S.No. : 01 SK_CE_B_200919

CPM - PERT

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CLASS TEST 2019-2020

CIVIL ENGINEERING

Date of Test : 20/09/2019

ANSWER KEY ➤ CPM - PERT

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

Detailed Explanations

4. (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.

5. (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.

7. (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. (d)

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

9. (a)

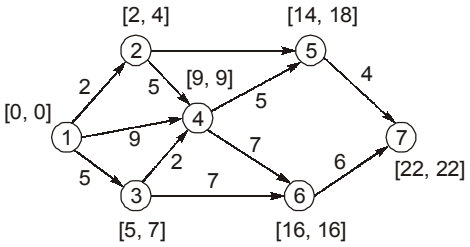
Arrow represents the activities and node represents the events.

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

∴ Maximum inventory is by the end of 2nd month which is 43 units.

12. (a)

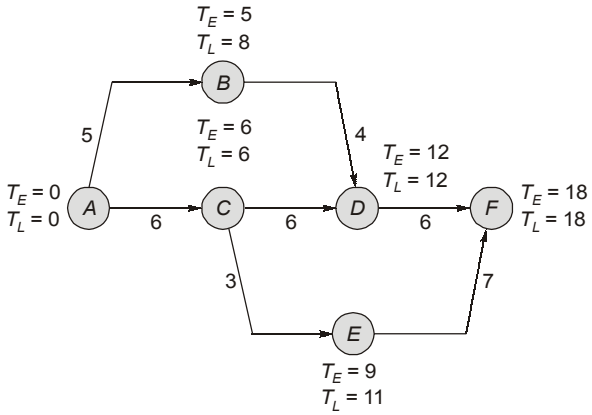


13. (a)

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

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

14. (d)



Total float = T_L for head event – T_E for tail event – duration of activity

Total float of AB = 8 – 0 – 5 = 3 weeks

Total float of CE = 11 – 6 – 3 = 2 weeks

Free float = T_E for head event – T_E for tail event – Duration of activity

Free float of EF = 18 – 9 – 7 = 2 weeks

∴ Total float AB + Total float of CE + Free float of EF = 3 + 2 + 2 = 7 weeks

15. (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

16. (c)

Independent float affects neither preceding nor following activities

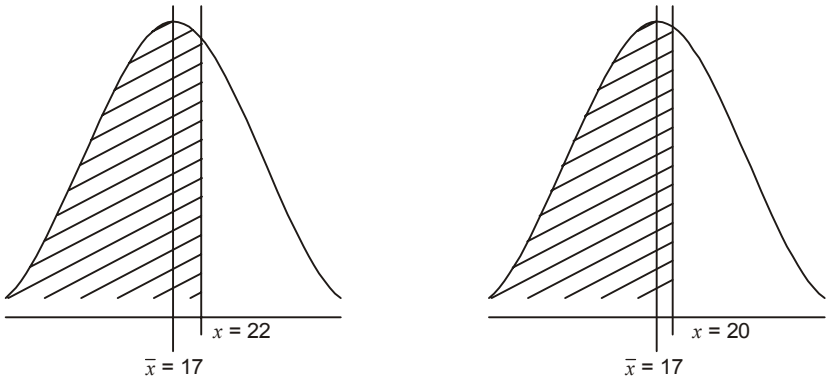
17. (a)

$$\bar{X} = 17 \text{ units}$$

$$\text{Variance, } \sigma^2 = 9$$

$$\text{Standard deviation, } \sigma = 3$$

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



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

$$P(Z < 1.67) = 95.2\%$$

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

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

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

$$= 11.07\%$$

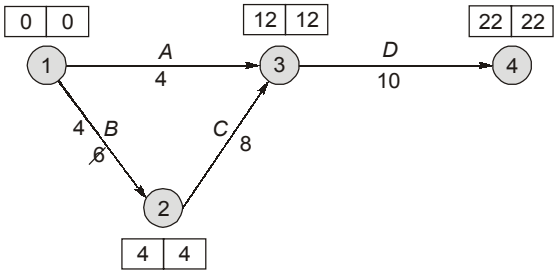
18. (d)

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

19. (b)

$$\sigma = \frac{t_p - t_0}{6}$$

$$\sigma_{Brown} = \frac{6-2}{6} = \frac{2}{3} = 0.67$$

$$\sigma_{Louis} = \frac{11-2}{6} = \frac{3}{2} = 1.5$$

$\therefore \quad \sigma_{Louis} > \sigma_{brown}$

$\therefore$ Mr. Louis was more uncertain than Mr. Brown.

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

24. (c)

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

$$= \frac{5 + 4 \times 15 + 60}{6}$$

= 20.83 minutes.

25. (d)

Free float for activity 1 – 3 will be zero.

26. (c)

During monitoring analysis of information is done and necessary changes are done to keep project as per schedule i.e. to rerail the project with minimum time over-run.

27. (d)

For 95% probability, area under curve should be 0.95.

For $A = 0.95,\ z = 1.65$

$$\text{Time required} = \sigma z + T_E = 4 \times 1.65 + 20$$
$$= 26.6 \text{ months}$$
$$= 26 \text{ months and } 18 \text{ days}$$

28. (a)

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

30. (a)

$$\text{Total float, TF} = \text{LFT} - \text{EFT} = 58 - 40 = 18 \text{ days}$$
$$\text{Free float, FF} = \{\text{EFT} - \text{EST}\} - t_{ij} = \{40 - 21\} - 19 = 0$$
$$\text{Independent float, IF} = \{\text{EFT} - \text{LST}\} - t_{ij} = \{40 - 39\} - 19 = -18 \text{ days}$$

Now. $$\text{FF} - \frac{\text{IF}}{\text{TF}} = 0 - \left\{-\frac{18}{18}\right\} = 1$$

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