

Capital Budgeting - Part 2

Question 1

Determine the risk adjusted net present value of the following projects:

	X	Y	Z
Net cash outlays (₹)	2,10,000	1,20,000	1,00,000
Project life	5 years	5 years	5 years
Annual Cash inflow (₹)	70,000	42,000	30,000
Coefficient of variation	1.2	0.8	0.4

The Company selects the risk-adjusted rate of discount on the basis of the coefficient of variation:

Coefficient of Variation	Risk-Adjusted Rate of Return	P.V. Factor 1 to 5 years At risk adjusted rate of discount
0.0	10%	3.791
0.4	12%	3.605
0.8	14%	3.433
1.2	16%	3.274
1.6	18%	3.127
2.0	22%	2.864
More than 2.0	25%	2.689

Question 2

Determine the risk adjusted net present value of the following projects:

	X	Y	Z
Net cash outlays (₹)	6,00,000	6,00,000	6,00,000
Project life	5 years	5 years	5 years
Annual Cash inflow (₹)	2,70,000	2,30,000	2,50,000
Beta factors for projects	1.6	1.2	1.4

The Company selects the risk-adjusted rate of discounting on the basis of the CAPM. Risk free Rate is 10% p.a. and Market Return is 20% p.a.

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Question 3

NJ Ltd. is considering one of two mutually exclusive proposals. Project A and Project B, which require cash outlays of ₹ 10,00,000 each.. The risk free rate is 10%. The expected net cash flows and their certainly equivalents are as follows:

	Project A		Project B	
Year-End	Cash Flow (₹)	C.E.	Cash Flow (₹)	C.E.
1	4,00,000	0.8	4,00,000	0.9
2	5,00,000	0.7	4,50,000	0.8
3	5,60,000	0.5	5,00,000	0.7
4	6,00,000	0.4	5,50,000	0.6

Determine NPV of both the projects and decide which project should be selected based on Certainly Equivalent Technique.

Question 4

The Textile Manufacturing Company Ltd. is considering one of two mutually exclusive proposals. Project M and Project N, which require cash outlays of ₹ 8,50,000 and ₹ 8,25,000 respectively. The certainly-equivalent (C.E) approach is used in incorporating risk in capital budgeting decisions. The current yield on government bonds is 6% and this is used as the risk free rate. The expected net cash flows and their certainly equivalents are as follows:

	Project M		Project N	
Year-End	Cash Flow (₹)	C.E.	Cash Flow (₹)	C.E.
1	4,50,000	0.8	4,50,000	0.9
2	5,00,000	0.7	4,50,000	0.8
3	5,00,000	0.5	5,00,000	0.7

Present value factors of ₹ 1 discounted at 6% at the end of year 1, 2 and 3 are 0.943, 0.890 and 0.840 respectively.

Required:

1. Which project should be accepted?

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2. If risk adjusted discount rate method is used, which project would be appraised with a higher rate and why?

Question 5

The following data has been supplied to you:

Life of the Project	6 Years
Cost of the Project	₹ 35,00,000
Annual Cash flows	₹ 12,00,000 p.a.
Discounting Rate (expected Rate of Return)	10% p.a.

Analyse the sensitivity of the project to changes in the following factors by 20%:

1. Increase in initial project cost by 20%,
2. Decrease in Annual cash inflows by 20% and
3. Increase in Cost of capital by 20% i.e. increase from 10% to 12%

Question 6

Cost of Project	₹ 15,00,000
Life of project	10 Years
Annual cash inflows	₹ 3,00,000 p.a.
Discounting rate	10% p.a.

Determine the NPV of the Project.

Analyse the sensitivity of each variable considering 10% change:

1. Increase in Cost of the project by 10%
2. Decrease in Annual cash inflows by 10%
3. Increase in Discounting rate by 10% (i.e. from 10% to 11%)
4. Decrease in Life of project by 10% (i.e. from 10 to 9 years)

Also analyse that to which factor among the above four, the project is most sensitive.

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Question 7

A Ltd. has to analyse the sensitivity of different variables with respect to NPV, involved in a project. The following data has been supplied to you:

Life of the Project	6 Years
Cost of the Project	₹ 35,00,000
Annual Cash flows	₹ 12,00,000 p.a.
Discounting Rate (expected Rate of Return)	10% p.a.

Question 8

Life of the Project	5 Years
Cost of the Project	₹ 25,00,000
Annual Cash flows	₹ 8,00,000 p.a.
Discounting Rate (expected Rate of Return)	16% p.a.

Determine the NPV of the project under each of the following scenarios as well as the overall expected NPV.

Scenario 1: Most-likely Case Scenario (Probability 70%):

All variables remain unchanged

Scenario 2: Best Case Scenario (Probability 10%):

Increase in annual cash inflows by 7.5% and decrease in cost of capital from 16% to 15%

Scenario 3: Worst Case Scenario (Probability 20%):

Increase in initial project cost by 8%, decrease in annual cash inflows by 7.5% and increase in cost of capital from 16% to 17%

Question 9

Initial outlay in a project is ₹ 14,00,000. Life of the project is 6 years. Discounting Rate is 12%. Annual Cash Flows After Tax during the life of the project for three different scenarios are expected as under:

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Year	Best Case	Most Likely	Worst Case
1	₹ 5,00,000	₹ 3,60,000	₹ 3,20,000
2	₹ 5,20,000	₹ 4,20,000	₹ 3,80,000
3	₹ 5,40,000	₹ 4,40,000	₹ 4,00,000
4	₹ 5,00,000	₹ 4,00,000	₹ 3,70,000
5	₹ 5,00,000	₹ 3,90,000	₹ 3,40,000
6	₹ 4,80,000	₹ 3,80,000	₹ 3,20,000

1. Determine NPV in each scenario.
2. If the management is certain about the most likely result in first three years but uncertain about the later three year's cash flows, analyze what will be the NPV expecting worst scenario in the later three years.

Question 10

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.

Question 11

ABC & Co. is evaluating a proposal having initial outlay of ₹ 1,40,000 and economic life of 2 years. The cash inflow and the respective probabilities have been found to be as follows:

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Year 1		Year 2	
Cash Inflow ₹	Prob.	Cash Inflow ₹	Prob.
1,00,000	0.3	1,40,000	0.5
80,000	0.5	70,000	0.3
10,000	0.2	60,000	0.2

Evaluate the proposal on the basis of expected NPV, given that the firm has required rate of 10%.

Question 12

The following information in respect of a proposal having an outlay ₹ 6,000 has been submitted before P Co.

Year 1		Year 2		Year 3	
Inflows ₹	Prob.	Inflows ₹	Prob.	Inflows ₹	Prob.
1,000	0.1	2,000	0.3	1,500	0.1
1,500	0.2	2,500	0.2	2,200	0.1
2,000	0.4	2,700	0.2	2,800	0.7
2,500	0.2	2,800	0.3	3,500	0.1
3,000	0.1				

Evaluate the proposal on the basis of expected NPV, given that the discount rate is 15%.

Question 13

XYZ Ltd. is evaluating 2 equal size mutually exclusive proposals A & B for which the respective cash flow together with associated probabilities are as follows:

Project A		Project B	
Cash flows ₹	Prob.	Cash flows ₹	Prob.
2,000	0.3	1,000	0.1
4,000	0.4	3,000	0.1
6,000	0.3	5,000	0.4
		7,000	0.3
		9,000	0.1

Find out the risks of the proposal in terms of standard deviation.

Question 14

The RST and Co. is engaged in evaluating the following 2 mutually exclusive proposals, A and B, for which the relevant information is as follows:

Project A		Project B	
Cash flows ₹	Prob.	Cash flows ₹	Prob.
1,50,000	0.3	- 4,00,000	0.2
2,00,000	0.3	3,00,000	0.6
2,50,000	0.4	4,00,000	0.1
		8,00,000	0.1

Evaluate the proposals in terms of the standard deviation and coefficient of variation.

Question 15

Consider the following estimates of cash flow with their respective probabilities:

Cash Flows	Probability
12,000	0.20
14,000	0.30
16,000	0.25
18,000	0.25

Life of the project is 5 years.

Discounting Rate is 10%.

Initial Investment is ₹ 52,000

You are required to determine the following:

1. Expected value of cash flow
2. Standard deviation w.r.t. EVCF
3. Coefficient of Variation w.r.t. EVCF
4. Expected NPV for the project

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Question 16

XYZ Ltd. is evaluating a project which requires an outlay of ₹ 16,000 and is expected to produce cash inflow for 5 years as follows:

Economic Conditions	Probability	ACF (₹)
Good	0.3	8,000
Average	0.5	5,000
Bad	0.2	3,000

Assume that there are only 3 streams of cash flows, as these are dependent over time. Discounting Rate is 12% p.a.

Determine the Expected NPV through separate NPVs of each possible outcome and the Standard Deviation w.r.t NPV.

Question 17

ABC Ltd. is evaluating a project which requires an outlay of ₹ 20,000 and is expected to produce cash inflow for 3 years as follows:

Year 1		Year 2		Year 3	
Cash Inflows ₹	Prob.	Cash Inflows ₹	Prob.	Cash Inflows ₹	Prob.
6,000	0.3	4,000	0.2	6,000	0.3
10,000	0.4	8,000	0.6	10,000	0.4
14,000	0.3	12,000	0.2	14,000	0.3

Evaluate the proposal on the basis of CV w.r.t. NPV, given that the risk free rate is 6%.

Question 18

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:

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Year 1		Year 2		Year 3	
CFAT (₹)	Prob.	CFAT (₹)	Prob.	CFAT (₹)	Prob.
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 an airline operations. The company wants to know:

1. The expected NPV of this venture assuming independent probability distribution with 6% risk free rate of interest.
2. The possible deviation in the expected NPV.

Question 19

Aeroflot airlines are planning to procure a light commercial aircraft for flying class clients at an investment of ₹ 50 lakhs. The expected cash flows after tax for next three years (in ₹ Lakhs) are as follows:

Year 1		Year 2		Year 3	
CFAT	Prob.	CFAT	Prob.	CFAT	Prob.
15	0.1	15	0.1	18	0.2
18	0.2	20	0.3	22	0.5
22	0.3	30	0.4	35	0.2
35	0.4	45	0.2	50	0.1

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

1. The expected NPV of this venture assuming independent probability distribution with 6% risk free rate of interest.
2. The possible deviation in the expected NPV.

Question 20

Shivam Ltd. is considering two mutually exclusive projects A and B. Project A costs ₹ 36,000 and project B ₹ 30,000. You have been given below the net present value probability distribution for each project.

Project A		Project B	
NPV estimates (₹)	Probability	NPV estimates (₹)	Probability
15,000	0.2	15,000	0.1
12,000	0.3	12,000	0.4
6,000	0.3	6,000	0.4
3,000	0.2	3,000	0.1

- i. Compute the expected net present values of projects A and B.
- ii. Compute the risk attached to each project i.e. standard deviation of each probability distribution.
- iii. Compute the profitability index of each project.
- iv. Which project do you recommend? State with reasons.

Question 21

Life of Project = 2 years;
 Cost = ₹ 10,000;
 Discounting Rate = 10% p.a.

Estimates of Cash Flows:

Economic Conditions	Probability	ACF (₹)
Good	0.6	9,000
Bad	0.4	3,000

You are required to determine Expected NPV:

1. Using EVCF
2. Through separate NPVs of each possible outcomes, assuming cash flows are *independent* over time.
3. Through separate NPVs of each possible outcomes, assuming cash flows are *dependent* over time.

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Question 22

Life of Project = 2 years;
Cost = ₹ 900;
Discounting Rate = 10% p.a.

Estimates of Cash Flows:

Economic Conditions	Probability	ACF (₹)
Good	0.3	1,000
Average	0.5	800
Bad	0.2	300

You are required to determine Expected NPV:

1. Using EVCF
2. Through separate NPVs of each possible outcomes, assuming cash flows are *independent* over time.
3. Through separate NPVs of each possible outcomes, assuming cash flows are *dependent* over time.

Question 23

A firm has an investment proposal, requiring an outlay of ₹ 80,000. The investment proposal is expected to have 2 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 probabilities assigned to cash inflows after tax for the year 2 are 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.

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Required:

1. Construct a decision tree for the proposed investment project and calculate expected net present value (NPV).
2. What net present value will the project yield, if worst outcome is realized? What is the probability of occurrence of this NPV?
3. What net present value will the project yield, if best outcome is realized? What is the probability of occurrence of this NPV?
4. Will the project be accepted?

(Note: 10% Discount factor 1 year 0.909, 2 year 0.826)

Question 24

Life of Project = 2 years;

Cost = ₹ 9,000;

Discounting Rate = 10% p.a.

Estimates of Cash Flows that are independent over time:

Economic Conditions	Probability	ACF (₹)
Good	0.6	8,000
Bad	0.4	4,000

1. Determine the Expected NPV through separate NPVs of each possible outcome and the Standard Deviation w.r.t NPV.
2. Determine the Standard Deviation w.r.t NPV using Hiller's Model.

Question 25

Mr. DJ has been allowed maximum 3 attempts for qualifying final exams conducted by ICAI. The probabilities that he appears in the 3 attempts are as below:

1 st Attempt	=	0.9	
2 nd Attempt	=	0.8	(If does not qualify in 1 st attempt)
3 rd Attempt	=	0.7	(If does not qualify in 2 nd attempt)

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Probabilities of passing the exams in each of the attempts on individual basis are:

1 st Attempt	=	0.65
2 nd Attempt	=	0.80
3 rd Attempt	=	0.90

You are required to find the probability that he becomes a Qualified CA.

Question 26

A gambler has been given options for playing three games of dice as described below:

Game 1 (G₁)

The gambler wins ₹ 13,000 if the dice shows 1. Entry ticket for this game is ₹ 4,000

Game 2 (G₂)

This game can be played only if game 1 is lost and additional entry ticket of ₹ 1,000 is purchased. The gambler wins ₹ 11,000 if the dice shows 1 or 2.

Game 3 (G₃)

This game can be played only if both of games 1 and 2 are lost and additional entry ticket of ₹ 1,000 is purchased. The gambler wins ₹ 9,000 if the dice shows 1, 2, 3 or 4.

Required:

1. Construct a decision tree for the gambler's options
2. Determine the cumulative costs and cumulative probability of win
3. Identify the strategy the gambler should adopt

Question 27

Big Oil is wondering whether to drill for oil in Westchester Country. The prospects are as follows:

Depth of Well (Feet)	Total Cost Millions of Dollars	Cumulative Probability of Finding Oil	PV of Oil (If Found) Millions of Dollars
2,000	4	0.5	10
4,000	5	0.6	9
6,000	6	0.7	8

Draw a decision tree showing the successive drilling decisions to be made by Big Oil. How deep should it be prepared to drill?

Question 28

Sreenath has been challenged for an IQ Test. The test shall have a series of three papers named as P_1 , P_2 & P_3 with cost of ₹ 3,00,000, ₹ 2,00,000 and ₹ 1,00,000 respectively.

P_2 can be attempted only on failure of P_1

P_3 can be attempted only on failure of P_2

Given below are cumulative probabilities of passing the papers. $P_1 = 0.5$, $P_2 = 0.8$ and $P_3 = 0.95$. The Prize to be awarded shall be ₹ 10,00,000 for passing P_1 , ₹ 8,00,000 for passing P_2 and ₹ 7,00,000 for passing P_3

You are required to construct a decision tree indicating various outcomes and determine individual probabilities of passing each test. Also determine the EMV for each decision and suggest a strategy that can be adopted for maximizing the benefit.

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Question 29

You own an unused Gold mine that will cost ₹ 10,00,000 to reopen. If you open the mine, you expect to be able to extract 1,000 ounces of Gold a year for each of three years.

After that the deposit will be exhausted. The Gold price is currently ₹ 5,000 an ounce, and each year the price is equally likely to rise or fall by ₹ 500 from its level at the start of year. The extraction cost is ₹4,600 an ounce and the discount rate is 10 per cent.

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Required:

1. Should you open the mine now or delay one year in the hope of a rise in the Gold price?
2. What difference would it make to your decision if you could costlessly (but irreversibly) shut down the mine at any stage? Show the value of abandonment option.

Question 30

NJ Ltd. is planning a project that is expected to have a life of 10 years. The estimates of future cash inflows from this project is highly uncertain. The company is to consider simulation technique for estimation of future cash inflows over the life of 10 years. The probability distribution with respect to the cash inflows are as follows:

Annual CF	Probabilities
5,00,000	0.12
6,00,000	0.23
7,00,000	0.34
8,00,000	0.22
9,00,000	0.09

Two digit Random Numbers for the simulation are as follows:

12, 71, 27, 92, 45, 39, 58, 74, 10, 43

Using the Monte Carlo Simulation Technique, make an estimate of cash inflows over the life of 10 years

Question 31

NJ Ltd. is planning a project that has initial investment of ₹ 1,30,000. The estimates of future cash inflows from this project and the project life are highly uncertain.

Cost of Capital is 10%. The company is to consider simulation technique for estimation of future cash inflows and the project life for 10 simulation runs. The probability distribution with respect to these variables are as follows:

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Annual Cash Flow	
Value (₹)	Probability
10,000	0.02
15,000	0.03
20,000	0.15
25,000	0.15
30,000	0.30
35,000	0.20
40,000	0.15

Project Life	
Years	Probability
3	0.05
4	0.10
5	0.30
6	0.25
7	0.15
8	0.10
9	0.03
10	0.02

Consider the following Random Numbers:

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

Ten manual simulation runs are to be performed for the project. To perform this operation, values are generated at random for the two exogenous variables viz., Annual Cash Flow and Project Life. For the first

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simulation run, take two digit random numbers picking the first 2 digits, starting from the 1st Row, 1st Column, (i.e. 53 for Annual Cash Flows and 97 Project Life).

Determine the NPV of the project for each of the 10 simulation runs.

Question 33

Annual cash flow in real terms	₹ 10,000 per annum
Inflation Rate (IR)	10% per annum
Discounting Rate (For real cash flows)	20% per annum
Life of the project	4 Years

You are required to calculate:

1. Money cash flows at end of each year.
2. Money Discounting Rate (MDR)
3. Present Value of Money cash flows using MDR
4. Present Value of Real cash flows using RDR

Question 34

Life of the Project	4 Years
Inflation Rate (IR)	8% per annum
Money Discounting Rate	25% per annum

Expected Money Cash flows are ₹ 20,000, ₹ 24,000, ₹ 26,000 and ₹ 28,000 respectively for 4 years.

You are required to calculate:

1. Real Cash flows for 4 years
2. Real Discounting Rate
3. Present Value of Money cash flows using MDR
4. Present Value of Real cash flows using RDR

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Question 35

KLM Ltd. requires ₹ 15,00,000 for a new project.

Useful life of project is 3 years.

Salvage value - NIL.

Depreciation is ₹ 5,00,000 p.a.

Given below are projected revenues and costs (excluding depreciation) ignoring inflation:

Year	1	2	3
Revenues in ₹	10,00,000	13,00,000	14,00,000
Costs in ₹	5,00,000	6,00,000	6,50,000

Applicable tax rate is 35%. Assume cost of capital to be 14% (after tax). The inflation rates for revenues and costs are as under:

Year	Revenues %	Costs %
1	9	10
2	8	9
3	6	7

PVF at 14%, for 3 years = 0.877, 0.769 and 0.675

Show amount to the nearest rupee in calculations.

You are required to calculate net present value of the project.

Question 36

Cost of the project is ₹ 5,00,000. Internal Rate of Return (For real cash flows) is 15%. Real cash flows increase constantly at 25% of previous year's real cash flows and the inflation rate is 10%. Calculate Money cash flows for 5 years assuming that the life of the project is also 5 years.

End of Capital Budgeting - Part 2

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