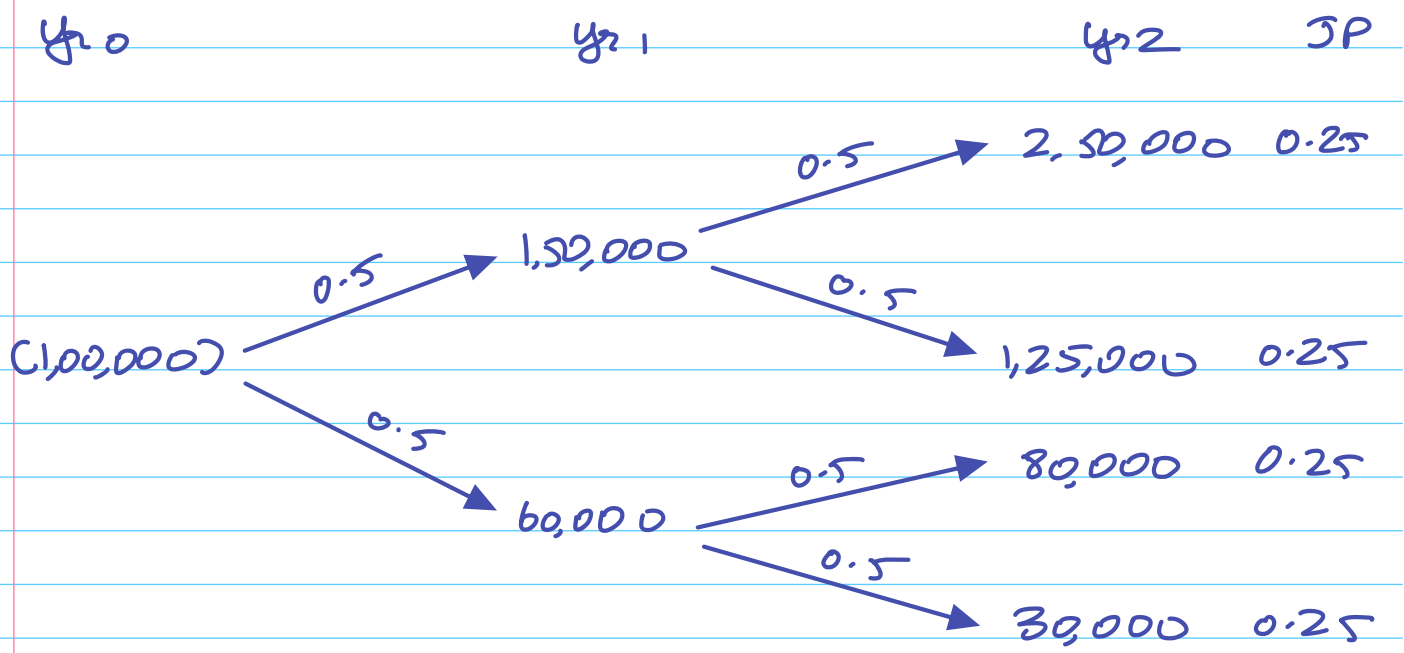
Derivatives
Abandonment Option

(D) Abandonment Option

Eg: We need to Invest ₹1,00,000 in a Project today. Life of Project is 2 years. In year 1, Project can give CI of either 1,50,000 [P=0.5] or 60,000 [P=0.5]
If in yr 1, CI = 1,50,000 then in yr 2, Project can give CI of either 2,50,000 [P=0.5] or 1,25,000 [P=0.5].
If in yr 1, CI = 60,000 then in yr 2, Project can give CI of either 80,000 [P=0.5] or 30,000 [P=0.5].
Calculate NPV, if COC = 10%.

Binomial Tree:



Step 1: Calculation of Avg CI at end of yrs 1 & 2

Year 1			Year 2		
CI (x)	P	Px	CI (x)	P	Px
1,50,000	0.5	75,000	2,50,000	0.25	
60,000	0.5	30,000	1,25,000	0.25	
		1,05,000	80,000	0.25	
			30,000	0.25	
					1,21,250

Step 2: Calculation of NPV:

Yr	CF	DF @ 10%	PV
0	(1,00,000)	1	
1	1,05,000	0.909	
2	1,21,250	0.826	
		NPV @ 10%	95,598

Recalculate NPV, if we have an Option to Abandon the Project for ₹ 1,20,000.

NOTE: Abandonment can't be exercised at yr 0 or yr 2.
Only check if feasible to abandon in yr 1

If in yr 1,

⊙ if CI = 1,50,000

⟶ If we Don't Abandon,

$$PV \text{ of } CI = \frac{2,50,000 \times 0.5 + 1,25,000 \times 0.5}{(1.1)^1}$$

$$= 1,70,455$$

⟶ If we Abandon,

$$PV \text{ of } CI = 1,20,000 \times 1$$

$$= 1,20,000$$

∴ we should NOT Abandon the Project if $CI_1 = 1,50,000$.

⊙ if CI = 60,000

⟶ If we Don't Abandon,

$$PV \text{ of } CI = \frac{80,000 \times 0.5 + 30,000 \times 0.5}{(1.1)^1}$$

$$= 50,000$$

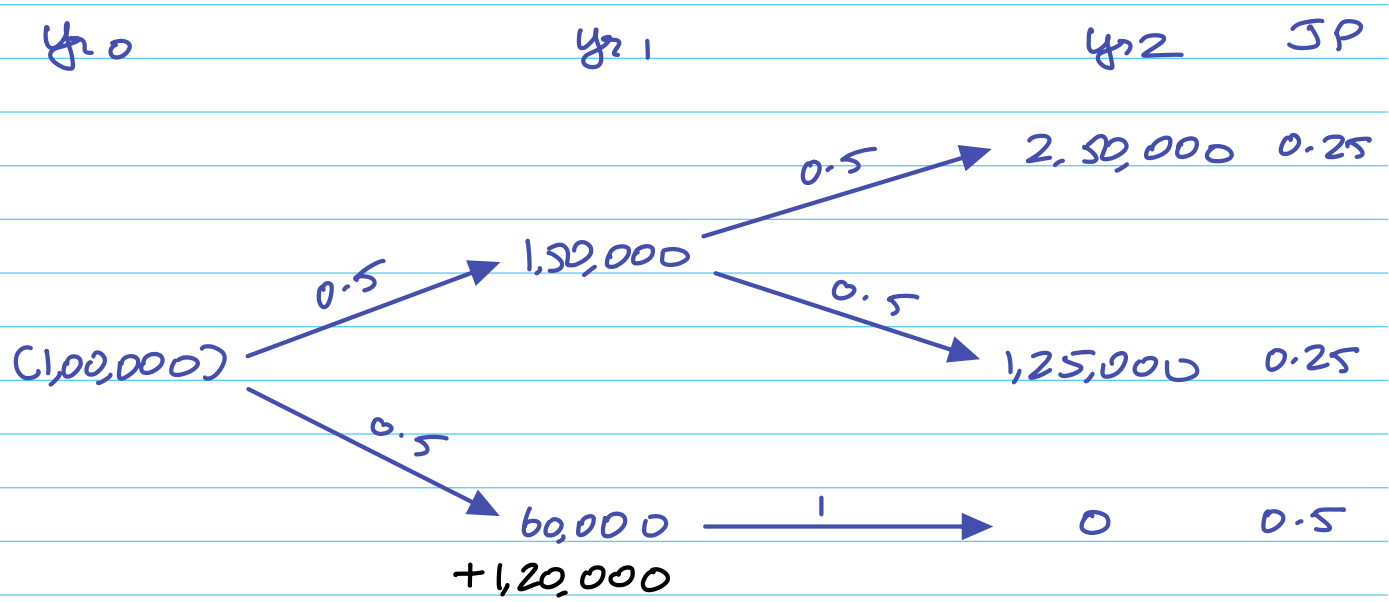
⟶ If we Abandon,

$$PV \text{ of } CI = 1,20,000 \times 1$$

$$= 1,20,000$$

∴ we should Abandon the Project if $CI_1 = 60,000$.

Revised Binomial Tree :



Calculation of Revised NPV :

Step 1 : Cal. of Avg CI at end of yrs 1, 2 :

Yr 1			Yr 2		
CI(x)	P	Px	CI(x)	P	Px
1,50,000	0.5		2,50,000	0.25	
1,80,000	0.5		1,25,000	0.25	
		1,65,000	0	0.5	93,750

Step 2 : Cal. of NPV

Yr	CF	DF @ 10%	PV
0	(1,00,000)	1	
1	1,65,000	0.909	
2	93,750	0.826	
		NPV @ 10%	1,27,423

∴ Value of Abandonment option =
1,27,423 − 95,598
= 31,825

Calculation of Abandonment Option, Using Binomial Risk Neutral Model.

∵ Abandonment Option is a RIGHT to SELL, it resembles a Put Option.

Value of Put on Due Date :

If $S_1 < K$, Put is ITM ; $P_1 = K - S_1$

If $S_1 \geq K$, Put is OTM/ATM ; $P_1 = 0$

Calculation of P_1 at end of yr 1 :

If $CI_1 = 1,50,000$:

S_1	K
↓	↓
PV of Future CIs = 1,70,455	1,20,000

∵ $S_1 > K$, Put is OTM & will be Lapsed.

$Put_v = 0$

If $CI_1 = 60,000$:

S_1	K
↓	↓
PV of Future CIs = 50,000	1,20,000

∵ $S_1 < K$, Put is ITM & will be Lapsed.

$Put_d = K - S_1$ i.e. 1,20,000 − 50,000 = 70,000

Calculation of P_0 :

$$P_0 = \frac{Put_u \times P_u + Put_d \times P_d}{(1+r_f)}$$

$$= \frac{0 \times 0.5 + 70,000 \times 0.5}{(1.1)^1}$$

$$= 31,818 \longrightarrow \text{Value of Put Option}$$

↓

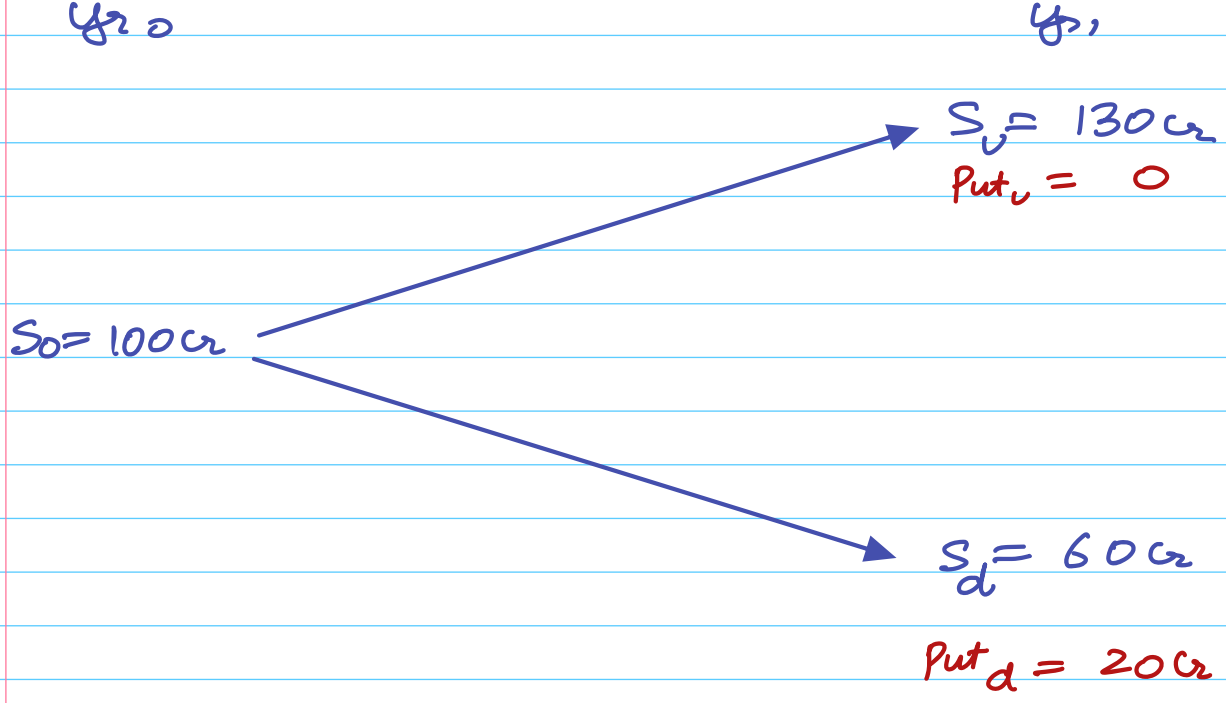
Value of Abandonment option

Revised NPV = Base NPV + Value of AO

= 95,598 + 31,818

= 1,27,416

Q.38) Binomial Tree



Step 1 : Identify S_u & S_d

$S_u = 100 Cr + 30\% = 130 Cr$
$S_d = 100 Cr - 40\% = 60 Cr$

Step 2 : Abandonment option is a RIGHT to Sell i.e. Put option, with $K = 80 Cr$.

$Put_u = 0$ [∵ OTM]

$Put_d = K - S_1$ [∵ ITM]
$= 80 - 60$
$= 20 Cr$

Step 3 : Calculation of p_u & p_d

$u = \frac{130 Cr}{100 Cr} = 1.3$

$d = \frac{60 Cr}{100 Cr} = 0.6$

$p_u = \frac{(1+r)^n - d}{u - d}$

$= \frac{(1.08)^1 - 0.6}{1.3 - 0.6}$

$= 0.6857$

& $p_d = 1 - 0.6857$
$= 0.3143$

Step 4 : $p_0 = \frac{Put_u \times p_u + Put_d \times p_d}{(1+r)^n}$

$= \frac{0 \times 0.6857 + 20 Cr \times 0.3143}{(1.08)^1}$

$= 5.82 Cr$

This is the value of abandonment option (Put Option).