income (Rs.)			
		1	2	3	4
A	1,00,000	32,000	76,000	34,000	28,000
B	1,00,000	30,500	25,000	45,000	80,000

☑ **Soln. :**

Calculation of net present value method

Project A

$$NPV = \frac{32{,}000}{(1+0.1)^1} + \frac{76{,}000}{(1+0.1)^2} + \frac{34{,}000}{(1+0.1)^3} + \frac{28{,}000}{(1+0.1)^4} - 1{,}80{,}000$$

$$= [29090.90 + 62809.91 + 25563.90 + 19178.08] - 1{,}00{,}000$$

$$= 36642.79$$

Project B

$$NPV = \frac{30500}{(1+0.1)^1} + \frac{25{,}000}{(1+0.1)^2} + \frac{45{,}000}{(1+0.1)^3} + \frac{80{,}000}{(1+0.1)^4} - 1{,}00{,}000$$

$$= [27727.27 + 20661.15 + 33834.58 + 54794.52] - 1{,}00{,}000$$

$$= 37017.52$$

Calculation of benefit cost ratio method

Project A

$$BCR = \frac{136642.79}{1{,}00{,}000} = 1.366$$

Project B

$$BCR = \frac{137017.52}{1{,}00{,}000} = 1.37$$

Thus project B is selected by both methods.

Ex. 2.3.9

The data pertaining to project A and B given bellow.

Suggest which one is to be accepted using NPV method. Company expects a return of 10%.

Table P. 2.3.9

Project	Initial Investment (Rs.)	Annual Benefits (Rs.)		
		1st Year	2nd Year	3rd Year
A	50,000	35,000	15,000	18,000
B	40,000	23,400	20,600	11,000

☑ **Soln. :**

Calculation of NPV method

Project A

$$NPV = \left[\frac{35{,}000}{(1+0.1)^1} + \frac{15{,}000}{(1+0.1)^2} + \frac{18{,}000}{(1+0.1)^3}\right] - 50{,}000$$

$$= [31818.18 + 12396.69 + 13533.83] - 50{,}000$$

$$= 7748.70$$

Project B

$$NPV = \left[\frac{23{,}400}{(1+0.1)^1} + \frac{20{,}600}{(1+0.1)^2} + \frac{11{,}000}{(1+0.1)^3}\right] - 40{,}000$$

$$= [21272.72 + 17024.74 + 8270.67] - 40{,}000 = 6568.13$$

Thus, project A is to be selected.

Ex. 2.3.10

What do you understand by NPV method ? The cost of project is Rs. 80,000 it has a cash inflow of Rs. 30,000 for a period 4 years. What is NPV if firm expects 12 % per annum ?

☑ **Soln. :**

Calculation of NPV method

Project A

$$NPV = \left[\frac{30,000}{(1+0.12)^1} + \frac{30,000}{(1+0.12)^2} + \frac{30,000}{(1+0.12)^3} + \frac{30,000}{(1+0.12)^4}\right] - 80,000$$

$$= [26785.71 + 23915.81 + 21353.40 + 19065.54] - 80,000$$

$$= \mathbf{11120.46}$$

Ex. 2.3.11

Following are the details of project A and B. Suggest which one is to be accepted by using

1. NPV 2. BCR ($i = 8\%$)

Table P. 2.3.11

Years	Project A	Project B
0	4,00,000	4,50,000
1	1,20,000	1,40,000
2	1,25,000	1,45,000
3	78,000	76,000
4	80,000	65,000
5	75,000	60,000
6	–	90,000

☑ **Soln. :**

Calculation of net present value

Project A

$$NPV = \frac{12,000}{(1+0.8)^1} + \frac{1,25,000}{(1+0.8)^2} + \frac{78,000}{(1+0.8)^3} + \frac{80,000}{(1+0.8)^4} + \frac{75,000}{(1+0.8)^5} - 4,00,000 = -9956.5 \text{ Rs.}$$

Project B

$$NPV = \frac{1,40,000}{(1+0.8)^1} + \frac{1,45,000}{(1+0.8)^2} + \frac{76,000}{(1+0.8)^3} + \frac{65,000}{(1+0.8)^4} + \frac{60,000}{(1+0.8)^5} + \frac{90,000}{(1+0.8)^6} - 4,50,000$$

$$= 9602 \text{ Rs.}$$

Thus, project B is to be selected.

Calculation of benefit lost ratio

$$\textbf{Project A : BCR} = \frac{390044}{4,00,000} = 0.975$$

$$\textbf{Project B : BCR} = \frac{459602}{4,50,000} = 1.02$$

Thus, project B is to be selected.