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CLASS TEST

CIVIL ENGINEERING

Date of Test : 10/10/2021

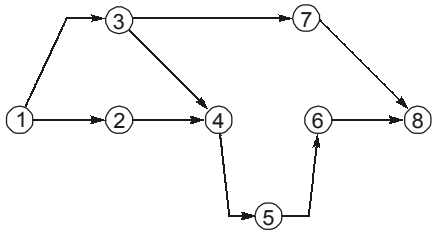
ANSWER KEY ➤ Construction Practice, Planning & Management

1.	(c)	7.	(a)	13.	(c)	19.	(d)	25.	(b)
2.	(a)	8.	(b)	14.	(b)	20.	(d)	26.	(d)
3.	(b)	9.	(d)	15.	(b)	21.	(c)	27.	(b)
4.	(b)	10.	(d)	16.	(b)	22.	(c)	28.	(b)
5.	(c)	11.	(b)	17.	(b)	23.	(c)	29.	(c)
6.	(a)	12.	(c)	18.	(a)	24.	(b)	30.	(d)

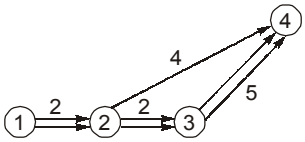
DETAILED EXPLANATIONS

1. (c)

There is an extra dummy between events (7) and (8).
There are two arrows joining events (2) and (4).
There is extra dummy connecting nodes (4) and (6).
The correct diagram will be as shown below
So there are three errors.



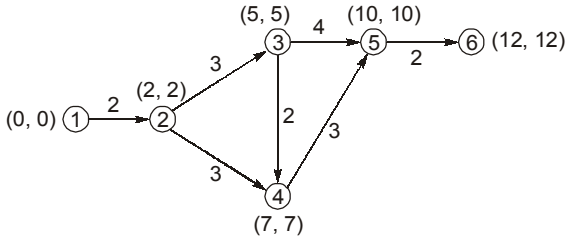
2. (a)



Critical path = 1 – 2 – 3 – 4

The sum of crash times along the critical path = 2 + 2 + 5 = 9 days.

3. (b)



Independent float = $(T_{Ej} - T_{Li}) - t_{ij}$

$(I_D)_{3\text{-}5} = (10 - 5) - 4 = 1$

5. (c)

$\bar{X} = 17 + 15 + 8 = 40$ days

S.D. = $\sqrt{4 + 4 + 1} = 3$

$$Z = \frac{X - \bar{X}}{\sigma} = \frac{43 - 40}{3} = 1$$

$\therefore$ $P(1) = 0.8413$ or 81.4%

6. (a)

In PERT analysis,

Activity duration $T_e = \dfrac{T_0 + 4T_m + T_p}{6}$ is beta distributed and project duration is normally distributed.

8. (b)

Rules for drawing Network Diagram:

(i) Each activity is represented by one and only one arrow in the network.

(ii) No two activities can be identified by the same beginning and end events.

(iii) In order to ensure the correct precedence relationship in the arrow diagram, following question must

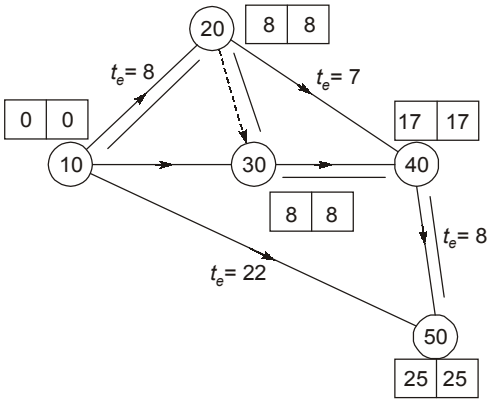
be checked whenever any activity is added to network.

(a) Which activity must be completed immediately before this activity can start?

(b) Which activity must follow this activity?

(c) Which activity must occur simultaneously with this activity?

9. (d)



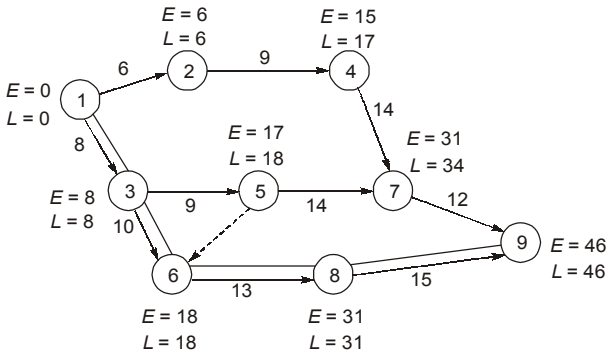
Critical path is given by 10 - 20 - 30 - 40 - 50

∴ The earliest expected occurrence time (T_E) for the event 50 is 25 days.

11. (b)

Dummy activity does not consume time or resources. It is used to maintain the logical sequence. It is used in a network to satisfy precedence requirement.

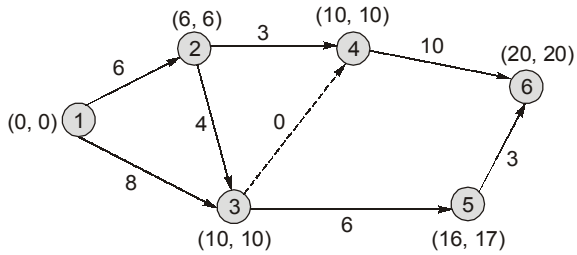
12. (c)



13. (c)

Planning is the most important phase of project management planning involves defining the objectives of a project, listing of tasks, or jobs that must be performed, determining gross requirement for material, manpower and preparing estimate of costs and durations for various activities to bring about satisfactory completion of project.

14. (b)



total float = $L_j - (E_i + t_{ij})$ = 17 – (10 + 6) = 1 day

15. (b)

- Critical path shows shortest duration needed to complete the project.
- Critical path is longest duration permissible in network.

16. (b)

Concurrent activities are those which either originate from a single node or terminate into single node. They are mutually independent as the starting or completion of these activities doesn't depend on each other.

The length of arrow doesn't has any significance. Length of arrow facilitates in easy visualization of the network and is adopted as per user.

Nodes are numbered as per Fulkerson's rule and it goes on increasing in the direction of project progress through every path.

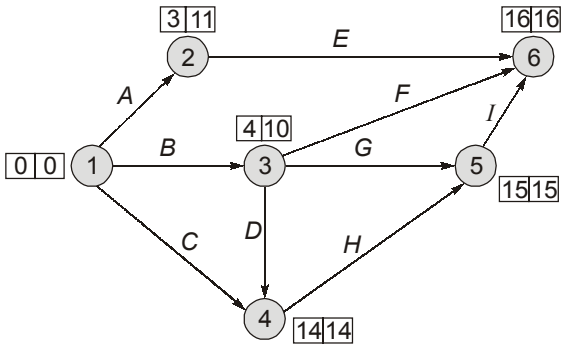
17. (b)

2 and 3

Ladder networks are mostly used for repititive activities so each origianal activity is split into same number of sequenced sub-activities.

18. (a)

The earliest expected time of each event is calculated and shown in the network below:



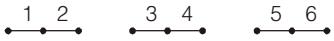
For activity H, latest finish time is 15 days.

19. (d)

Case I:

Case II:

After clubbing the activities



$$\text{Std. deviation of individual activities} = \frac{10-4}{6} = 1 \text{ (before clubbing)}$$

$$\therefore \quad \text{Std. deviation of whole project in case-I} = \sqrt{1^2+1^2+1^2+1^2+1^2+1^2} = \sqrt{6}$$

$$\text{Std. deviation of individual activities after clubbing} = \sqrt{1^2+1^2} = \sqrt{2}$$

$$\therefore \quad \text{Std. deviation of whole project in case-II } (X_2) = \sqrt{(\sqrt{2})^2+(\sqrt{2})^2+(\sqrt{2})^2} = \sqrt{6}$$

$$\therefore \quad \frac{x_2}{x_1} = \frac{\sqrt{6}}{\sqrt{6}} = 1$$

20. (d)

Let quantity of excavation done manually be H

Let quantity of excavation done by machine be M

Then, $H + M = 4000$ cum

Total cost : $T = 3 \times 20 \times H + 0.2 \times 500 \times M$

$T = 60\ H + 100\ M$

By trial and error:

$H = 1500$; $M = 2500$ $\quad T = 340000$

$H = 1800$; $M = 2200$ $\quad T = 328000$

$H = 2250$; $M = 1750$ $\quad T = 310000$

$H = 2500$; $M = 1500$ $\quad T = 300000$

21. (c)

- Critical path has a total float of 0.
- Slack time is associated with an event.

22. (c)

Project duration, T = 7 + 6 + 11 + 14 + 5

= 43 days

Variance = $2^2 + 2^2 + 3^2 + 4^2 + 1^2 = 34$

Standard deviation $\sigma = \sqrt{34} = 5.8$ days

Range of project duration = (Minimum time, Maximum time)

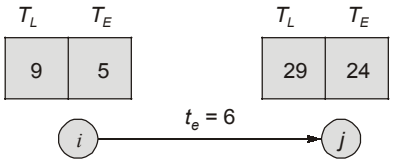
Minimum time = $T - 3\sigma = 25.6$ days

Maximum time = $T + 3\sigma = 60.4$ days

23. (c)

$$t_e = \frac{t_0 + 4t_m + t_p}{6} = \frac{5 + 4 \times 15 + 60}{6} = 20.83 \text{ minutes.}$$

24. (b)



(Duration in days)

$F_T = T_L^j - T_E^i - t_e^{ij} = 29 - 5 - 6 = 18$ days

$F_F = T_E^j - T_E^i - t_e^{ij} = 24 - 5 - 6 = 13$ days

$F_{ID} = T_E^j - T_L^i - t_e^{ij} = 24 - 9 - 6 = 9$ days

$F_{IF} = F_T - F_F = 18 - 13 = 5$ days

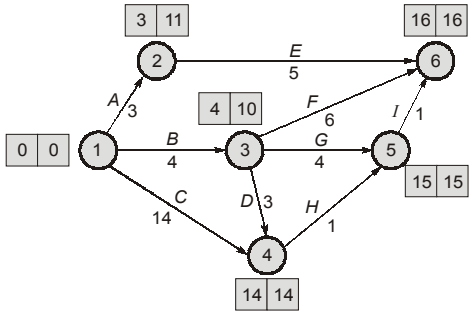
25. (b)

In A-O-N network, there is no place for dummy activity and events.

1-6 and 3-6 is logically redudnant in the network.

26. (d)

The earliest expected time of each event is calculated and shown in the network below.



For activity *H*, latest finish time is 15 days.

27. (b)

$$t_L = 10,\ t_0 = 8 \text{ and } t_P = 14$$

$$\sigma = \frac{t_P - t_0}{6} = \frac{14 - 8}{6} = 1$$

Duration with a probability of 95% $= t_L + \sigma \times z = 10 + 1 \times 1.6$

$= 11.6$ weeks

28. (b)

$$\text{Cost slope} = \frac{\text{Crash cost - Normal cost}}{\text{Normal time - Crash time}}$$

$$\text{Crash cost} = 75 \times (10 - 8) + 350 = ₹500$$

29. (c)

Let σ be the standard deviation for the whole project.

$$\sigma_{AB} = \frac{12 - 6}{6} = 1$$

$$\sigma_{BC} = \frac{12 - 4}{6} = 1.33$$

$$\sigma_{CD} = \frac{8}{6} = 1.33$$

$$\sigma = \sqrt{\sigma_{AB}^2 + \sigma_{BC}^2 + \sigma_{CD}^2} = 2.13$$

Expected time of project completion:

$$t_E = \frac{12 + 4 \times 8 + 6}{6} + \frac{12 + 4 \times 5 + 4}{6} + \frac{3 + 4 \times 4 + 11}{6}$$

$= 8.33 + 6 + 5 = 19.33$

Range $= 19.33 \pm 3\sigma = 19.33 \pm 6.39 = 12.94$ to 25.72 days

30. (d)

SPCAF for 10% for 3 years $= 1.3310$

$$\text{CRF for 10\% for 3 years} = \frac{i \times SPCAF}{SPCAF - 1} = \frac{0.1 \times 1.3310}{0.3310} = 0.40211$$

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