NPV = ₹ 4,914

Sensitivity Analysis

(i) Increase of Plant Value by ₹ 4,914

$$\therefore \quad \frac{4,914}{10,000} \times 100 = 49.14\%$$

(ii) Increase of Running Cost by ₹ 4,914

$$\frac{4,914}{3,668 + 4,210} = \frac{4,914}{7,878} \times 100 = 62.38\%$$

(iii) Fall in Saving by ₹ 4,914

$$\frac{4,914}{11,004 + 11,788} = \frac{4,914}{22,792} \times 100 = 21.56\%$$

Hence, savings factor is the most sensitive to affect the acceptability of the project as in comparison of other two factors a slight % change in this fact shall more affect the NPV than others.

Question – 13

R Ltd. is considering a project with the following Cash flows:

In ₹

Years	Cost of Plant	Recurring Cost	Savings
0	20,000		
1		8,000	24,000
2		10,000	28,000

The cost of capital is 9%.

Evaluate the sensitivity of the project in respect of all factors except time such that:

(i) NPV become zero and

(ii) adversely varying factors value by 10%.

The P.V. factor at 9% are as under:

Years	Cost of Plant
0	1

1	0.917
2	0.842

Note: Round off calculation upto 2 decimal points.

(MTP April – 2024)

Solution:

Working Note:

Year 1	Running Cost	₹ 8,000 × 0.917	= (₹ 7,336)
	Savings	₹ 24,000 × 0.917	= ₹ 22,008
Year 2	Running Cost	₹ 10,000 × 0.842	= (₹ 8,420)
	Savings	₹ 28,000 × 0.842	= ₹ 23,576
			= ₹ 29,828
Year 0	Less: P.V. of Cash Outflow	₹ 20,000 × 1	= ₹ 20,000
	NPV		= ₹ 9,828

(i) Sensitivity Analysis (by making NPV Zero)

(1) Increase of Plant Value by ₹ 9,828

$$\therefore \frac{9,828}{20,000} \times 100 = 49.14\%$$

(2) Increase of Running Cost by ₹ 9,828

$$\frac{9,828}{7,336 + 8,420} = \frac{9,828}{15,756} \times 100 = 62.38\%$$

(3) Fall in Saving by ₹ 9,828

$$\frac{9,828}{22,008 + 23,576} = \frac{9,828}{45,584} \times 100 = 21.56\%$$

Hence, savings factor is the most sensitive to affect the acceptability of the project as in comparison of other two factors a slight % change in this fact shall more affect the NPV than others.

(ii) Sensitivity Analysis if there is a variation of 10% in the factors.

(1) If the initial project cost is varied adversely by say 10%.

NPV (Revised) (₹ 9,828 – ₹ 2,000) = ₹ 7,828

$$\text{Change in NPV} = \frac{₹\ 9,828 - ₹\ 7,828}{₹\ 9,828} = 20.35\%$$

(2) If Annual Running Cost is varied by say 10%.

NPV (Revised) (₹ 9828 – ₹ 800 × 0.917 – ₹ 1000 × 0.842)

= ₹ 9,828 – ₹ 733.60 – ₹ 842 = ₹ 8,252.40

$$\text{Change in NPV} = \frac{₹\ 9,828 - ₹\ 8,252.40}{₹\ 9,828} = 16.03\%$$

(3) If Saving is varied by say 10%.

NPV (Revised) (₹ 9,828 – ₹ 2400 × 0.917 – ₹ 2800 × 0.842)

= ₹ 9,828 – ₹ 2,200.80 – ₹ 2,357.60 = ₹ 5,269.60

$$\text{Change in NPV} = \frac{₹\ 9,828 - ₹\ 5,269.60}{₹\ 9,828} \times 100 = 46.38\%$$

Hence, savings factor is the most sensitive to affect the acceptability of the project.

Question – 14

The Easygoing Company Limited is considering a new project with initial investment, for a product "Survival". It is estimated that IRR of the project is 16% having an estimated life of 5 years.

Financial Manager has studied that project with sensitivity analysis and informed that annual fixed cost sensitivity is 7.8416%, whereas cost of capital (discount rate) sensitivity is 60%.

Other information available are:

Profit Volume Ratio (P/V) is 70%,

Variable cost ₹ 60/- per unit

Annual Cash Flow ₹ 57,500/-

Ignore Depreciation on initial investment and impact of taxation. Calculate

(i) Initial Investment of the Project

(ii) Net Present Value of the Project

(iii) Annual Fixed Cost

(iv) Estimated annual unit of sales

(v) Break Even Units

Cumulative Discounting Factor for 5 years

8%	9%	10%	11%	12%	13%	14%	15%	16%	17%	18%
3.339	3.890	3.791	3.696	3.605	3.517	3.433	3.352	3.274	3.199	3.127

(SM TYK – 12)

Solution:

(i) Initial Investment

IRR = 16% (Given)

At IRR, NPV shall be zero, therefore

Initial Cost of Investment = PVAF (16%,5) × Cash Flow (Annual)

= 3.274 × ₹ 57,500

= ₹ 1,88,255

(ii) Net Present Value (NPV)

Let Cost of Capital be X, then $\frac{16-X}{X}$ = 60% X = 10%

Thus NPV of the project

= Annual Cash Flow × PVAF (10%, 5) – Initial Investment

= ₹ 57,500 × 3.791 – ₹ 1,88,255

= ₹ 2,17,982.50 – ₹ 1,88,255

= ₹ 29,727.50

(iii) Annual Fixed Cost

Alternative I

Let change in the Fixed Cost which makes NPV zero is X. Then,

₹ 29,727.50 – 3.791X = 0

Thus X = ₹ 7,841.60

Let original Fixed Cost be Y then,

Y × 7.8416% = ₹ 7,841.60

Y = ₹ 1,00,000

Thus Fixed Cost is equal to ₹ 1,00,000

Alternative II

$$\text{Sensitivity in FC} = \frac{\text{NPV}}{\text{PV of FC}}$$

$$7.8416\% = \frac{29{,}727.50}{\text{PV of FC}}$$

PV of FC = ₹ 3,79,100

PV of FC = Annual FC × PVAF

3,79,100 = X × 3.791

X = ₹ 1,00,000

(iv) Estimated Annual Units of Sales

$$\text{Selling price per unit} = \frac{₹\ 60}{100\% - 70\%} = ₹\ 200$$

$$\frac{\text{Annual Cash Flow + Fixed Cost}}{\text{P/V Ratio}} = \text{Sales Value}$$

$$\frac{₹\ 57,500 + ₹\ 1,00,000}{0.70} = ₹\ 2,25,000$$

$$\text{Sales in Units} = \frac{₹\ 2,25,000}{₹\ 200} = 1,125 \text{ units}$$

(v) Break Even Units

$$\frac{\text{Fixed Cost}}{\text{Contribution Per Unit}} = \frac{1,00,000}{140} = 714.285 \text{ units}$$

Question – 15

Unnat Ltd. is considering investing ₹ 50,00,000 in a new machine. The expected life of machine is five years and has no scrap value. It is expected that 2,00,000 units will be produced and sold each year at a selling price of ₹ 30.00 per unit. It is expected that the variable costs to be ₹ 16.50 per unit and fixed costs to be ₹ 10,00,000 per year. The cost of capital of Unnat Ltd. is 12% and acceptable level of risk is 20%.

You are required to measure the sensitivity of the project's net present value to a change in the following project variables:

(a) Sale Price;

(b) Sales Volume;

(c) Variable Cost;

(d) On further investigation it is found that there is a significant chance that the expected sales volume of 2,00,000 units per year will not be achieved. The sales manager of Unnat Ltd. suggests that sales volumes could depend on expected economic states which could be assigned the following probabilities:

State of Economy	Annual Sales (in Units)	Probability
Poor	1,75,000	0.30
Normal	2,00,000	0.60
Good	2,25,000	0.10

Calculate expected net present value of the project and give your decision whether company should accept the project or not.

(SM TYK – 13)

Solution:

NPV Calculation

NPV = (30 – 16.50) × 2,00,000 unit × 3.605 – 10,00,000 × 3.605 – 50,00,000

= 13.50 × 7,21,000 – 36,05,000 – 50,00,000

= ₹ 11,28,500

(a) Sales Price

Let assume contribution per unit be x

x × 7,21,000 – 86,05,000 – 50,00,000 = 0

$$x = \frac{86,05,000}{7,21,000} = 11.93$$

CPU = SP – VC

11.93 = x – 16.50

x = ₹ 28.43

$$\text{Sensitivity} = \frac{30 - 28.43}{30} \times 100$$

= 5.23%

Alternative

Let the sale price/Unit be S so that the project would break even with 0 NPV.

∴ ₹ 50,00,000 = [2,00,000 (S – ₹ 16.50) – ₹ 10,00,000] PVIAF (12%,5)

₹ 50,00,000 = [2,00,000 S – ₹ 33,00,000 – ₹ 10,00,000] 3.605

₹ 50,00,000 = [2,00,000S – ₹ 43,00,000] 3.605

₹ 13,86,963 = 2,00,000S – ₹ 43,00,000

₹ 56,86,963 = 2,00,000S

S = ₹ 28.43 which represents a fall of (30 – 28.43)/30 or 0.0523 or 5.23%

(b) Sales Volume

Let assume present value of sales volume be x

$13.50\,x - 36,05,000 - 50,00,000 = 0$

$$x = \frac{86,05,000}{13.50} = 6,37,407$$

$$\text{Sensitivity} = \frac{7,21,000 - 6,37,407}{7,21,000} \times 100$$

$$= 11.59\%$$

Alternative

Let V be the sale volume so that the project would break even with 0 NPV.

$\therefore$ ₹ 50,00,000 = [V (₹ 30 – ₹ 16.50) – ₹ 10,00,000] PVIAF (12%,5)

₹ 50,00,000 = [V (₹ 13.50) – ₹ 10,00,000] PVIAF (12%,5)

₹ 50,00,000 = [₹ 13.50V – ₹ 10,00,000] 3.605

₹ 13,86,963 = ₹ 13.50V – ₹ 10,00,000

₹ 23,86,963 = ₹ 13.50V

V = 1,76,812 which represents a fall of (2,00,000 – 1,76,812)/2,00,000 or 0.1159 or 11.59%

(c) Variable Cost

Let assume variable cost per unit be x

CPU = SP – VC

$11.93 = 30 - x$

$x = 18.07$

$$\text{Sensitivity} = \frac{18.07 - 16.50}{16.50} \times 100$$

$$= 9.51\%$$

Alternative

Let the variable cost be V so that the project would break even with 0 NPV.

₹ 50,00,000 = [2,00,000 (₹ 30 – V) – ₹ 10,00,000] PVIAF(12%,5)

₹ 50,00,000 = [₹ 60,00,000 – 2,00,000 V – ₹10,00,000] 3.605

₹ 50,00,000 = [₹ 50,00,000 – 2,00,000 V] 3.605

₹ 13,86,963 = ₹ 50,00,000 – 2,00,000 V

₹ 36,13,037 = 2,00,000V

V = ₹ 18.07 which represents a fall of (18.07 – 16.50)/16.50 or 0.0951 or 9.51%

(d) Expected Net Present Value

(1,75,000 × 0.30) + (2,00,000 × 0.60) + (2,25,000 × 0.10) =1,95,000

NPV = [1,95,000 × ₹ 13.50 – ₹ 10,00,000] 3.605 – ₹50,00,000

= ₹ 8,85,163

Further NPV in worst and best cases will be as follows:

Worst Case:

[1,75,000 × ₹ 13.50 – ₹ 10,00,000] 3.605 – ₹ 50,00,000 = - ₹ 88,188

Best Case:

[2,25,000 × ₹ 13.50 – ₹ 10,00,000] 3.605 – ₹ 50,00,000 = ₹ 23,45,188

Thus, there are 30% chances that the rise will be a negative NPV and 70% chances of positive NPV. Since acceptable level of risk of Unnat Ltd. is 20% and there are 30% chances of negative NPV hence project should not be accepted.

Question – 16

X Ltd. is considering its new project with the following details:

Sr. No.	Particulars	Figures
1	Initial capital cost	₹ 400 Cr.

2	Annual unit sales	5 Cr.
3	Selling price per unit	₹ 100
4	Variable cost per unit	₹ 50
5	Fixed costs per year	₹ 50 Cr.
6	Discount Rate	6%

Required:

1. Calculate the NPV of the project.
2. Compute the impact on the project's NPV considering a 2.5 per cent adverse variance in each variable. Which variable is having maximum effect?

Consider Life of the project as 3 years.

Solution:

1. Calculation of Net Cash Inflow per Year

	Particulars	Amount (₹)
A	Selling price per unit	100
B	Variable cost per unit	50
C	Contribution per unit (A – B)	50
D	Number of units sold per year	5 Cr.
E	Total Contribution (C × D)	₹ 250 Cr.
F	Fixed cost per year	₹ 50 Cr.
G	Net cash inflow per year (E - F)	₹ 200 Cr.

Calculation of Net Present Value (NPV) of the Project

Year	Year Cash Flow (₹ in Cr.)	PV factor @ 6%	Present Value (PV) (₹ in Cr.)
0	(400.00)	1.000	(400.00)
1	200.00	0.943	188.60
2	200.00	0.890	178.00
3	200.00	0.840	168.00
Net Present Value			134.60

Here, NPV represent the most likely outcomes and not the actual outcomes. The actual outcome can be lower or higher than the expected outcome.

2. Sensitivity Analysis considering 2.5% Adverse Variance in each variable

	Particulars	Base	Initial capital cost increased to ₹ 410 crore	Selling Price per Unit Reduced to ₹ 97.5	Variable Cost Per Unit increased to ₹ 51.25	Fixed Cost Per Unit increased to ₹ 51.25	Units sold per year reduced to 4.875 crore
		(₹)	(₹)	(₹)	(₹)	(₹)	(₹)
A	Selling price per unit	100	100	97.5	100	100	100
B	Variable cost per unit	50	50	50	51.25	50	50
C	Contribution per unit (A – B)	50	50	47.5	48.75	50	50
		(₹in Cr.)	(₹in Cr.)	(₹in Cr.)	(₹in Cr.)	(₹in Cr.)	(₹in Cr.)
D	Number of units sold per year (units in Crores)	5	5	5	5	5	4.875
E	Total Contribution (C × D)	250	250	237.5	243.75	250	243.75
F	Fixed cost per year	50	50	50	50	51.25	50
G	Net Cash Inflow per year (E – F)	200	200	187.5	193.75	198.75	193.75
H	PV of Net cash Inflow per year (G × 2.673)	534.60	534.60	501.19	517.89	531.26	517.89
I	Initial capital cost	400	410	400	400	400	400
J	NPV (H – I)	134.60	124.60	101.19	117.89	131.26	117.89
	K Percentage Change in NPV	-	-7.43%	-24.82%	-12.41%	-2.48%	-12.41%

The above table shows that by changing one variable at a time by 2.5% (adverse) while keeping the others constant, the impact in percentage terms on the NPV of the project can be calculated. Thus, the change in selling price has the maximum effect on the NPV by 24.82%.

(ii) Scenario Analysis

Question – 17

XYZ Ltd. is considering a project "A" with an initial outlay of ₹ 14,00,000 and the possible three cash inflow attached with the project as follows:

Particulars	Year 1	Year 2	Year 3
Worst case	450	400	700
Most likely	550	450	800
Best case	650	500	900

Assuming the cost of capital as 9%, determine NPV in each scenario. If XYZ Ltd is certain about the most likely result in first two years but uncertain about the third year's cash flow, analyze what will be the NPV expecting worst scenario in the third year.

Solution:

The possible outcomes will be as follows:

Year	PVF @ 9%	Worst Case		Most likely		Best case	
		Cash Flow	PV	Cash Flow	PV	Cash Flow	PV
		(₹ '000)	(₹ '000)	(₹ '000)	(₹ '000)	(₹ '000)	(₹ '000)
0	1	(1,400)	(1,400)	(1,400)	(1,400)	(1,400)	(1,400)
1	0.917	450	412.65	550	504.35	650	596.05
2	0.842	400	336.80	450	378.90	500	421.00
3	0.772	700	540.40	800	617.60	900	694.80
NPV			-110.15		100.85		311.85

If XYZ Ltd. is certain about the most likely result in first two years but uncertain about the third year's cash flow, then, NPV expecting worst case scenario is expected in the third year will be as follows:

$$= - ₹\ 14,00,000 + \frac{₹\ 5,50,000}{(1+0.09)} + \frac{₹\ 4,50,000}{(1+0.09)^2} + \frac{₹\ 7,00,000}{(1+0.09)^3}$$

$$= - ₹\ 14,00,000 + ₹\ 5,04,587 + ₹\ 3,78,756 + ₹\ 5,40,528$$

$$= ₹\ 23,871$$

Question – 18

A firm has an investment proposal, requiring an outlay of ₹ 80,000. The investment proposal is expected to have two years economic life with no salvage value. In year 1, there is a 0.4 probability that cash inflow after tax will be ₹ 50,000 and 0.6 probability that cash inflow after tax will be ₹ 60,000. The probability assigned to cash inflow after tax for the year 2 is as follows:

The cash inflow year 1	₹ 50,000		₹ 60,000	
The cash inflow year 2		Probability		Probability
	₹ 24,000	0.2	₹ 40,000	0.4
	₹ 32,000	0.3	₹ 50,000	0.5
	₹ 44,000	0.5	₹ 60,000	0.1

The firm uses a 10% discount rate for this type of investment.

Required:

(i) Construct a decision tree for the proposed investment project and calculate the expected net present value (NPV).

(ii) What net present value will the project yield, if worst outcome is realized? What is the probability of occurrence of this NPV?

(iii) What will be the best outcome and the probability of that occurrence?

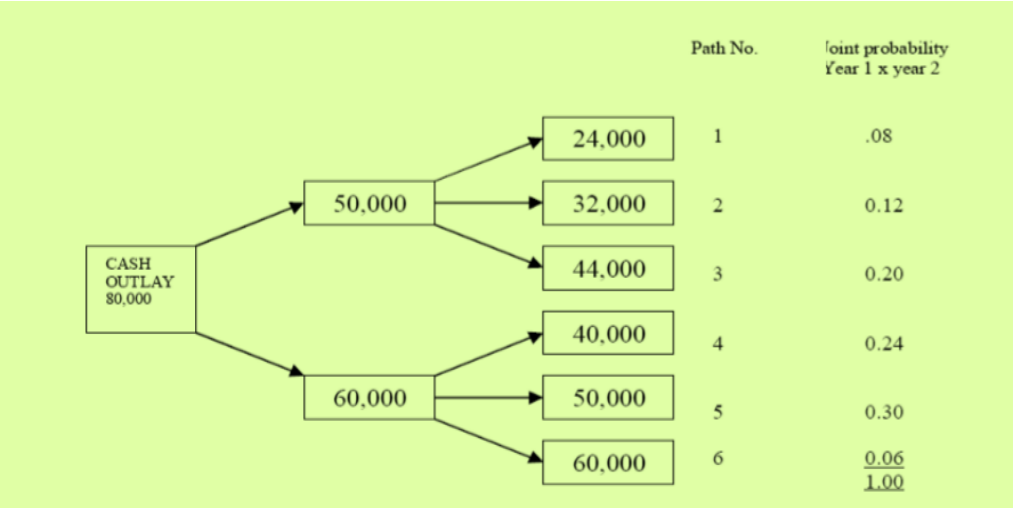
(iv) Will the project be accepted?

(Note: 10% discount factor 1 year 0.909; 2 year 0.826)

(SM TYK – 20)

Solution:

(i) The decision tree diagram is presented in the chart, identifying various paths and outcomes, and the computation of various paths/outcomes and NPV of each path are presented in the following tables:



The Net Present Value (NPV) of each path at 10% discount rate is given below:

Path	Year 1 Cash Flows (₹)	Year 2 Cash Flows (₹)	Total Cash Inflows (PV) (₹)	Cash Inflows NPV (₹)	(₹)
1	50,000 × 0.909 = 45,450	24,000 × 0.826 = 19,824	65,274	80,000	(-) 14,726
2	45,450	32,000 × 0.826 = 26,432	71,882	80,000	(-) 8,118
3	45,450	44,000 × 0.826 = 36,344	81,794	80,000	1,794
4	60,000 × 0.909 = 54,540	40,000 × 0.826 = 33,040	87,580	80,000	7,580
5	54,540	50,000 × 0.826 = 41,300	95,840	80,000	15,840
6	54,540	60,000 × 0.826 = 49,560	1,04,100	80,000	24,100

Statement showing Expected Net Present Value ₹

z	NPV (₹)	Joint Probability	Expected NPV
1	-14,726	0.08	-1,178.08
2	-8,118	0.12	-974.16
3	1,794	0.20	358.80
4	7,580	0.24	1,819.20
5	15,840	0.30	4,752.00
6	24,100	0.06	1,446.00
			6,223.76

(ii) If the worst outcome is realized the project will yield NPV of – ₹ 14,726. The probability of occurrence of this NPV is 8% and a loss of ₹ 1,178 (path 1).

(iii) The best outcome will be path 6 when the NPV is at ₹ 24,100. The probability of occurrence of this NPV is 6% and a expected profit of ₹ 1,446.

(iv) The project should be accepted because the expected NPV is positive at ₹ 6,223.76 based on joint probability.

Question – 19

Skylark Airways is planning to acquire a light commercial aircraft for flying class clients at an investment of ₹ 50,00,000. The expected cash flow after tax for the next three years is as follows: **(₹)**

Year 1		Year 2		Year 3	
CFAT	Probability	CFAT	Probability	CFAT	Probability
14,00,000	0.1	15,00,000	0.1	18,00,000	0.2
18,00,000	0.2	20,00,000	0.3	25,00,000	0.5
25,00,000	0.4	32,00,000	0.4	35,00,000	0.2
40,00,000	0.3	45,00,000	0.2	48,00,000	0.1

The Company wishes to take into consideration all possible risk factors relating to airline operations. The company wants to know:

(i) The expected NPV of this venture assuming independent probability distribution with 6 per cent risk free rate of interest.

(ii) The possible deviation in the expected value.

(iii) How would standard deviation of the present value distribution help in Capital Budgeting decisions?

(SM TYK – 01)

Solution:

(i) Expected NPV

(₹ in lakhs)

Year I			Year II			Year III		
CFAT	P	CF × P	CFAT	P	CF × P	CFAT	P	CF × P
14	0.1	1.4	15	0.1	1.5	18	0.2	3.6
18	0.2	3.6	20	0.3	6.0	25	0.5	12.5
25	0.4	10.0	32	0.4	12.8	35	0.2	7.0
40	0.3	12.0	45	0.2	9	48	0.1	4.8
	$\bar{x}$ or CF	27.0		$\bar{x}$ or CF	29.3			$\bar{x}$ or CF 27.9

NPV	PV factor @ 6%	Total PV
27	0.943	25.461
29.3	0.890	26.077
27.9	0.840	23.436
	PV of cash inflow	74.974
	Less: Cash outflow	50.000
	NPV	24.974

(ii) Possible deviation in the expected value

Year I				
$X - \bar{X}$	$X - \bar{X}$	$X - \bar{X}^2$	P_1	$X - \bar{X}^2 P_1$
14 – 27	-13	169	0.1	16.9
18 – 27	-9	81	0.2	16.2
25 – 27	-2	4	0.4	1.6
40 – 27	13	169	0.3	50.7
				85.4

$\sigma_1 \sqrt{85.4} = 9.241$

Year II				
$X - \bar{X}$	$X - \bar{X}$	$(X - \bar{X})^2$	P_2	$(X - \bar{X})^2 P_2$
15-29.3	-14.3	204.49	0.1	20.449
20-29.3	-9.3	86.49	0.3	25.947
32-29.3	2.7	7.29	0.4	2.916
45-29.3	15.7	246.49	0.2	49.298
				98.61

$\sigma_2 \sqrt{98.61} = 9.930$

Year III				
$X - \bar{X}$	$X - \bar{X}$	$(X - \bar{X})^2$	P_3	$(X - \bar{X})^2 P_3$
18-27.9	-9.9	98.01	0.2	19.602
25-27.9	-2.9	8.41	0.5	4.205
35-27.9	7.1	50.41	0.2	10.082
48-27.9	20.1	404.01	0.1	40.401
				74.29

$\sigma_3 \sqrt{74.29} = 8.619$

Standard deviation about the expected value:

$$\sigma \sqrt{\frac{85.4}{(1.06)^2} + \frac{98.61}{(1.06)^4} + \frac{74.29}{(1.06)^6}} = 14.3696$$

(iii) Standard deviation is a statistical measure of dispersion; it measures the deviation from a central number i.e. the mean.

In the context of capital budgeting decisions especially where we take up two or more projects giving somewhat similar mean cash flows, by calculating standard deviation in such cases, we can measure in each case the extent of variation. It can then be used to identify which of the projects is least risky in terms of variability of cash flows.

A project, which has a lower coefficient of variation will be preferred if sizes are heterogeneous.

Besides this, if we assume that probability distribution is approximately normal we are able to calculate the probability of a capital budgeting project generating a net present value less than or more than a specified amount.

Question – 20

Project X and Project Y are under the evaluation of XY Co. The estimated cash flows and their probabilities are as below:

Project X : Investment (year 0) ₹ 70 lakhs

Probability Weights	0.30	0.40	0.30
Years	₹ lakhs	₹ lakhs	₹ lakhs
1	30	50	65
2	30	40	55
3	30	40	45

Project Y: Investment (year 0) ₹ 80 lakhs.

Probability Weighted	Annual cash flows through life
	₹ lakhs
0.20	40
0.50	45
0.30	50

(a) Which project is better based on NPV, criterion with a discount rate of 10%?

(b) Compute the standard deviation of the present value distribution and analyze the inherent risk of the projects.

(SM TYK – 05)

Solution:

(a) Calculation of NPV of XY Co.:

Project X		Cash flow	PVF	PV
Year				
1	(30 × 0.3) + (50 × 0.4) + (65 × 0.3)	48.5	0.909	44.09
2	(30 × 0.3) + (40 × 0.4) + (55 × 0.3)	41.5	0.826	34.28
3	(30 × 0.3) + (40 × 0.4) + (45 × 0.3)	38.5	0.751	28.91
				107.28
	NPV: (107.28 – 70.00) =			(+) 37.28

Project Y (For 1-3 Years)

1-3	(40 × 0.2) + (45 × 0.5) + (50 × 0.3) NPV (113.16 – 80.00)=	45.5	2.487	113.16 (+) 33.16

(b) Calculation of Standard deviation σ

As per Hiller's model

Project X

Year

1 $\sqrt{(30-48.5)^2 0.30 + (50-48.5)^2 0.40 + (65-48.5)^2 0.30}$

$= \sqrt{185.25} = 13.61$

2 $\sqrt{(30-41.5)^2 0.30 + (40-41.5)^2 0.40 + (55-41.5)^2 0.30}$

$= \sqrt{95.25} = 9.76$

3 $\sqrt{(30-38.5)^2 0.30 + (40-38.5)^2 0.40 + (45-38.5)^2 0.30}$

$= \sqrt{35.25} = 5.94$

Standard Deviation about the expected value

$$= \sqrt{\frac{185.25}{(1+0.10)^2} + \frac{95.25}{(1+0.10)^4} + \frac{35.25}{(1+0.10)^6}}$$

$$= \sqrt{\frac{185.25}{1.21} + \frac{95.25}{1.4641} + \frac{35.25}{1.7716}}$$

$= \sqrt{153.10 + 65.06 + 19.90}$

$= \sqrt{238.06}$

$= 15.43$

Project Y (For 1-3 Years)

$\sqrt{(40-45.5)^2 0.20 + (45-45.5)^2 0.50 + (50-45.5)^2 0.30}$

$= \sqrt{12.25} = 3.50$

Standard Deviation about the expected value

$$= \sqrt{\frac{12.25}{(1+0.10)^2} + \frac{12.25}{(1+0.10)^4} + \frac{12.25}{(1+0.10)^6}}$$

$$= \sqrt{\frac{12.25}{1.21} + \frac{12.25}{1.4641} + \frac{12.25}{1.7716}}$$

$$= \sqrt{10.12 + 8.37 + 6.91}$$

$$= \sqrt{25.4}$$

$$= 5.03$$

Analysis: Project Y is less risky as its Standard Deviation is less than Project X.

Question – 21

XY Ltd. has under its consideration a project with an initial investment of ₹ 1,00,000. Three probable cash inflow scenarios with their probabilities of occurrence have been estimated as below:

Annual cash inflow (₹)	20,000	30,000	40,000
Probability	0.1	0.7	0.2

The project life is 5 years and the desired rate of return is 20%. The estimated terminal values for the project assets under the three probability alternatives, respectively, are ₹ 0, 20,000 and 30,000.

You are required to:

(i) Find the probable NPV;

(ii) Find the worst-case NPV and the best-case NPV; and

(iii) State the probability occurrence of the worst case, if the cash flows are perfectly positively correlated over time.

(SM TYK – 08)

Solution:

(i) NPV based on expected cash flows would be as follows: