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Crashing of project N/w

① Consider the data of a project as shown in the following table:-

Activity	Normal time (weeks)	Normal cost (Rs)	Crash time (weeks)	Crash cost (Rs)
1-2	7	700	4	850
1-3	5	500	3	700
1-4	8	600	5	1,200
2-5	9	800	7	1,250
3-5	5	700	3	1,000
3-6	6	1,100	5	1,300
4-6	7	1,200	5	1,450
5-7	2	400	1	500
6-7	3	500	2	850

If the indirect cost per week is Rs. 200, find the optimal crashed project completion time.

→ Step 1:- find the slope.

$$\text{Slope} = \frac{\text{Crashed cost} - \text{Normal cost}}{\text{Normal time} - \text{Crashed time}}$$

Activity	Normal time	Normal cost	Crash time	Crash cost	slope
1-2	7	700	4	850	50
1-3	5	500	3	700	100
1-4	8	600	5	1200	200
2-5	9	800	7	1250	225
3-5	5	700	3	1000	150
3-6	6	1100	5	1300	200
4-6	7	1200	5	1450	125
5-7	2	400	1	500	100
6-7	3	500	2	850	350

$$\text{Slope } (1\text{-}2) = \frac{850 - 700}{7 - 4} = \frac{150}{3} = 50$$

Now, draw network diagram.

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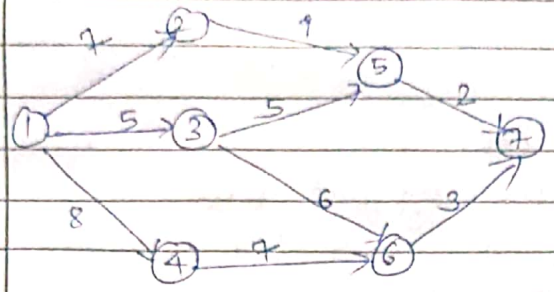
Iteration 1:-



List down possible paths with durations

1-2-5-7 = 7+4+2 = (18) → C.P
1-3-5-7 = 5+5+2 = 12
1-3-6-7 = 5+6+3 = 14
1-4-6-7 = 8+7+3 = (18) → C.P

Among these possible paths, get the path with max. duration. Here, we have got two critical paths

∴ Normal project completion time = 18 weeks
Critical path 1 = 1-2-5-7
Critical path 2 = 1-4-6-7

Σ Normal cost = Total direct Normal cost.
∴ Total direct Normal cost = Rs. 6500
Indirect cost = (18) × 200 = 3,600
(18) ↑ C.P duration; 200 ↑ provided
Total 10,100

∴ Total cost = Rs. 10,100

Find Crash limit & slope for critical path.

Crash limit = Crash time − Normal time

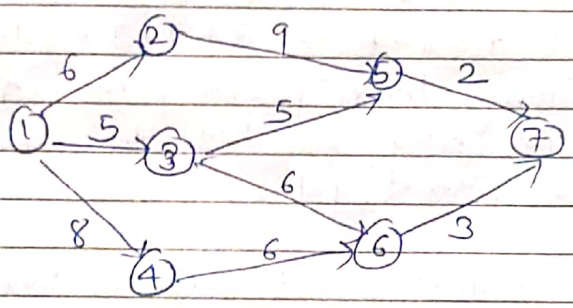
Critical path	Critical activity	Crash limit	Cost slope	
1-2-5-7	1-2	3	(50)	→ min
	2-5	2	225	
	5-7	1	100	
1-4-6-7	1-4	3	200	
	4-6	2	(125)	→ min
	6-7	2	350	

- Find the least slope value for each path.
- Always crash activity by one week only.

for C.P 1-2-5-7, reduce activity 1-2 by one week.
for C.P 1-4-6-7, reduce activity 4-6 by one week.

Iteration 2 -

- Draw network diagram again with new times for activity 1-2 & 4-6



List down all paths again.

1-2-5-7 = 6+9+2 = (17) → C.P.
1-3-5-7 = 5+5+2 = 12
1-3-6-7 = 5+6+3 = 14
1-4-6-7 = 8+6+3 = (17) → C.P.

Normal project completion time = 17 weeks
critical path1 = 1-2-5-7
critical path2 = 1-4-6-7

Take the total cost from iteration 1,
Total cost = 10,100

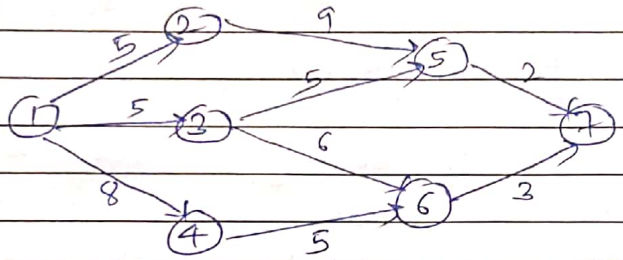
T.C = pre. total cost + direct cost (Slope cost) − indirect cost

For C.P T.C = 10,100 + [50+125] − 200
= 10,075

After crashing → This total cost should be lesser than prev. total cost)

Critical path	Critical activity	Crash limit	Cost Slope
1-2-5-7	1-2	2	(50) → min.
	2-5	2	225
	5-7	1	100
1-4-6-7	1-4	3	200
	4-6	1	(125) → min
	6-7	1	350

Iteration 3 –



1 – 2 – 5 – 7 = 5 + 9 + 2 = (16) → C.P

1 – 3 – 5 – 7 = 5 + 5 + 2 = 12

1 – 3 – 6 – 7 = 5 + 6 + 3 = 14

1 – 4 – 6 – 7 = 8 + 5 + 3 = (16) → C.P

∴ Normal project completion time = 16 weeks

Critical path 1 = 1-2-5-7

Critical path 2 = 1-4-6-7

T.C = pre. total cost + direct cost (Slope cost) – indirect cost

= 10,075 + [50 + 125] – 200

= 10,050

Closer than prev., so move towards next iteration

Critical path	Critical activity	Crash limit	Cost Slope
1-2-5-7	1-2	1	(50) → min
	2-5	2	225
	5-7	1	100
1-4-6-7	1-4	3	(200) → min
	4-6	0	125 → we can't crash as limit is 0
	6-7	1	350

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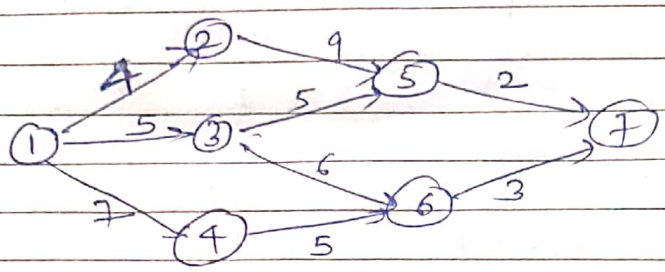
Itration 4 –



1-2-5-7 = 4+9+2 = (15) → C.P

1-3-5-7 = 5+5+2 = 12

1-3-6-7 = 5+6+3 = 14

1-4-6-7 = 7+5+3 = (15) → C.P

∴ Normal project completion time = 15 weeks.

T.C = 10,050 + [50 + 200] − 200

= 10,100

This is greater than prev. ituation cost, so stop the procedure. We can conclude that prev. ituation solution will be the optimum solution.

∴ The project completion time = 16 weeks with the total cost of Rs 10,050. & the critical paths are 1-2-5-7 & 1-4-6-7.