CLASS TEST

SL.: 01_JP_ME__30072022

MADE EASY
India's Best Institute for IES, GATE & PSUs

Delhi | Bhopal | Hyderabad | Jaipur | Lucknow | Pune | Bhubaneswar | Kolkata | Patna

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

INDUSTRIAL ENGINEERING

MECHANICAL ENGINEERING

Date of Test : 30/07/2022

ANSWER KEY

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

DETAILED EXPLANATIONS

1. **(c)**

Lead time has effect on reorder point. Increase or decrease in lead time has no effect on EOQ. So if the lead time increases from 10 to 20 days, the EOQ will remain the same.

2. **(b)**

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

3. **(a)**

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

7. **(d)**

ABC = It is depends on the usage value.
VED = It is on the importance of inventory.
HML = It is based on unit price of inventory.
SDE = It is based on availability of inventory item.

8. **(c)**

Solving linear programming problem by simplex method, if two ratios of right hand side b_i to the coefficient of entering variable "a" are found to be equal, it implies that the problem has degeneracy.

9. **(d)**

Total float (*TF*) denotes the amount of time by which an activity can be deleyed without delaying the project completion day.

$$TF = LFT_j - EST_i - t_{ij}$$

10. **(c)**

The three determinants of the type of layout are type of product, type of process and the volume of production.
Assembly shops of automobiles is an example of mass production.

11. (b)

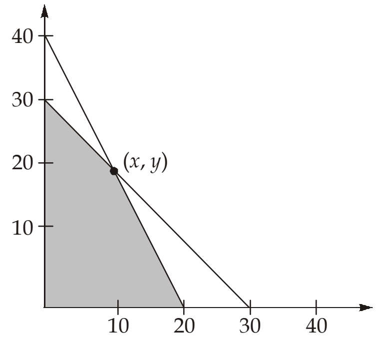
Let x and y be the units of model P and Q

$$\text{Maximum, } p = 75x + 60y$$

$$8x + 4y \leq 160 \quad \text{... (i)}$$

$$x + y \leq 30 \quad \text{... (ii)}$$

$x \geq 0, y \geq 0$



Solving by graphical method

Point (x, y) is intersection of (i) and (ii)

$$8x + 4y = 160$$

$$x + y = 30$$

Solving we get, $x = 10$

$y = 20$

So, corner point are:

(0, 30), (20, 0), (10, 20)

Profit for (20, 0)

$$p = 75 \times 20 + 60 \times 0 = \text{Rs.}1500$$

For (0, 30)

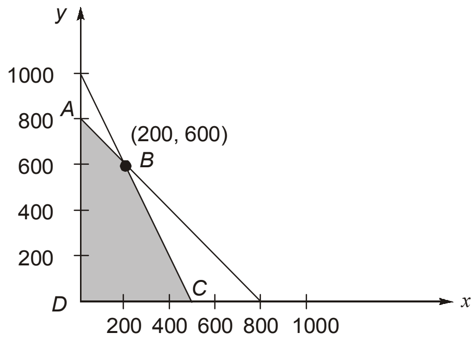
$$p = 75 \times 0 + 60 \times 30 = \text{Rs.}1800$$

For (10, 20)

$$p = 75 \times 10 + 20 \times 60 = \text{Rs.}1950$$

Hence maximum, $P = 10$, $Q = 20$

13. (b)



$$Z_A = 4 \times 0 + 3 \times 800 = 2400$$

$$Z_B = 4 \times 200 + 3 \times 600 = 2600$$

$$Z_C = 4 \times 500 + 0 \times 3 = 2000$$

$$Z_D = 0$$

From the graph, we can conclude that, the problem has unique optimum solution.

14. (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

[0]	35	45
15	[0]	40
10	20	[0]

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

15. **(c)**

$$\text{Desired cycle time, } T_c = \frac{\text{Production time available}}{\text{Desired units of output}}$$

$$= \frac{8 \times 60}{100} = 4.8 \text{ min}$$

Theoretical minimum number of work stations,

$$\Rightarrow \quad \frac{\Sigma t_i}{t_c} = \frac{2+2+3+1+3}{4.8}$$

$$= 2.5 \simeq 3 \text{ work stations}$$

Note : Number of stations will always be a integer number.

16. **(b)**

$$\text{Arrival rate } (\lambda) = 5/\text{hour}$$

$$\text{Service rate } (\mu) = 6/\text{hour}$$

$$\rho = \frac{\lambda}{\mu} = \frac{5}{6} = 0.833$$

$$P(\text{no queue}) = P(0 \text{ person in system}) + P(1 \text{ person in system})$$

$$= P_0 + P_1$$

$$= P_0 + \rho P_0 = P_0(1+\rho) = 1 - \rho^2$$

$$= 0.305$$

17. **(a)**

Step 1: Take minimum process time of M_1 and M_2 and put it on left (if it is of M_1 or if it is of M_2 put it on right (end).

B-A-C-D-E-F

or

B-A-C-E-D-F

18. **(b)**

Given: d = 800 unit/week, Lead time = 4 week.

We know, ROl = $X + SS$

X - Average demand during lead time.

SS - Safety stock.

$$\bar{x} = \text{LT} \times d = 4 \times 800 = 3200$$

$$\text{SS} = z\sigma$$

z - Standard normal variant.

σ - Standard deviation for demand variation during lead time.

Here, given σ for 1 week we have to calculate it for 4 weeks,

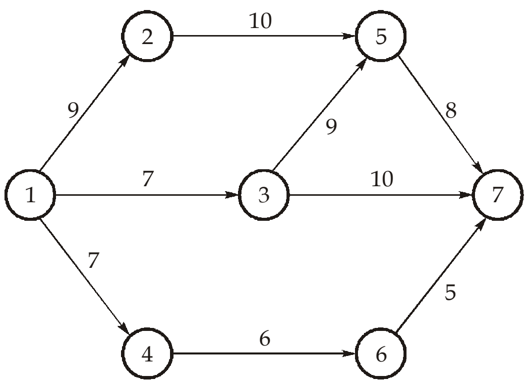
$$\sigma^2 = 100^2 + 100^2 + 100^2 + 100^2$$

$$\sigma = 200$$

$$\text{SS} = 200 \times 1.645 = 329$$

$$\text{ROL} = 3200 + 329 = 3529 \text{ unit}$$

19. **(a)**



Activity	t_e
1 - 2	9
1 - 3	7
1 - 4	7
2 - 5	10
3 - 5	9
3 - 7	10
4 - 6	6
5 - 7	8
6 - 7	5

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

Paths

1 - 2 - 5 - 7 → 27

1 - 3 - 5 - 7 → 24

1 - 3 - 7 → 17

1 - 4 - 6 - 7 → 18

So, 27.

21. **(c)**

	A	B	C	$(A + B)$ x	$(B + C)$ y
J_1	8	5	4	13	9
J_2	10	6	9	16	15
J_3	6	2	8	8	10
J_4	7	3	6	10	9
J_5	11	4	5	15	9
J_3 J_2 J_5 J_1 J_4					

23. (c)

$$F_n = F_{n-1} + \alpha\,(D_{n-1} - F_{n-1})$$

D_i	F_i	$e_i = (D_i - F_i)$
60	62	–2
65	61.2	3.8
68	62.72	5.28
64	64.832	–0.832

$$\text{MAP error} = \frac{1}{n}\sum\left|\frac{D_i - F_i}{D_i}\right| = 100\times\left(\frac{\frac{2}{60}+\frac{3.8}{65}+\frac{5.28}{68}+\frac{0.832}{64}}{4}\right) = 4.56\%$$

25. (c)

$$\text{Assuming cycle time} = 10 \text{ minutes}$$

$$\Sigma t_i = 10 + 9 + 7 + 9 + 8 = 43$$

$$\text{Balance delay} = 1 - \frac{\Sigma t_i}{n \times t_c}$$

$$= 1 - \frac{43}{5\times 10} = 0.14 = 14\%$$

26. (b)

To minimize time first apply row transaction (Subtract minimum time of row by other) we get

	M_1	M_2	M_3	M_4
J_1	2	0	1	4
J_2	0	1	4	2
J_3	3	2	~~0~~	1
J_4	1	3	0	2

Then apply column transaction (Subtract column minimum by others)

	M_1	M_2	M_3	M_4
J_1	2	[0]	1	3
J_2	[0]	1	4	1
J_3	3	2	0	[0]
J_4	1	3	[0]	1

So, $J_1 = M_2$, $J_2 = M_1$, $J_3 = M_4$, $J_4 = M_3$

27. (b)

$$C_0 = 60 \text{ per order}$$

For order size greater than 100

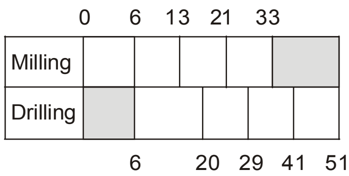
$$EOQ = \sqrt{\frac{2DC_0}{C_h}} = \sqrt{\frac{2\times 1000\times 60}{100\times 0.1}} = 109.54$$

as EOQ is falling under assumed range i.e. greater than 100, it will be optimum size.

28. **(a)**

According to Johnson rule, the correct order will be

C - D - B - A



Utilisation of milling M/C = $\frac{33}{51} \times 100 = 64.71\%$

Utilisation of drilling M/C= $\frac{45}{51} \times 100 = 88.24\%$

29. **(c)**

Month	Actual sales	Weightage
1st	100	0.10
2nd	90	0.20
3rd	105	0.30
4th	95	0.40

Forecasted sale for 5th month = 0.40 × 95 + 0.30 × 105 + 0.20 × 90 + 0.10 × 100

= 97.5 units ≃ 98 units

30. **(c)**

We are given :

D = 5000 bushes per day

P = 8000 bushes per day

C_0 = ₹ 20

C_h = ₹ 0.08 per 1000 bushes

= ₹ 0.00008 per item

$$EOQ = \sqrt{\frac{2DC_0}{C_h}\left(\frac{P}{P-D}\right)}$$

$$\Rightarrow \quad EOQ = \sqrt{\frac{2 \times 5000 \times 20}{0.00008}\left(\frac{8000}{8000-5000}\right)} = 81649.658 \text{ items}$$

$$\text{Hence, production run} = \frac{81649.658}{5000} = 16.3 \text{ days}$$

■■■■