Production Planning and Control Test 3

Number of Questions: 25 **Time:60 min.**

Directions for questions 1 to 25: Select the correct alternative from the given choices.

1. A *N*-period moving average method is used to forecast the demand for the upcoming period. If the smoothing constant used is 0.2 then the value of *N* is
(A) 10 (B) 11
(C) 9 (D) 8

2. In the ISO standards for coding a *NC* part program all the letters of English alphabet were standardized. What is the meaning for the alphabet '*G*'?
(A) Feed function (B) Tool function
(C) Spindle speed function (D) Preparatory function

3. A firm produces plain paper with a selling price of ₹300 per roll. The fixed cost and variable cost of are ₹200,000 and ₹150 per roll respectively. What is the breakeven point in Rupees?
(A) ₹3,00,000 (B) ₹2,00,000
(C) ₹4,00,000 (D) ₹8,00,000

4. The arrival rate in a queue was found to be 5 persons per hour and the service rate has 0.1 persons per minute. What is the utilization factor of the system?
(A) 1.2 (B) 0.834
(C) 0.667 (D) 0.334

5. A billing counter at a shopping mall has an average arrival rate of 4 persons per hour and an average service rate of 6 persons per hour. What is the probability that there are more than two persons in the system?
(A) 70.37% (B) 29.63%
(C) 42.18% (D) 57.81%

6. In the Breakeven chart the angle of incidence is the angle between the lines made by
(A) Sales revenue and Total cost
(B) Total cost and fixed cost
(C) Sales revenue and fixed cost
(D) None of the above

7. Which of the following is NOT an input to the materials requirements planning system?
(A) Bill of materials
(B) Inventory records
(C) Master production schedule
(D) Capacity control

8. The benefits of applying material requirements planning are:
(P) Better utilization of machines
(Q) Reduced Inventory
(R) Quick response to fluctuation in demand
(A) (*P*) and (*Q*) (B) (*Q*) and (*R*)
(C) (*P*), (*Q*) and (*R*) (D) (*P*) and (*R*)

9. The process of deciding when and in what order does the work starts and in a certain amount of time how much work gets finished is done in
(A) Dispatching (B) Scheduling
(C) Forecasting (D) None of the above

10. Which of these is NOT a factor which affects scheduling?
(A) Customer's demand
(B) Plant Location
(C) Delivery dates
(D) Availability of Manpower

11. A four-month moving average is considered for the sales of a product for which the actual sales are given for six months of a year. What is the forecast for the month of August if the sales and forecast for the month of July are equal?

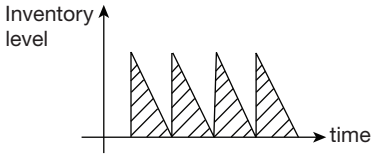
JAN	FEB	MAR	APR	MAY	JUN
40	40	30	50	60	50

(A) 47.500 (B) 45.625
(C) 45.357 (D) 51.875

12. The forecast for the year 2003 was found to be 15.5 by using a three-year weighted moving average method. The forecast is calculated by using 50% of the previous year sales, 30% of the sales of two years ago and 20% of the sales of three years ago. What is the sales in the year 2000 if 2001 and 2002 encountered a sales of 20 and 15 respectively?
(A) 10 (B) 2
(C) 5 (D) 20

13. By using exponential smoothing method the forecasts for the months of October and November are 60 and 70 respectively. What is the smoothing constant if the actual demands for the months of October and November are 90 and 100 respectively.
(A) 0.25 (B) 0.34
(C) 0.67 (D) 0.75

14. Which of the following is an assumption made for the given inventory model?

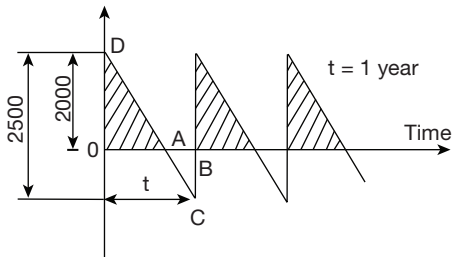


(A) The inventory carrying cost is dependent.
(B) Demand is non uniform.
(C) Lead time is non zero.
(D) Replenishment of stock is instantaneous.

15. A particular item has a demand of 5000 units per year with the cost of one order as ₹400. If 5 orders are placed yearly to meet the demand then what is holding cost per unit of the item per year?
(A) ₹4 (B) ₹2
(C) ₹2.5 (D) ₹8

16. The shortage cost, ordering cost and holding cost of an item are ₹1.5/unit/year, ₹50/order and ₹2.5/unit/year respectively. If the demand is 3000 units per year then what is optimum quantity to be ordered per order?
(A) 320 (B) 566
(C) 213 (D) 29

17. The Inventory model for an item is given by the graph. What is the total cost during the time *t*? (ordering cost = ₹100/order, carrying cost = ₹2/unit/year and shortage cost = ₹1/unit/year)



(A) ₹1650 (B) ₹1000
(C) ₹1750 (D) ₹3400

18. An inventory model for a product with uniform demand rate and zero lead time estimated the optimum inventory cost as ₹400 and the optimal quantity per order as 250 units. What is the inventory carrying cost per unit for a unit time if there are no shortages allowed?
(A) ₹1.6 (B) ₹2.56
(C) ₹1.2 (D) ₹0.625

19. Match List I with List II

List I		List II	
P.	GO2	1.	Tool change
Q.	MO3	2.	Circular Interpolation
R.	MO6	3.	Line interpolation.
S.	GO1	4.	Spindle on, CW

Here, *CW* = clockwise

	P	*Q*	*R*	*S*
(A)	4	2	1	3
(B)	2	4	1	3
(C)	3	4	1	2
(D)	3	1	4	2

20. The break even chart of a firm between the revenue in lakhs of Rupees versus the units of output in thousands is plotted and the equations for the fixed cost and sales revenue are given. What is the new breakeven point if the fixed cost is increased by 1 lakh and if the previous breakeven point is (3, 4)? (All other conditions remain the same)

Fixed cost: $y = 2$, Sales revenue: $y = \frac{4}{3}x$

x – Number. of units in thousands, y – Revenue in lakhs of Rupees.
(A) (3, 4) (B) (4, 3)
(C) (3.5, 5) (D) (4.5, 6)

21. A counter at a railway reservation center was a queue waiting time as 10 minutes and a utilization factor of 0.75. What is the arrival rate of the counter in persons per hour?
(A) 18 (B) 32
(C) 13.5 (D) 24

22. The utilization factor of a ticket booking counter is 0.8 when the waiting time in the system is 20 minutes. What is the waiting time in the queue before being served?
(A) 15 minutes (B) 16 minutes
(C) 12 minutes (D) 10 minutes

23. In a workshop a set of jobs have to be processed under two machines, processing times for the jobs are given. Which job is processed third in the first machine?

	Jobs	Machine 1	Machine 2
1	A	3	12
2	B	11	10
3	C	9	8
4	D	7	2
5	E	13	15
6	F	5	6

(A) Job *F* (B) Job *B*
(C) Job *C* (D) Job *E*

24. Seven jobs are to be processed on a machine with the given processing times. What is the mean flow line in minutes if the jobs are allotted according to the shortest processing time rule?

Jobs	A	B	C	D	E	F	G
Processing time (minutes)	7	3	4	8	11	10	6

(A) 27.167 (B) 8.167
(C) 3.326 (D) 37.674

25. What is the value of y when $x = 50$ according to the regression time of y on x plotted from the given data?

x	10	19	25	28	34	40
y	4	6	8	8.5	9	10

(A) 22.91 (B) 21.64
(C) 20.39 (D) 15.65

Answer Keys

1. C	**2.** D	**3.** C	**4.** B	**5.** B	**6.** A	**7.** D	**8.** C	**9.** B	**10.** B
11. D	**12.** A	**13.** B	**14.** D	**15.** A	**16.** B	**17.** C	**18.** A	**19.** B	**20.** D
21. C	**22.** B	**23.** D	**24.** A	**25.** A					

Hints and Explanations

1. $\alpha = \frac{2}{N+1}$

$\alpha = 0.2$

$\Rightarrow \quad N = \frac{2}{\alpha} - 1 = \frac{2}{0.2} - 1 = 10 - 1 = 9$ Choice (C)

2. Choice (D)

3. BEP = Break Even Point $= \frac{F}{S-V}$

$F = ₹\ 200000$, $S = ₹300$, $V = ₹150$

$\therefore \quad \text{BEP} = \frac{200000}{300-150} = \frac{4000}{3}$

BEP in rupees = BEP.S $= \frac{4000}{3} \times 300 =$ ₹400000

Choice (C)

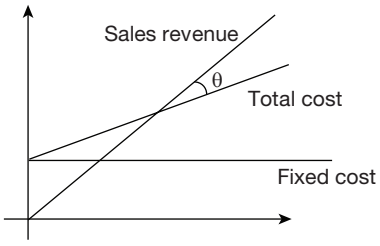
4. $\lambda = 5$/hr, $\mu = 0.1$/min $= 6$/hr

utilization factor $= \frac{\lambda}{\mu} = \frac{5}{6} = 0.833$ Choice (B)

5. Probability of more than n persons in the system is given by $= \left(\frac{\lambda}{\mu}\right)^{n+1}$ $\therefore$ probability of more than 2 persons in the system is $= \left(\frac{4}{6}\right)^{2+1} = \left(\frac{2}{3}\right)^3 = 0.2963 = 29.63\%$

Choice (B)

6.



θ is the angle of incidence Choice (A)

7. The three inputs to the MRP system are
1. Master production schedule.
2. Bill of materials and
3. Inventory records. Choice (D)

8. Choice (C)

9. Choice (B)

10. The factors which affect scheduling are:
Customers demand, Customers delivery dates, Stock available at the dealers, time interval to process finished goods from raw materials, inventory with the firm, availability of machines, material and manpower, feasibility of production runs etc. Choice (B)

11. Forecast for the month of July

$= \frac{\text{Sales of}\left(\text{MAR} + \text{APR} + \text{MAY} + \text{JUN}\right)}{4}$

$= \frac{30+50+60+50}{4} = 47.5$

As the forecast is same as the sales for the month of July; Sales in July = 47.5

$\therefore$ Forecast for the month of August

$= \frac{\text{Sales of}\left(\text{APR} + \text{MAY} + \text{JUN} + \text{JUL}\right)}{4}$

$= \frac{50+60+50+47.5}{4} = 51.875$ Choice (D)

12. Forecast for 2003 = 50% of 2002 + 30% of 2001 + 20% of 2000

$\left(\frac{50}{100}\right) \times 15 + \left(\frac{30}{100}\right) \times 20 + \left(\frac{20}{100}\right) \times S = 15.5 \Rightarrow S = 10$

$\therefore$ Sales in the year 2000 = 10 Choice (A)

13.

	October	November
Demand	90	100
Forecast	60	70

By using exponential smoothing method the forecast for November is:

$F_N = \alpha D_o + (1 - \alpha) F_o$

$\therefore \quad 70 = \alpha\, 90 + (1 - \alpha) 60$

$\therefore \quad 30\alpha = 10$

$\Rightarrow \quad \alpha = \frac{1}{3} = 0.34$ Choice (B)

14. From the given model, whenever an order is placed the stock is replenished instantaneously with zero lead time. The demand and inventory carrying cost are constant. Choice (D)

15. $D = 5000$, $C_o = ₹400$

Number of orders $= \frac{D}{q} = 5$

$$q = \sqrt{\frac{2DC_o}{C_c}} = \sqrt{\frac{2\times5000\times400}{C_c}} = \sqrt{\frac{4000000}{C_c}} = \frac{2000}{\sqrt{C_c}}$$

$$\therefore \quad \frac{5000.\sqrt{C_c}}{2000} = 5 \Rightarrow \qquad \sqrt{C_c} = 2$$

$\Rightarrow$ C_c = ₹4 per unit per year Choice (A)

16. C_o = ₹50/order, C_c = ₹2.5/unit/year

C_s = ₹1.5/unit/year and D = 3000 units

$$\therefore q = \sqrt{\frac{2DC_o}{C_c}\left(\frac{C_c+C_s}{C_s}\right)} = \sqrt{\frac{2\times3000\times50}{2.5}\times\left(\frac{2.5+1.5}{1.5}\right)}$$

q = 565.68 ≃566 units Choice (B)

17. Let the time taken for O to A be t_1 and from A to B be t_2.

$t_1 + t_2 = t$ = 1 year

$\therefore$ Total cost for the interval t

$$= \left(\frac{1}{2}\times2000\times t_1\times C_c\right) + \left(\frac{1}{2}\times500\times t_2\times C_s\right) + C_o$$

By similar triangles; Δ^{le} OAD and Δ^{le} ABC

$$\frac{t_1}{OD} = \frac{t_2}{BC} \Rightarrow \frac{t_1}{t_2} = \frac{OD}{BC} = \frac{2000}{500} = 4$$

$\Rightarrow$ $t_1 = 4\,t_2$

$\Rightarrow$ $5t_2 = 1$

$\Rightarrow$ t_2 = 0.2 year and t_1 = 0.8 year

$\therefore$ Total cost = (1000 × 0.8 × 2) + (250 × 0.2 × 1) + 100

= ₹1750 Choice (C)

18. Optimum quantity per order for an inventory model with uniform demand rate, zero lead time and no shortages is:

$$q = \sqrt{\frac{2DC_o}{C_c}}$$

D = demand, C_o = ordering cost, C_c = holding cost

$$\therefore \quad q = \sqrt{\frac{2DC_o}{C_c}} = 250 \Rightarrow 2DC_o = 62500\,C_c \quad \text{—— (1)}$$

The optimum inventory cost = $\sqrt{2DC_o\,C_c} = 400$

$\therefore$ $2DC_o\,C_c$ = 160000 —— (2)

Substituting (1) in (2)

$\Rightarrow$ 62500 $(C_c)^2$ = 160000

$\therefore$ $C_c = \sqrt{\frac{64}{25}} = \frac{8}{5}$ = ₹1.6 Choice (A)

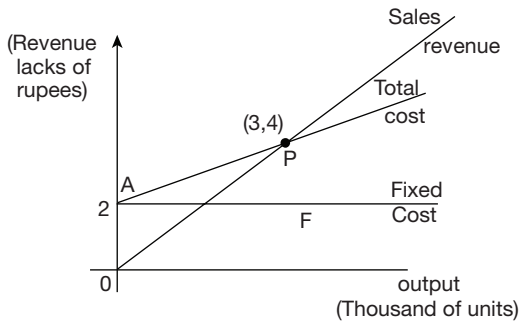
19. Choice (B)

20. Fixed cost: y = 2 ——— (1)

Sales revenue: $y = \frac{4}{3}x$ ——— (2)

Break even point = (3, 4)

Break even point is the intersection of the sales revenue and the total cost.

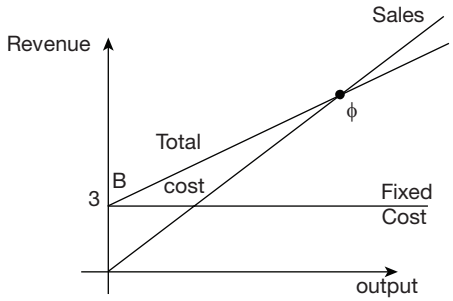


The point P is the BEP

$\therefore$ The equation of total cost is given by the two points $A(0, 2)$ and $P(3, 4)$

$$y - 2 = \frac{2}{3}x \quad \Rightarrow \quad 2x - 3y + 6 = 0 \text{ ——— (3)}$$

when the fixed cost is increased by 1 lack the break even point shifts towards the right hand side.



$\therefore$ The total cost line shifts without any variation in the slope.

$\therefore$ By the equation of previous total cost the slope of the line is $m = \frac{2}{3}$

$\therefore$ The equation of new total cost line is $y = mx + c$

The point $B(0, 3)$ lies on the line

$\therefore$ $3 = \frac{2}{3}.0 + C$

$\Rightarrow$ $C = 3$

$\therefore$ The new line is $2x - 3y + 9 = 0$ —— (4)

$\therefore$ The new breakeven point Q is given by solving the equations (2) and (4)

$y = \frac{4}{3}x$ and $2x - 3y + 9 = 0$

$\Rightarrow$ (x, y) = (4.5, 6)

Choice (D)

21. Waiting time in queue = $\frac{\lambda}{\mu(\mu-\lambda)}$ = 10 min

Utilization factor = $\frac{\lambda}{\mu}$ = 0.75

$\therefore$ $\frac{\lambda}{\mu(\mu-\lambda)} = \frac{0.75}{(\mu-0.75\mu)} = \frac{10}{60}$ hr

$\therefore \quad \mu = 18/\text{hr}$

$\Rightarrow \quad \lambda = 13.5/\text{hr}$ Choice (C)

22. $\left(\frac{\lambda}{\mu}\right) = 0.8 \Rightarrow \lambda = 0.8\mu$

Waiting time in the system $= \frac{1}{\mu - \lambda} = 20$ min

$\therefore \quad \frac{1}{(1-0.8)\mu} = 20$

$\Rightarrow \quad \mu = 0.25/\text{min}$

$\lambda = 0.8\ \mu = 0.2/\text{min}$

$\therefore$ Waiting time in the queue

$= \frac{\lambda}{\mu(\mu - \lambda)} = \frac{0.2}{0.25 \times 0.05}$

= 16 min Choice (B)

23.

Jobs	Machine A	Machine B
A	3	12
B	11	10
C	9	8
D	7	2
E	13	15
F	5	6

The shortest processing time among all the jobs is for job *D* in machine 2.

					D

The next shortest time is for job *A* in machine 1.

A					D

Then the job *F* on machine 1, job *C* on machine 2, job *B* on machine 2.

$\therefore$ The optimal sequence is

A	F	E	B	C	D

$\therefore$ The third job on machine 1 is job *E*. Choice (D)

24. Sequence according to the shortest processing time is:
B-C-G-A-D-F-E
Completion times are: 3, 7, 13, 20, 28, 38 and 49
Mean flow time

$= \frac{3+7+18+20+28+38+49}{7} = 23.286$ minutes

Choice (A)

25.

X	Y	X^2	XY
10	4	100	40
19	6	361	114
25	8	625	200
28	8.5	784	238
34	9	1156	306
40	10	1600	400
ΣX	ΣY	ΣX^2	ΣXY
156	45.5	4626	1298

$n = 6$

The regression time of y on x is

$Y = a + bX$

$b = \frac{n\Sigma XY - \Sigma X \Sigma Y}{n\Sigma X^2 - (\Sigma X)^2} = \frac{6.(1298) - (156)(45.5)}{6(4626) - (156)^2}$

$b = 0.20175$

$a = \frac{\Sigma Y + b\Sigma X}{n} = \frac{45.5 + (0.20175)(156)}{6}$

$a = 12.8289$

$\therefore \quad Y = 12.8289 + 0.20175X$

at $X = 50$

$Y = 12.8289 + (0.20175)(50) = 22.91$ Choice (A)