CLASS TEST

S.No.: 01_JP_ME_01092026

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INDUSTRIAL ENGINEERING

MECHANICAL ENGINEERING

Date of Test : 01/09/2026

ANSWER KEY

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

DETAILED EXPLANATIONS

1. (b)

$$F_t = F_{t-1} + \alpha(D_{t-1} - F_{t-1})$$
$$F_{14} = 75, \quad D_{14} = 100, \quad \alpha = 0.5$$
$$F_{15} = 75 + 0.5(100 - 75) = 87.5$$
$$F_{16} = 87.5 + 0.5(100 - 87.5) = 93.75$$

Now

$$(\text{Error})_{14}^2 = (25)^2 = 625$$
$$(\text{Error})_{15}^2 = (12.5)^2 = 156.25$$
$$(\text{Error})_{16}^2 = (6.25)^2 = 39.06$$
$$\text{MSE} = \frac{625 + 156.25 + 39.06}{3} = 273.44$$

2. (b)

Large size of inventory is a sign of
- poor scheduling
- inefficient planning
- vendors are not well-coordinated

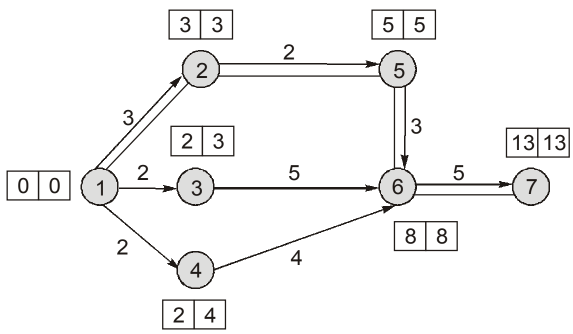
3. (a)

When a demand pattern is consistently increasing or decreasing, Regression analysis is very useful forecasting technique.

4. (b)

$$\lambda\,(\text{Arrival rate}) = 3/\text{hour}$$
$$\mu\,(\text{Service rate}) = 10/\text{hour}$$
$$\rho = \frac{\lambda}{\mu} = \left(\frac{3}{10}\right) = 0.3$$
$$\text{Queue length} = \left(\frac{\rho^2}{1-\rho}\right) = \frac{(0.3)^2}{1-0.3} = 0.129$$

5. (c)



Critical path is 1 – 2 – 5 – 6 – 7.

6. (b)

For maximization LPP, the objective function coefficient for an artificial variable is $-M$.

8. (d)

At break even point

$$\begin{aligned}\text{Fixed price + variable price} &= \text{Total Revenue}\\ 400000 + 20\,N &= 30\,N\\ 10\,N &= 400{,}000\\ N &= 40000 \text{ units}\\ \text{Margin of safety} &= \frac{\text{Total sales} - \text{sales at B.E.P.}}{\text{Total sales}}\\ &= \frac{1500000-(40000\times 30)}{1500000}\times 100 = 20\%\end{aligned}$$

9. (c)

Job	Machine A	Machine B
P	5	2
Q	1	6
R	9	7
S	3	8
T	10	4

Sequence Q - S - R - T - P

10. (d)

$$\begin{aligned}\text{Number of orders} &= 12\\ Q^* &= \frac{7200}{12} = 600\\ \text{Average inventory} &= \frac{600}{2} = 300 \text{ units}\end{aligned}$$

11. (b)

	S_1	S_2	S_3
P	60	95	105
Q	85	70	110
R	90	100	80

Step 1 : Subtract minimum entry in each row from all the entries on that row,

	S_1	S_2	S_3
P	0	35	45
Q	15	0	40
R	10	20	0

Step 2 : Making the assignment

$\boxed{0}$	35	45
15	$\boxed{0}$	40
10	20	$\boxed{0}$

The minimum cost = 60 + 70 + 80 = ₹ 210

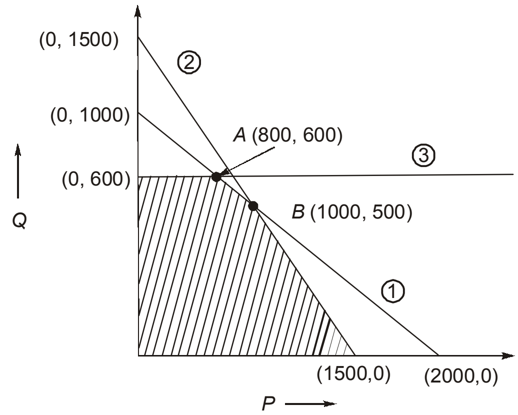
12. (a)

Given

$$P + 2Q \leq 2000 \quad \text{...(i)}$$
$$P + Q \leq 1500 \quad \text{... (ii)}$$
$$Q \leq 600$$

Objective function

$$Z_{max} = 3P + 5Q$$



At point A $\quad z = 3 \times 800 + 600 \times 5 = 5400$

At point B $\quad z = 3 \times 1000 + 5 \times 500 = 5500$

Hence z to be maximum at (1000, 500)

13. (c)

14. (a)

Time required to wash one car is $2 \times 1.2 = 2.4$ mins.

Number of cars washed in 1 hr in 1 stall

$$= \frac{60}{2.4} = 25$$

$$\therefore \quad \text{No of stalls} = \frac{60}{25} = 2.4 \simeq 3$$

15. (a)

$$(TC)_1 = \left(\frac{45}{60} + \frac{25}{60}x\right)200$$

$$(TC)_2 = \left(2.5 + \frac{5x}{60}\right)800$$

At BEP: $\quad (TC)_1 = (TC)_2$

or $\quad \left(\frac{45}{60} + \frac{25}{60}x\right)200 = \left(2.5 + \frac{5x}{60}\right)800$

or $\quad \frac{45}{60} + \frac{25x}{60} = 10 + \frac{20x}{60}$

or $\quad 5x = 600 - 45 = 555$

or $\quad x = 111$ units

16. (b)

$$\lambda = 6\text{/hour}$$
$$\mu = 8\text{/hour]}$$

$$\rho = \frac{\lambda}{\mu} = \frac{6}{8} = 0.75$$

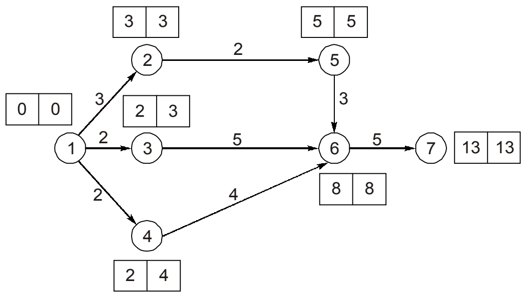
$$L_q = \frac{\rho^2}{1-\rho} = \frac{0.75^2}{0.25} = 2.25 \text{ technicians}$$

$$W_q = \frac{L_q}{\lambda} = \frac{\rho^2}{(1-\rho)\lambda} = \frac{0.75^2}{0.25\times 6} = 22.5 \text{ minutes}$$

$$W_s = \frac{L_s}{\lambda} = \frac{\rho}{(1-\rho)\lambda} = \frac{0.75}{0.25\times 6} = 30 \text{ minutes}$$

Alternate: As $W_s > W_q$ always, only option (b) follow it.

17. (a)



Critical path is 1 – 2 – 5 – 6 – 7

Project duration,

$$t_E = 3 + 2 + 3 + 5 = 13$$

Free float (4 – 6) = 8 – 4 – 2 = 2

18. (d)

$$\text{RSFE} = \sum_{i=1}^{n} (D_i - F_i)$$

19. (d)

Let Q be the number of units stocked per week and let r be the duration for it, i.e., the actual number of units sold per week.

Given : C_1 = ₹30 per unit per week

C_2 = ₹ 70 per unit per week

$\therefore$ The critical ratio is $p_c = \frac{C_2}{C_1 + C_2} = \frac{70}{30+70} = 0.70$

The cumulative distribution of weekly demand as follows:

Monthly sales (x)	0	1	2	3	4	5
$p(x)$	0.04	0.06	0.25	0.35	0.20	0.1
$Q = \Sigma p(x)$	0.04	0.1	0.35	0.70	0.90	1.00

Since the critical ratio i.e., 0.7 is equal to cumulative probability for 3 units, hence 3 units must be stocked every week.

20. (c)

Given: F = ₹600000

v = ₹15

s = ₹40

At break even point (BEP),

$$\text{Number of units, } x = \frac{F}{s-v} = \frac{600000}{25} = 24000 \text{ units}$$

$$\text{Margin of safety} = \frac{\text{Total sales} - \text{Sales at BEP}}{\text{Total sales}} = \frac{2000000 - (24000 \times 40)}{2000000}$$

$$= 0.52 = \mathbf{52\%}$$

21. (b)

Given: $\lambda = 30$ trains per day

$$\mu = \frac{60 \times 24}{36} = 40 \text{ trains per day}$$

$$\text{System utilization, } \rho = \frac{\lambda}{\mu} = \frac{30}{40} = 0.75$$

$\because$ Probability that queue size exceed 10,

$$P(\geq 10) = \rho^{10} = (0.75)^{10} = \mathbf{0.056}$$

22. (d)

Given, $D = 4000$ units

C_o = ₹20 per order

C_h = ₹4 per year

$$\text{EOQ, } Q^* = \sqrt{\frac{2DC_o}{C_h}} = \sqrt{\frac{2 \times 4000 \times 20}{4}} = 200 \text{ units}$$

$$\text{Optimum number of orders} = \frac{D}{Q^*} = \frac{4000}{200} = 20$$

24. (b)

$$TF = LFT - EFT = 58 - 40 = 18$$

$$FF = \{EFT - EST\} - t_{ij} = 40 - 21 - 19 = 0$$

$$IF = \{E_j - L_i\} - t_{ij} = \{40 - 39\} - 19 = -18$$

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

25. (b)

For $n = 7$

$$\text{Smoothing constant, } \alpha = \frac{2}{n+1} = \frac{2}{7+1} = 0.25$$

26. (b)

Given: $a = 14$

$m = 20$

$b = 26$

$$\text{Standard deviation, } \sigma = \frac{b-a}{6} = \frac{26-14}{6} = 2$$

27. (d)

Variance (σ^2) in time estimates $= \left(\dfrac{t_p - t_0}{6}\right)^2$

In case of expert A, the variance $\left(\dfrac{8-4}{6}\right)^2 = \dfrac{4}{9} = 0.444$

In case of expert B, the variance $\left(\dfrac{10-4}{6}\right)^2 = 1$

In case of expert C, the variance $\left(\dfrac{8-3}{6}\right)^2 = 0.6944$

In case of expert D, the variance $\left(\dfrac{9-6}{6}\right)^2 = 0.25$

So, the variance is less in the case of D. Hence, it is concluded that the expert D is more certain about his estimates of time.

28. (b)

Given, $a = 4$ days $\quad b = 12$ days

$E = 8$ days $\quad m = ?$

$$E = \frac{a + 4\,\text{m} + b}{6}$$

$m = 8$ days

26. (a)

Given: $D = 15000$ bolts/year $\quad C_h = 25\%$ of C

$C_o =$ ₹6.50 per order

EOQ at unit price ₹2.00

$$\text{EOQ} = \sqrt{\frac{2 \times D \times C_o}{C_h}} = \sqrt{\frac{2 \times 15000 \times 6.5}{0.25 \times 2}} = 624.5 \text{ bolts}$$

Since EOQ of 624.5 is corresponding to the lowest unit price of ₹2.00 so it will be feasible EOQ.

$\because$ Optimum total cost, $TC = \dfrac{D}{Q^*}C_o + \dfrac{Q^*}{2}C_h + D \times C$

$$= \frac{15000}{624.5} \times 6.5 + \frac{624.5}{2} \times (0.25 \times 2) + 15000 \times 2$$

$= 156.125 + 156.125 + 30000 =$ ₹30312.25

30. (b)

Given: Variables, $n = 4$ variables

Constraints, $m = 2$ equations

$n - m = 2$

$${}^nC_m = \frac{n!}{m!(n-m)!} = \frac{4!}{2!2!} = 6 \text{ corner points}$$

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