CLASS TEST

Sl. : 01_IG_CE_E+F+J_120922

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CPMT-PERT

CIVIL ENGINEERING

Date of Test : 12/09/2022

ANSWER KEY ➤

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

DETAILED EXPLANATIONS

2. (a)

The distribution curve for the time taken to complete each activity of a project resembles a β-distribution curve and the distribution curve for the time taken to complete entire project (consisting of several activities) in general resembles a normal distribution curve.

3. (c)

In A-O-N network, dummy activities are eliminated.

2 - 6, 1 - 6 and 3 - 6 are already established and hence need not be taken into the network.

4. (c)

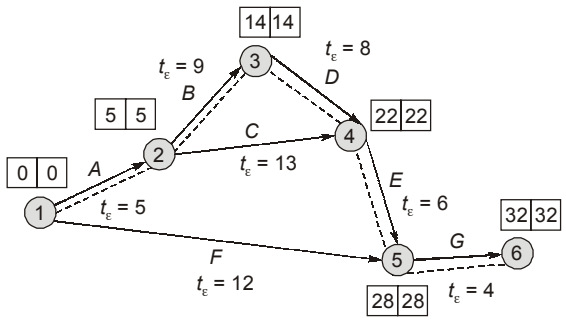
Expected times of activities *A* and *B* respectively are

$$t_{EA} = \frac{4+6\times4+8}{6} = 6 \text{ days}$$

$$t_{EB} = \frac{5+5.5\times4+9}{6} = 6 \text{ days}$$

$$\therefore \quad t_{EA} = t_{EB}$$

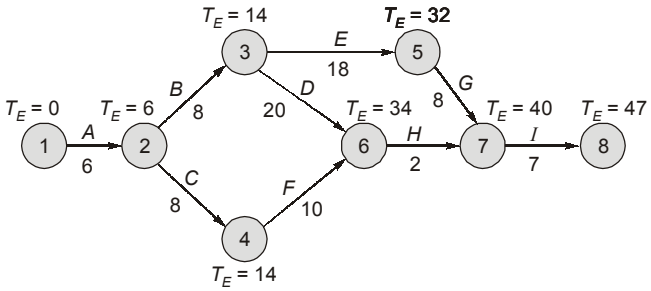
8. (a)



∴ Critical path is 1 - 2 - 3 - 4 - 5 - 6

and expected duration is 32 days.

9. (b)



Expected project completion time,

$$T_E = 47 \text{ days}$$

Standard deviation, $\sigma = \sqrt{\text{Variance}} = \sqrt{9} = 3$ days

Normal deviation, $Z = \frac{T_S - T_E}{\sigma} = \frac{50-47}{3} = 1$

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11. (c)

Month	Demand	Procurement at beginning of months	Withdrawal through month	Balance Resource
1	0	0.2 × 50 = 10	0	10
2	0	0.5 × 50 + 0.2 × 40 = 33	0	43
3	50	0.3 × 50 + 0.5 × 40 + 0.2 × 60 = 47	50	43 + 47 – 50 = 40
4	40	0.3 × 40 + 0.5 × 60 = 42	40	40 + 42 – 40 = 42
5	60	0.3 × 60 = 180	60	42 + 18 – 60 = 0

$\therefore$ Maximum inventory is by the end of 2nd month which is 43 units.

12. (a)

Days	Resources per day
8 - 11	8
11 - 16	8 + 6 = 14
16 - 19	6
19 - 20	6 + 7 = 13
20 - 22	6 + 7 + 9 = 22
22 - 24	7 + 9 = 16
24 - 28	7

$$\therefore \frac{\text{Maximum resource needed per day}}{\text{Minimum resource needed per day}} = \frac{22}{6} = 3.67$$

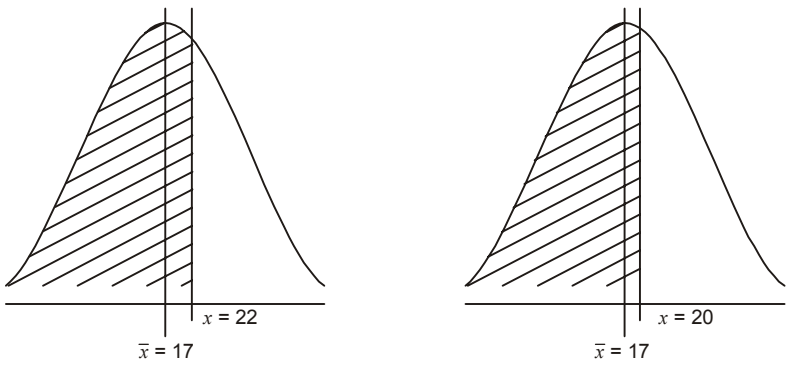
13. (a)

$\bar{X}$ = 17 units

Variance, σ^2 = 9

Standard deviation, σ = 3

$$Z = \frac{x - \bar{x}}{\sigma}$$



For 22 days, $Z = \frac{22-17}{3} = \frac{5}{3} = 1.67$

$P(Z < 1.67)$ = 95.2%

For 20 days, $Z = \dfrac{20-17}{3} = \dfrac{3}{3} = 1$

$P(Z < 1) = 84.13\%$

$\therefore \quad P(Z < 1.66) - P(Z < 1) = 95.2\% - 84.13\%$

$= 11.07\%$

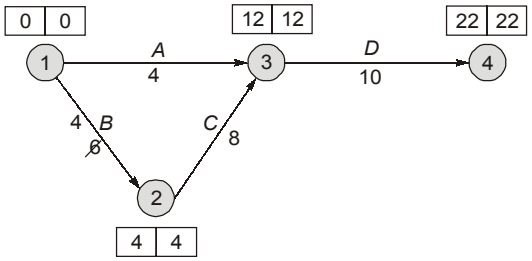
14. (d)

Activity	Crash limit (days)	Cost Slope (₹/day)
A	4 – 3 = 1	(105 – 80) / (4 – 3) = 25
B	6 – 4 = 2	(250 – 180) / (6 – 4) = 35
C	8 – 5 = 3	(320 – 200) / (8 – 5) = 40
D	10 – 6 = 4	(530 – 350) / (10 – 6) = 45

Activity	*A*	*B*	*C*	*D*
Critical	–	✓	✓	✓

Since the critical activity *B* has the lowest crash cost per day, it should be crashed first.

Hence, crash activity *B* by 2 days



Critical path is still *B-C-D*

Project completion time = 22 days

Project cost = 810 + (2) (35) = ₹ 880

15. (c)

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

17. (a)

$TF = LFT - EFT \text{ (or } LST - EST) = 58 - 50 = 8$

$FF = (EFT - EST) - t_{ij}$

$= (50 - 31) - 19 = 0$

$IF = (EFT - LST) - t_{ij}$

$= (50 - 39) - 19 = -8$

$\therefore \quad TF - \dfrac{FF}{IF} = 8 - \left(-\dfrac{0}{8}\right) = 8$

18. (a)

Cost of machine = ₹ 100000

Rate of interest = 10%

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Capital recovery factor (CRF) $= \dfrac{i(1+i)^n}{(1+i)^n - 1}$

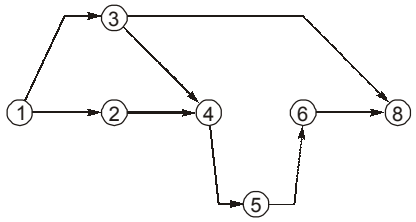
$= \dfrac{0.1(1+0.1)^{20}}{(1+0.1)^{20} - 1} = 0.11746$

$\therefore$ The annual equipment cost $= 100000 \times 0.11746$

$= ₹\,11746$

19. (c)

There is an extra dummy between events (7) and (8).
There are two arrows joining events (2) and (4).
No dummy is required between (4) and (6) as precedence is already established.
The correct diagram will be



So there are a total of three errors.

20. (d)

Annual depreciation $= \dfrac{P - 1000}{5}$

Book value at the end of 2 years

$= P - 2 \times \dfrac{(P-1000)}{5} = 6400$

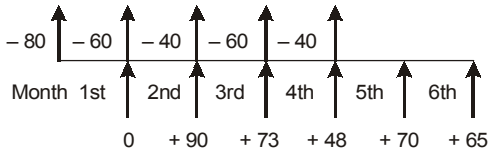
$\Rightarrow \quad P = ₹\,10000$

21. (c)

By increasing the angle of swing, the output of dragline will reduced since output will be maximum at optimum depth of cut, so it will be further reduced if depth of cut is more or less than optimum depth of cut.

22. (c)

Cash flow diagram



Outflows are shown negative and inflows as positive
After four months, net cash flow

$= 90 + 73 + 48 - 80 - 60 - 40 - 60 - 40$

$= -69$ money units

23. (d)

Average investment = ₹53000

Annual depreciation = ₹11,000

Money cost @ 15% of average investment

$= 0.15 \times 53{,}000 = 7950$

Taxes @ 5% of average investment

$= 0.05 \times 53{,}000 = 2650$

Total annual fixed cost = 11000 + 7950 + 2650 = 21,600

$$\text{Hourly ownership cost} = \frac{21{,}600}{1800} = 12$$

24. (b)

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

$\therefore$ Crash cost $= 75 \times (10 - 8) + 350 = 500$

27. (a)

Given, $t_0 = 5$ days, $t_m = 10$ days, $t_p = 21$ days

$$\text{Expected time, } t_e = \frac{t_0 + 4t_m + t_p}{6} = \frac{5 + 4 \times 10 + 21}{6} = 11 \text{ days}$$

$$\text{Standard deviation, } \sigma = \frac{t_p - t_0}{6} = \frac{21 - 5}{6} = 2.67 \text{ days}$$

$\therefore$ $$\text{Required ratio, } \frac{t_e}{\sigma} = \frac{11}{2.67} = 4.12$$

28. (a)

This is the sum of crash times along the critical path.

30. (c)

Activity Day	A	B	C	D	E	Total Resources
2	12		1			13
3	12		1			13
4	12	6	1			19
5	12	6				18
6		6		6		12
7		6		6		12
8		6		6	9	21
9		6		6	9	21
10		6			9	15
11		6				6

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