$$= ₹\ 1,00,000 + \frac{₹\ 40,000}{(1+0.20)^1} + \frac{₹\ 40,000}{(1+0.20)^2} + \frac{₹\ 40,000}{(1+0.20)^3} + \frac{₹\ 40,000}{(1+0.20)^4}$$

$$+ \frac{₹\ 40,000}{(1+0.20)^5} + \frac{₹\ 30,000}{(1+0.20)^5}$$

= - ₹ 1,00,000 + ₹ 33,333.33 + ₹ 27,777.78 + ₹ 23,148.15 + ₹ 19,290.12 + ₹ 16,075.10 + ₹ 12,056.33

NPV = ₹ 31,680.81

Expected NPV

= (- ₹ 40,187.76 × 0.1) + (-₹ 2,244.08 × 0.7) + (₹ 31,680.81 × 0.2)

= ₹ 746.52

(ii) For the worst case, the cash flows from the cash flow column farthest on the left are used to calculate NPV

$$= ₹\ 1,00,000 + \frac{₹\ 20,000}{(1+0.20)^1} + \frac{₹\ 20,000}{(1+0.20)^2} + \frac{₹\ 20,000}{(1+0.20)^3} + \frac{₹\ 20,000}{(1+0.20)^4} + \frac{₹\ 20,000}{(1+0.20)^5}$$

= - ₹ 1,00,000 + ₹ 16,666.67 + ₹ 13,888.89 + ₹ 11,574.07 + ₹ 9,645.06 + ₹ 8037.76

NPV = - ₹ 40,187.76

For the best case, the cash flows from the cash flow column farthest on the right are used to calculated NPV

$$= ₹\ 1,00,000 + \frac{₹\ 40,000}{(1+0.20)^1} + \frac{₹\ 40,000}{(1+0.20)^2} + \frac{₹\ 40,000}{(1+0.20)^3} + \frac{₹\ 40,000}{(1+0.20)^4}$$

$$+ \frac{₹\ 40,000}{(1+0.20)^5} + \frac{₹\ 30,000}{(1+0.20)^5}$$

= - ₹ 1,00,000 + ₹ 33,333.33 + ₹ 27,777.78 + ₹ 23,148.15 + ₹ 19,290.12 + ₹ 16,075.10 + ₹ 12,056.33

NPV = ₹31,680.81

(iii) If the cash flows are perfectly dependent, then the low cash flow in the first year will mean a low cash flow in every year. Thus, the possibility of the worst case occurring is the probability of getting ₹20,000 net cash flow in year 1 is 10%.

Question: 22

Following are the estimates of the net cash flows and probability of a new project of M/s X Ltd.:

	Year	P = 0.3	P = 0.5	P = 0.2
Initial investment	0	4,00,000	4,00,000	4,00,000
Estimated net after tax cash inflows per year	1 to 5	1,00,000	1,10,000	1,20,000
Estimated salvage value (after tax)	5	20,000	50,000	60,000

Required rate of return from the project is 10%. Find:

(i) The expected NPV of the project.

(ii) The best case and the worst case NPVs.

(iii) The probability of occurrence of the worst case if the cash flows are perfectly dependent overtime and independent overtime.

(iv) Standard deviation and coefficient of variation assuming that there are only three streams of cash flow, which are represented by each column of the table with the given probabilities.

(v) Coefficient of variation of X Ltd. on its average project which is in the range of 0.95 to1.0. If the coefficient of variation of the project is found to be less risky than average, 100basis points are deducted from the Company's cost of Capital

Should the project be accepted by X Ltd?

(SM TYK – 07)

Solution:

(i) Expected NPV

Worst Case

ENPV = (-)4,00,000 + 1,00,000 × 3.790 + 20,000 × 0.621

= -₹ 8,580/-

Base Case

ENPV = (-)4,00,000 + 1,20,000 × 3.790 + 60,000 × 0.621

= ₹ 92,060/-.

Best Case

ENPV = (-)4,00,000 + 1,20,000 × 3.790 + 60,000 × 0.621

= ₹ 92,060/-.

Expected NPV

= 0.30 × (-) 8,580 + 0.5 × 47,950 + 92,060 × 0.20

= ₹ 39,813/-

(ii) ENPV of The Worst Case

1,00,000 × 3.790 = ₹ 3,79,000

(Students may have 3.791 also the values will change accordingly)

20,000 × 0.621 = ₹ 12,420/-

ENPV = (-)4,00,000 + 3,79,000 + 12,420 = (-) ₹ 8,580/-

ENPV of the best case

ENPV = (-)4,00,000 + 1,20,000 × 3.790 + 60,000 × 0.621

= ₹ 92,060/-.

(iii) (a) Required probability = 0.3

(b) Required probability = $(0.3)^5$ = 0.00243

(iv) The base case NPV = (-) 4,00,000 + (1,10,000 × 3.79) + (50,000 × 0.621)

= ₹ 47,950/-

ENPV = 0.30 × (-) 8,580 + 0.5 × 47,950 + 92,060 × 0.20

= ₹ 39,813/-

Therefore,

$$\sigma_{ENPV} = \sqrt{0.3(-8,580 - 39,813)^2 + 0.5(47,950 - 39,813)^2 + 0.2 + (92,060 - 39,813)^2}$$

= ₹ 35,800/-

Therefore, CV = 35,800/39,813

= 0.90

(v) Risk adjusted out of cost of capital of X Ltd. = 10% - 1% = 9%.

NPV

Expected Cash Flows

1 to 5 = (1,00,000 × 0.3 +1,10,000 × 0.5 + 1,20,000 × 0.2)

= 1,09,000

Expected Salvage Value [5th year]

= (20,000 × 0.3 + 50,000 × 0.5 + 60,000 × 0.2)

= 43,000

NPV = (1,09,000 × 3.890) + (43,000 × 0.650) – 4,00,000

= ₹ 51,960

Therefore, the project should be accepted.

Question – 23

Cyber Company is considering two mutually exclusive projects. Investment outlay of both the projects is ₹ 5,00,000 and each is expected to have a life of 5 years. Under three possible situations their annual cash flows and probabilities are as under:

		Cash Flow (₹)	
Situation	**Probabilities**	**Project A**	**Project B**
Good	0.3	6,00,000	5,00,000
Normal	0.4	4,00,000	4,00,000

Worse	0.3	2,00,000	3,00,000

The cost of capital is 7 per cent, which project should be accepted? Explain with workings.

(SM TYK – 02)

Solution:

Expected Cash Flows & Standard Deviation

Project A

Expected Cash Flows

= (6,00,000 × 0.3) + (4,00,000 × 0.4) + (2,00,000 × 0.3)

= 4,00,000

$$\sigma_x = \sqrt{(6,00,000 - 4,00,000)^2\ 0.3 + (4,00,000 - 4,00,000)^2 + (2,00,000 - 4,00,000)^2\ 0.3}$$

= ₹ 1,54,919

Project B

ENCF = 0.3 (5,00,000) + 0.4 (4,00,000) + 0.3 (3,00,000)

= 4,00,000

σ^2 = 0.3 (5,00,000 – 4,00,000)^2 + 0.4 (4,00,000 – 4,00,000)^2 + 0.3 (3,00,000 – 4,00,000)^2

$\sigma = \sqrt{6,00,00,00,000}$

σ = 77,459.66

Expected NPV

A = (4,00,000 × PVAF 7 % 5) – 5,00,000

= (4,00,000 × 4.100) – 5,00,000 = 11,40,000

B = (4,00,000 × 4.100) – 5,00,000 = 11,40,000

Project B should be accepted due to lower risk.

Recommendation: NPV in both projects being the same, the project should be decided on the basis of standard deviation and hence project 'B' should be accepted having lower standard deviation, means less risky.

(iii) Simulation

Question – 24

Cost of Machine = ₹ 1,30,000

Discounting Rate = 10% p.a.

Annual Cash Flow		Project Life	
Value (₹)	Probability	Value (Year)	Probability
10,000	0.02	3	0.05
15,000	0.03	4	0.10
20,000	0.15	5	0.30
25,000	0.15	6	0.25
30,000	0.30	7	0.15
35,000	0.20	8	0.10
40,000	0.15	9	0.03
		10	0.02

Random Number

53479	81115	98036	12217	59526
97344	70328	58116	91964	26240
66023	38277	74523	71118	84892
99776	75723	03172	43112	83086
30176	48979	92153	38416	42436
81874	83339	14988	99937	13213
19839	90630	71863	95053	55532
09337	33435	53869	52769	18801
31151	58295	40823	41330	21093
67619	52515	03037	81699	17106

Take beginning two digit random number. One for annual cash flows & second for project life.

Solution:

Annual Cash Flow				Project Life			
Value (₹)	Probabil-ity	Cumula-tive	Tow Digit	Value (Year)	Probabil-ity	Cumula-tive	Two Digit

		Probabil-ity	Random No.			Probabil-ity	Random No.
10,000	0.02	0.02	00 – 01	3	0.05	0.05	00 – 04
15,000	0.03	0.05	02 – 04	4	0.10	0.15	05 – 14
20,000	0.15	0.20	05 – 19	5	0.30	0.45	15 – 44
25,000	0.15	0.35	20 – 34	6	0.25	0.70	45 – 69
30,000	0.30	0.65	35 – 64	7	0.15	0.85	70 – 84
35,000	0.20	0.85	65 – 84	8	0.10	0.95	85 – 94
40,000	0.15	1.00	85 - 99	9	0.03	0.98	95 – 97
				10	0.02	1.00	98 - 99

Simulation Results

Annual Cash Flow			Project Life			
Run	Random No.	Corres. Value of Annual Cash Flow (1)	Random No.	Corres. Value of Project Life	PVAF @ 10% (2)	NPV (1) × (2) – 1,30,000
1	53	30,000	97	9	5.759	42,770
2	66	35,000	99	10	6.145	85,075
3	30	25,000	81	7	4.868	(8,300)
4	19	20,000	09	4	3.170	(66,600)
5	31	25,000	67	6	4.355	(21,125)
6	81	35,000	70	7	4.868	40,380
7	38	30,000	75	7	4.868	16,040
8	48	30,000	83	7	4.868	16,040
9	90	40,000	33	5	3.791	21,640
10	58	30,000	52	6	4.355	650

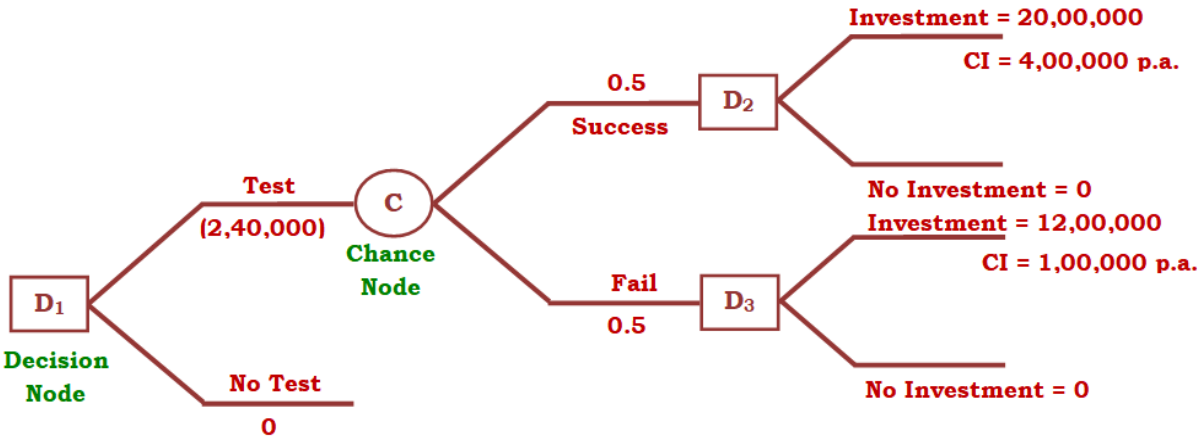
(iv) Decision Tree

Question – 25

L & R Limited wishes to develop new virus-cleaner software. The cost of the pilot project would be ₹ 2,40,000. Presently, the chances of the product being successfully launched on a commercial scale are rated at 50%. In case it does succeed. L&R can invest a sum of ₹20 lacs to market the product. Such an effort can generate perpetually, an annual net after tax cash income of ₹4 lacs. Even if the commercial launch fails, they can make an investment of a smaller amount of ₹12 lacs with the hope of gaining perpetually a sum of ₹1 lac. Evaluate the proposal, adopting decision tree approach. The discount rate is 10%.

Solution:

Decision tree diagram is given below:



DECISION TREE

At Decision Point D_2

Option 1: If investment NPV $= \frac{4,00,000}{10\%} - 20,00,000 = 20,00,000$

Option 2: No investment NPV = 0

No investment is better

At Decision Point D_3

Option 1: Investment NPV $= \frac{1,00,000}{10\%} - 12,00,000 = -2,00,000$

Option 2: No investment NPV = 0

Investment is better due to higher NPV

Calculation of EMV at Point C

EMV = (20,00,000 × 0.5) + (0 × 0.5)

= 10,00,000

At Decision Point D_1

Option 1: Testing NPV = (10,00,000 – 2,40,000) = ₹ 7,60,000

Option 2: No Testing NPV = 0

Testing is better due to higher NPV

PART 3: REPLACEMENT DECISION

Question – 26

Company X is forced to choose between two machines A and B. The two machines are designed differently but have identical capacity and do exactly the same job. Machine A costs ₹ 1,50,000 and will last for 3 years. It costs ₹ 40,000 per year to run. Machine B is an 'economy' model costing only ₹ 1,00,000, but will last only for 2 years, and costs ₹ 60,000 per year to run. These are real cash flows. The costs are forecasted in rupees of constant purchasing power. Ignore tax. Opportunity cost of capital is 10 per cent. Which machine company X should buy?

(SM TYK – 24)

Solution:

Calculation of EAPVCO

Machine A

PVCO = 1,50,000 + (40,000 × 2.487)

= 2,94,474

$$\text{EA PVCO} = \frac{\text{PVCO}}{\text{PVAF}} = \frac{2,49,480}{2.487} = 1,00,314$$

Machine B

PVCO = 1,00,000 + (60,000 × 1.735)

$$\text{EA PVCO} = \frac{2,04,100}{1.735} = 1,17,637$$

Question – 27

A Company named Roby's cube decided to replace the existing Computer system of their organization. Original cost of old system was ₹ 25,000 and it was installed 5 years ago. Current market value of old system is ₹ 5,000. Depreciation of the old system was charged with life of 10 years with Estimated Salvage value as Nil. Depreciation of the new system will be charged with life over 5 years Present cost of the new system is ₹ 50,000. Estimated Salvage value of the new system is ₹1,000. Estimated cost savings with new system is ₹ 5,000 per year. Increase in sales with new system is assumed at 10% per year based on original total sales of ₹ 1,00,000. Company follows straight line

method of depreciation. Cost of capital of the company is 10% whereas tax rate is 30%.

Solution:

Calculation of NPV

		Year	PVF (10%)	Amount	P.V.
(A)	Cash outflows				
	Cost of new machine	0	1,000	50,000	50,000
	Sale of old machine (W.N.1)	0	1,000	(7,250)	(7,250)
					42,750
(B)	Cash inflows				
	Incremental CFAT (W.N.2)	1-5	3.791	12,690	48,108
	Incremental T.V. [2,000 – 0]	5	0.621	1,000	621
	(B)				48,729
	NPV (B – A)				5,979

Since NPV is positive, hence old machine should be replaced.

W.N. 1: Sale of Old Machine

Sales consideration = ₹ 5,000 .....(i)

(-) B.V. = ₹ 12,500

Capital loss = ₹ 7,500

Tax saving @ 30% = 2,250 .....(ii)

Net (i + ii) = 7,250

W.N. 2: Incremental CFAT

Increase in sales [₹ 1,00,000 × 10%] = ₹ 10,000

Saving in Exp = ₹ 5,000

Incremental CFAT = ₹ 15,000 .....(i)

(-) Incremental depreciation

[Depreciation of new – Depreciation of old]