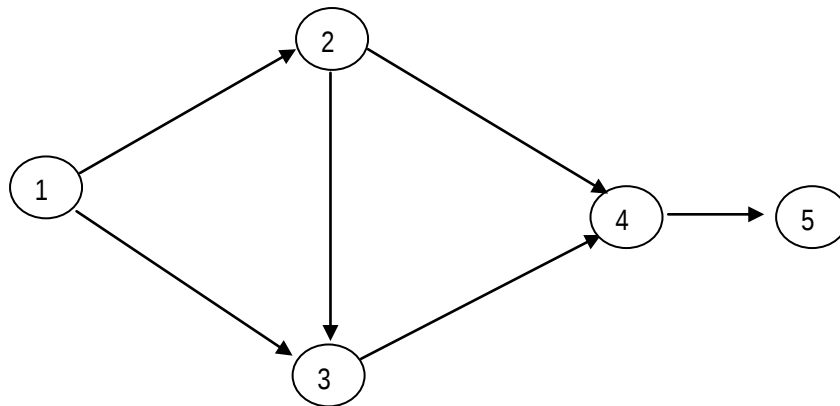


PROGRAMME EVALUATION AND REVIEW TECHNIQUE

Question 1

The normal time, crash time and crashing cost per day are given for the following network:



Activity	Normal time (days)	Crash time (days)	Crashing cost (Rs./day)
1 - 2	18	14	40
1 - 3	23	22	20
2 - 3	8	5	60
2 - 4	10	6	40
3 - 4	3	2	80
4 - 5	8	6	50

- (i) Crash the project duration in steps and arrive at the minimum duration. What will be the critical path and the cost of crashing?

- (ii) If there is an indirect cost of Rs. 70 per day, what will be the optimal project duration and the cost of crashing? (10 Marks) (Nov., 2008)

Answer

- (i) Critical path

1 – 2 – 3 – 4 – 5 37 days

Paths:

		Normal	Crash
1 – 2 – 4 – 5		36	26
1 – 2 – 3 – 4 – 5		37	27
1 – 3 – 4 – 5		34	30

	Crash Activity	Days,	Cost
Step I	1 – 2	1	40
II	1 – 2	1	40
III	4 – 5	1	50
IV	4 – 5	1	50
V	2 – 3	1	60
VI	1 – 2 & 1 – 3	<u>1</u>	<u>60</u> (40 + 20)
		<u>6</u>	<u>300</u>

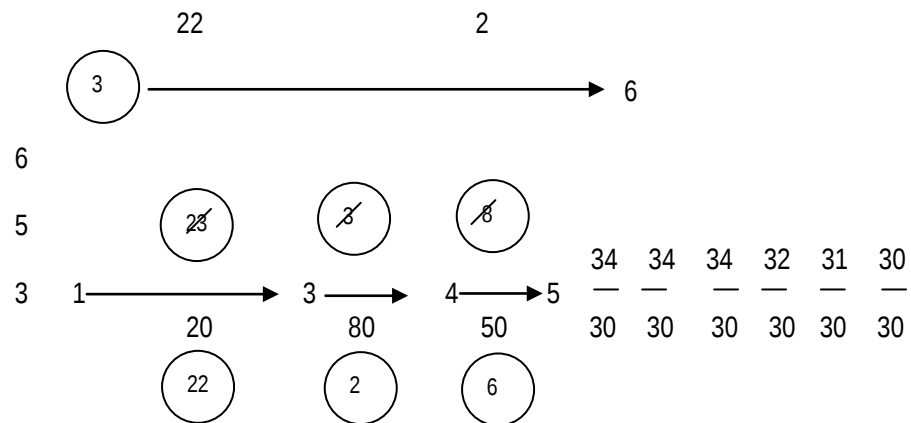
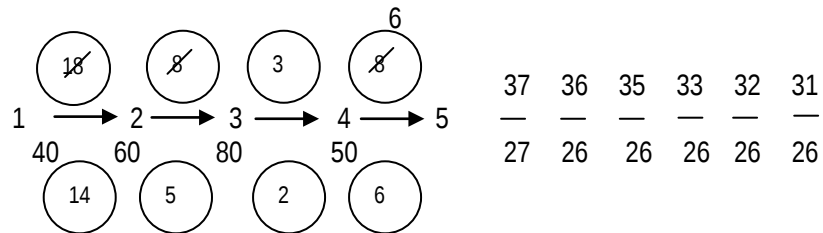
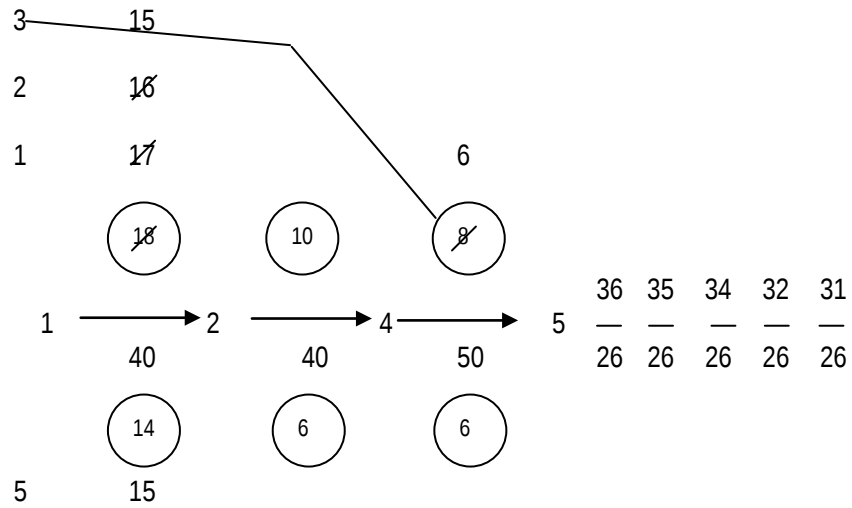
Revised critical paths : $\begin{matrix} 1-2-4-5 & \ddot{u} \\ 1-2-3-4-5 & \ddot{y} \\ 1-3-4-5 & \dot{p} \end{matrix}$ 31 days

VII 1 – 2 & 3 – 4 (40 + 80) $\frac{120}{420}$ 30 days

But VII is not done if indirect cost = 70, which is < 120.

(ii) Project duration is 31 days and cost of crashing is 300.

Workings of Crashing:



Critical Path : 1 - 2 - 3 - 4 - 5 (37 days) Crashing cost

(1)	1 - 2	1 day	40
(2)	1 - 2	1 day	40
(3)	4 - 5	2 days	100
(4)	2 - 3	1 day	60
(5)	1 - 2 & 1 - 3	1 day (40 + 20)	<u>60</u>
			<u>300</u>

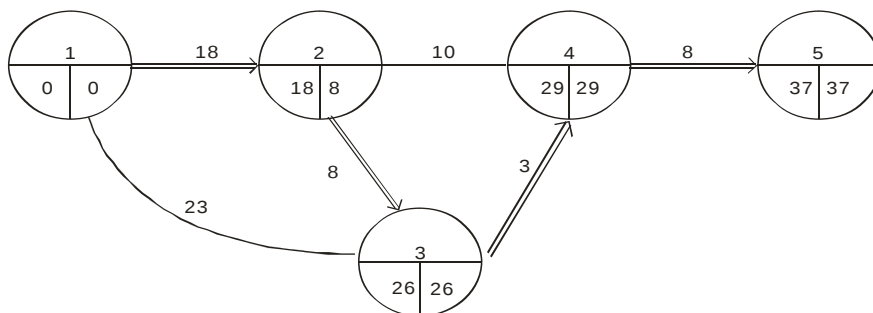
Revised critical Path : 1 - 2 - 4 - 5
 1 - 2 - 3 - 4 - 5
 1 - 3 - 4 - 5

Duration 31 days

(Note: After each crashing a networking diagram has to be drawn and critical path has to be decided).

Alternative Solution:

(i) Network Diagram:



Project duration = 37 days.

Critical Paths :

(i) 1 → 3 → 4 → 5

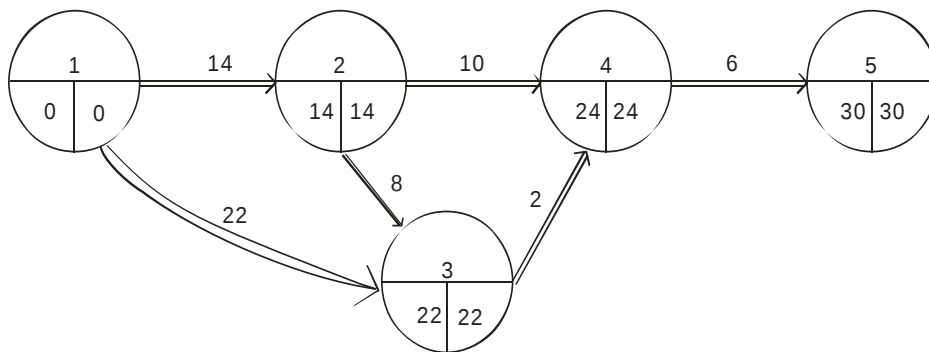
(ii) 1 - 2 - 3 - 4 - 5

Crashing by Steps

Step : 1	Crash activity	Crashing No. of days	Crash cost per day (Rs.)	Crashing cost (Rs.)
	1 - 2	3	40	120

Step : 2	1- 2	1	40	40
	1- 3	1	20	20
Step : 3	4- 5	2	50	100
Step : 4	3- 4	1	80	<u>80</u>
				<u>360</u>

Revised Network



Effective crashing days = 7

Critical Paths:

- (i) 1 - 2 - 4 - 5
- (ii) 1 - 3 - 4 - 5
- (iii) 1 - 2 - 3 - 4 - 5

Project duration = 30 days

Crashing cost = Rs. 360

- (ii) For optimal project duration, we have to consider indirect cost per day i.e., Rs. 70. The crashing cost of activity 3-4 is Rs. 80 which is higher than indirect cost per day. Hence, we may opt it out (Step 4).

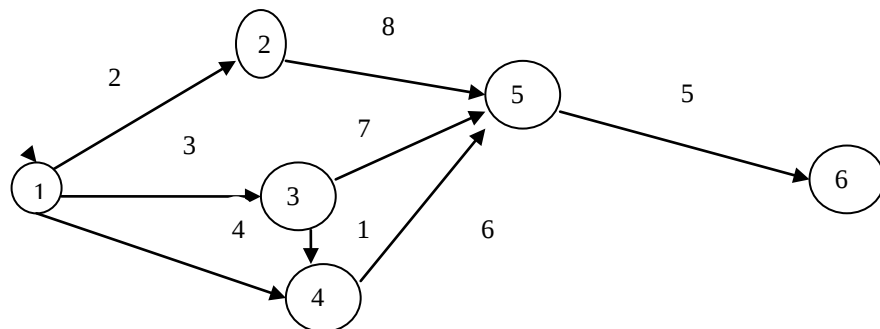
In that case, project duration = 31 days.

Crashing cost = Rs. 280.

Saving in indirect cost = 6 × Rs. 70 = Rs. 420.

Question 2

The following network gives the duration in days for each activity :



- (i) You are required to list the critical paths.
- (ii) Given that each activity can be crashed by a maximum of one day, choose to crash any four activities so that the project duration is reduced by 2 days. (6 Marks)(Nov.,2009)

Answer

Critical Paths:

All are critical paths:

- (i) 1 – 2 – 5 – 6 2 + 8 + 5 = 15
- (ii) 1 – 3 – 5 – 6 3 + 7 + 5 = 15
- (iii) 1 – 4 – 5 – 6 4 + 6 + 5 = 15
- (iv) 1 – 3 – 4 – 5 – 6 3 + 1 + 6 + 5 = 15

- (i) Choose 5 – 6, common path;

Crash by 1 day

- (ii) Choose: 1 – 2, 1 – 3, 1 – 4

Or

- (iii) Choose: 1 – 2, 3 – 5, 4 – 5

Or

- (iv) Choose: 2 – 5, 3 – 5, 4 – 5

Or

- (v) Choose: 1 – 3, 1 – 4, 2 – 5