CLASS TEST

Sl. : 01IGCE_GHIJ_30072024

MADE EASY

India's Best Institute for IES, GATE & PSUs

Delhi | Bhopal | Hyderabad | Jaipur | Pune | Kolkata

Web: www.madeeasy.in | **E-mail:** info@madeeasy.in | **Ph:** 011-45124612

CPMT-PERT

CIVIL ENGINEERING

Date of Test : 30/07/2024

ANSWER KEY

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

DETAILED EXPLANATIONS

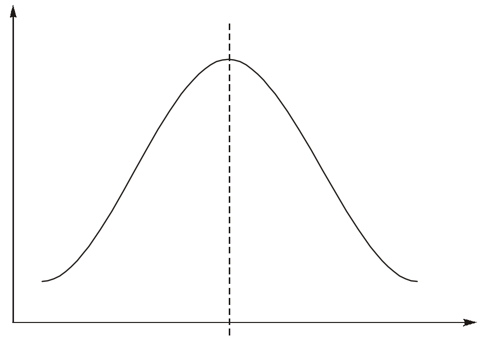
1. **(a)**

$$\text{Sinking fund factor} = \frac{i}{(1+i)^n - 1}$$

$$i = 6\% \; n = 6 \text{ years,}$$

$$\therefore \quad \text{SFF} = \frac{0.06}{(1+0.06)^6 - 1} = 0.1433 \simeq 0.14$$

2. **(a)**



For $Z > 0$ $\quad p > 50\%$

$Z = 0$ $\quad p = 50\%$

$Z < 0$ $\quad p < 50\%$

3. **(d)**

Gantt chart indicates comparison of actual progress with the scheduled progress.

4. **(a)**

5. **(b)**

6. **(d)**

7. **(c)**

8. **(c)**

Capital recovery factor,

$$\text{CRF} = \frac{i(1+i)^n}{(1+i)^n - 1}$$

$$= \frac{0.06 \times (1+0.06)^8}{(1+0.06)^8 - 1} = 0.1610$$

9. **(b)**

10. **(a)**

$$t_e = \frac{(t_0 + 4t_m + t_p)}{6}$$

$$= \frac{(6 + 4 \times 11 + 16)}{6} = 11 \text{ days}$$

11. (c)

$$Z = \frac{T_S - T_E}{\sigma}$$

Z normal deviate	1.1	1.2	1.3
%Probability	86.43	88.49	90.32

Value of Z for 90% probability.

$$\frac{1.3 - 1.2}{90.32 - 88.49} = \frac{1.3 - Z_{90}}{90.32 - 90}$$

$\Rightarrow$ $Z_{90} = 1.2825$

Using, $T_E = 45$ weeks

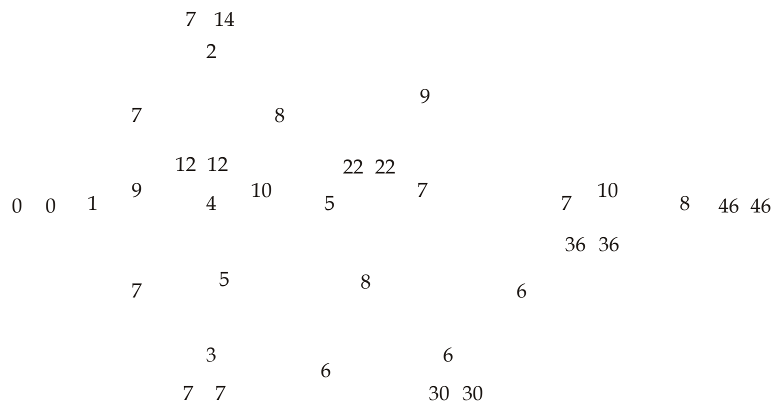
$\sigma = \sqrt{V}$

$\Rightarrow$ $\sigma = \sqrt{12.25} = 3.5$

$\therefore$ $Z_{90} = 1.2825 = \dfrac{T_S - 45}{3.5}$

$\simeq$ $T_S = 49.489 \text{ weeks} \simeq 50 \text{ weeks}$

12. (a)



Path	**Days**
1–2–8	16
1–2–5–7–8	32
1–2–5–6–7–8	39
1–4–5–7–8	36
1–4–5–6–7–8	43
1–3–4–5–7–8	39
→ 1–3–4–5–6–7–8	46 (Critical path)

1–3–6–7–8 29

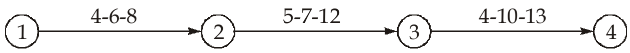
$$(TF)_{2\text{-}5} = 22 - 7 - 8 = 7 \text{ days}$$

$$(FF)_{3\text{-}6} = (TF)_{3\text{-}6} - (\text{Slack})_6$$

$$= (30 - 7 - 6) - (30 - 30)$$

$$= 17 \text{ days}$$

13. (b)



$$(t_E)_{1\text{-}2} = \frac{4 + 4 \times 6 + 8}{6} = 6 \text{ days}$$

$$(t_E)_{2\text{-}3} = \frac{5 + 4 \times 7 + 12}{6} = 7.5 \text{ days}$$

$$(t_E)_{3\text{-}4} = \frac{4 + 4 \times 10 + 13}{6} = 9.5 \text{ days}$$

$$(t_E)_{\text{project}} = t_{E_1} + t_{E_2} + t_{E_3} = 23 \text{ days}$$

$$\sigma_{1\text{-}2} = \frac{8 - 4}{6} = \frac{2}{3}$$

$$\sigma_{2\text{-}3} = \frac{12 - 5}{6} = \frac{7}{6}$$

$$\sigma_{2\text{-}3} = \frac{13 - 4}{6} = \frac{9}{6} = \frac{3}{2}$$

$$\sigma_{\text{project}} = \sqrt{\sigma_{1-2}^2 + \sigma_{2-3}^2 + \sigma_{2-3}^2}$$

$$= \sqrt{\left(\frac{2}{3}\right)^2 + \left(\frac{7}{6}\right)^2 + \left(\frac{3}{2}\right)^2}$$

$$= \sqrt{0.444 + 1.3611 + 2.25}$$

$$= 2.0137$$

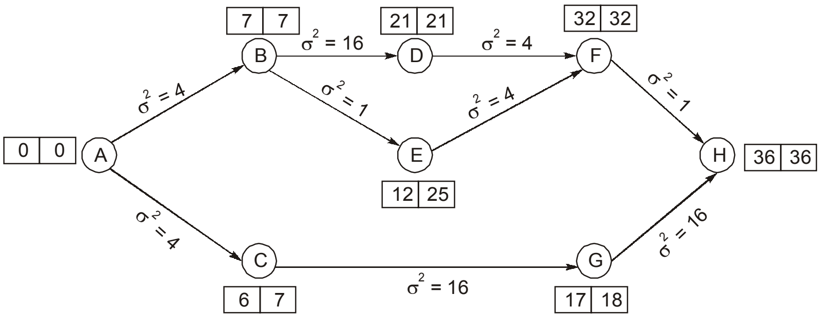
Maximum expected time for project completion

$$= \mu + 3\sigma$$

$$= 23 + 3 \times 2.0137$$

$$= 29.0411 \text{ days} \simeq 29 \text{ days}$$

14. (b)



Standard deviation of project,

$$\sigma = \sqrt{4+16+4+1} = 5 \text{ days}$$

$$Z = \frac{T_S - T_E}{\sigma} = \frac{31-36}{5} = -1$$

Thus, $P(t \leq 31) = P(Z \leq -1)$

$= 0.5 - \phi(1) = 0.5 - (0.8413 - 0.5)$

$= 0.1587 = 15.87\%$

15. (a)

Total volume of earth work in excavation,

$$V = L \times B \times H$$

$$H = 800 + 300 + 300 + 60$$

$$= 1460 \text{ mm}$$

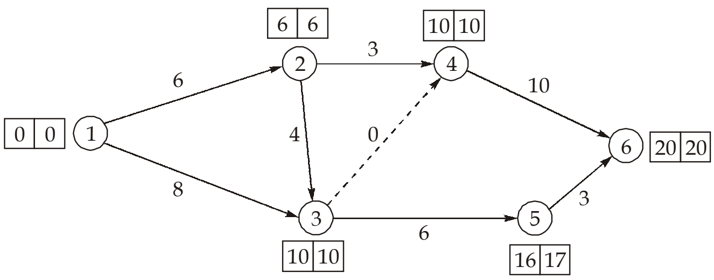
$$B = 2000 \text{ mm}$$

$L = 1000$ mm ($\because$ Per meter length of footing is required)

$$V = \frac{1460 \times 2000 \times 1000}{10^9} \text{ m}^3$$

$$= 2.92 \text{ m}^3$$

16. (b)



Critical path is $1 \rightarrow 2 \rightarrow 3 \rightarrow 4 \rightarrow 6$

$\because$ Variance = 4

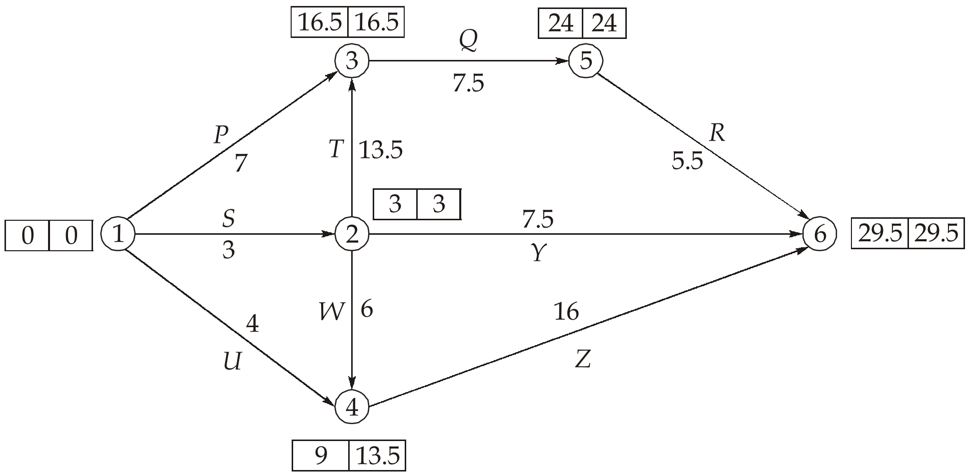
$\therefore$ Standard deviation = $\sqrt{\text{Variance}} = 2$

$$Z = \frac{X - \bar{X}}{2} = \frac{24-20}{2} = 2$$

$\therefore$ From given table,

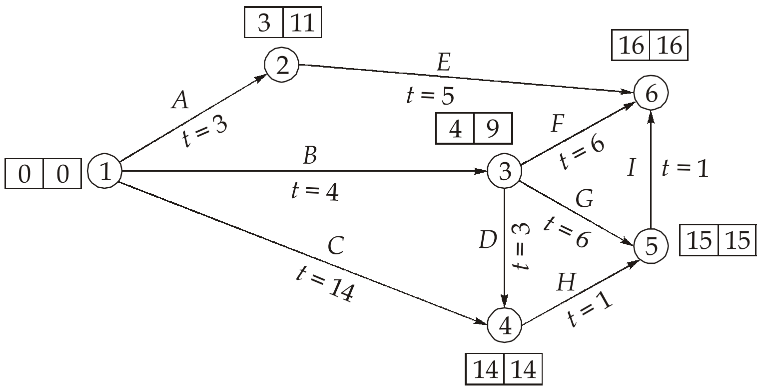
Probability $(Z = 2) = 97.92\%$

17. (d)



50% probability corresponds to time required for all activities to be completed along critical path i.e., 29.5 days.

18. (a)



$$F_T = T_L^j - T_E^i - t_{ij}$$

$\therefore \quad (F_T)_D = 14 - 4 - 3$

$= 7$ days

19. (d)

Limitation of bar chart:

(i) Lack of degree of details

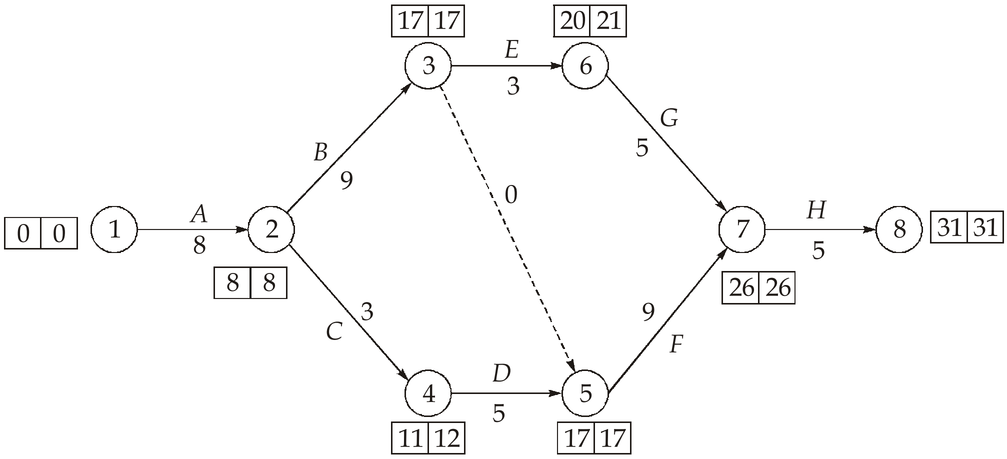
(ii) Review of project progress

(iii) It does not show interdependencies and relationship between various activities of the project.

(iv) Time uncertainties

(v) It does not indicate the critical activities of the project.

20. (d)



21. (b)

Duration range is given by

$$T_E \pm 3\sigma = (9T \pm 3\sigma)$$

Standard deviation, $\sigma = \sqrt{\mu^2 + \mu^2 + \mu^2 + \mu^2 + \mu^2 + \mu^2 + \mu^2 + \mu^2 + \mu^2}$

$\Rightarrow$ $\sigma = 3\,\mu$

Duration range $= 9\,T \pm 3(3\,\mu)$

$= 9\,T \pm 9\,\mu$

22. (b)

$\because$ FDDB (fixed factor for double decline balance method $= \dfrac{2}{n}$

Where, n is useful line of equipment in year.

Hence, FDDB $= \dfrac{2}{4} = \dfrac{1}{2}$

So, book value at the end of second year (B_2),

$$= C_i(1 - FDDB)^2$$

$$= 200{,}000\left(1 - \frac{1}{2}\right)^2$$

$$= \frac{200{,}000}{4} = \text{Rs. } 50{,}000$$

Hence option (b) is correct.

23. (b)

From table for $P = 95\%$

$$z = 1.6 + \frac{1.7 - 1.6}{99 - 91}(95 - 91) = 1.65$$

$$z = \frac{T_S - T_E}{\sigma}$$

Standard deviation, $\sigma = \sqrt{\text{Variance}} = \sqrt{16} = 4$ weeks

$$\therefore \quad 1.65 = \frac{T_S - 50}{4}$$

$$\Rightarrow \quad T_S = 56.6 \text{ weeks}$$

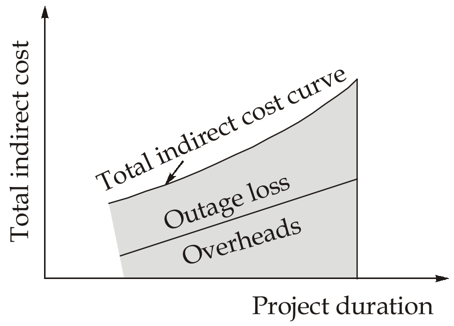
24. (d)

In resource levelling, project duration may get changed.

25. (c)

Indirect cost: Indirect cost of a project are those expenses which can not be assigned or associated to any individual activity of the project.

- Indirect cost is associated with a group of activities or project as a whole.



- Indirect cost always increases with time.
- Overheads increases linearly with time at constant rate but outage loss increase non-linearly with time.

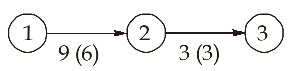
26. (b)

$$\text{Cost slope} = \frac{\Delta c}{\Delta t}$$

$$\text{For activity 1–2, cost slope} = \frac{9500 - 8000}{9 - 6} = \text{Rs. } 500$$

$$\text{For activity 2–3, cost slope} = \frac{5500 - 5000}{2} = \text{Rs. } 250$$

Since cost slope of activity 2–3 is less and hence crashing it by 2 days.



Total project duration = 12 days

$$\therefore \quad \text{Total cost} = 8000 + 5000 + 12 \times 300 + 2 \times 250 = \text{Rs. } 17100$$

27. (a)

$$t_e = \frac{t_o + 4t_m + t_p}{6}$$

$$t_{eAB} = \frac{4+4\times6+8}{6} = 6 \text{ days}$$

$$t_{eBC} = \frac{7+4\times7+9}{6} = 7.33 \text{ days}$$

$$t_{eCD} = \frac{3+4\times4+9}{6} = 4.67 \text{ days}$$

$\therefore$ Expected project duration= 18 days.

28. (c)

29. (b)

Effective cycle time = Forward time + Return time + Fixed time

$$= \left(\frac{100}{250\times0.8} + \frac{100}{300\times0.8}\right)60 + 25$$

= 80 seconds

Hence option (b) is correct.

30. (c)

$$P_{\text{avg}} = \frac{P(n+1)+S(n-1)}{2n} = \frac{30\times(5+1)+5(5-1)}{2\times5} = 20 \text{ lakhs}$$

■■■■