

N.B.:

- (1) Question number 1 is compulsory
- (2) Solve any three questions from the remaining five questions
- (3) Figures to right indicate full marks
- (4) Assume suitable data if necessary.
- (5) Notations carry usual meaning.

Q.1 Attempt any four

(A) Derive basic conventional inventory model with the assumption that demand is constant. (05)

(B) Solve the following L.P. problem using graphical method. (05)

$$\begin{aligned} \text{Maximize } Z &= 5x_1 + 4x_2 \\ \text{subject to } &x_1 - 2x_2 \leq 1, \\ &x_1 + 2x_2 \geq 3, \\ &x_1, x_2 \geq 0. \end{aligned}$$

(C) Write a short note on resource leveling (05)

(D) What do you mean by Maximin and Minimax criterion for decision making under uncertainty? Explain in brief. (05)

(E) How will you understand from graphical solution that solution is Infeasible, Unbounded and Infinite number of solution in LPP? (05)

(F) Assign the four subjects to three teachers. Students have to study One subject on their own. The matrix given below indicates the marks score and the objective is to score maximum marks. (05)

Teachers	Subjects			
	S1	S2	S3	S4
P1	50	30	60	40
P2	35	45	55	50
P3	20	25	45	40

Q.2(A) Solve the following L.P. problem using Big-M method.

$$\begin{aligned} \text{maximize } Z &= 2x_1 + 3x_2 + 4x_3, \\ \text{subject to } &3x_1 + x_2 + 4x_3 \leq 600, \\ &2x_1 + 4x_2 + 2x_3 \geq 480, \\ &2x_1 + 3x_2 + 3x_3 = 540, \\ &x_1, x_2, x_3 \geq 0. \end{aligned}$$

(12)

- (B) The arrival rate of customers at a banking counter follows Poisson distribution with a mean of 45 per hour. The service rate of the counter clerk also follows Poisson distribution with a mean of 60 per hour. (08)
- What is the probability of having 0 customer in the system?
 - What is the probability of having 5 customers in the system?
 - What is the probability of having 10 customers in the system?
 - Also find the number of customers in the system and in the queue.

Q.3(A) Solve the following game using dominance property and find the game value. (10)

	I	II	III	IV
I	3	2	4	0
II	3	4	2	4
III	4	2	4	0
IV	0	4	0	8

(B) Solve the following transportation problem for optimal transportation plan. (10)

	1	2	3	4	5	Supply
A	4	3	1	2	6	80
B	5	2	3	4	5	60
C	3	5	6	3	2	40
D	2	4	4	5	3	20
Demand	60	60	30	40	10	

Q.4(A) Explain the following (08)

- P-system and Q-system
- Decision tree

(B) A project schedule has the following characteristics: (12)

Activity	Time(weeks)	Activity	Time(weeks)
1-2	4	5-6	4
1-3	1	5-7	8
2-4	1	6-8	1
3-4	1	7-8	2
3-5	6	8-10	5
4-9	5	9-10	7

- Construct the network
- Compute E and L for each event, and Find the critical path

Q.5(A) Solve the following LPP by Simplex method (10)

$$\begin{aligned} \text{Max } Z &= 6X_1 + 10X_2 + 2X_3 \\ \text{Sub to } 2X_1 + 4X_2 + 3X_3 &\leq 40 \\ X_1 + X_2 &\leq 10 \\ 2X_2 + X_3 &\leq 12 \text{ and } X_1, X_2, X_3 \geq 0 \end{aligned}$$

- (B) A dairy firm wants to determine the quantity of butter it should meet the demand. Past records have shown the following patterns: (10)

Quantity required (kg)	No of days demand occurred
15	6
20	14
25	20
30	80
35	40
40	30
50	10

The stock levels are restricted to the range 15 to 50 kg due to inadequate storing facilities. Butter costs Rs. 40 per kg and is sold at Rs. 50 per kg.

- Construct the conditional profit table
- Determine the action alternative associated with the maximization of expected profit.
- Determine EVPI.

- Q.6 (A) The automobile company manufactures around 145 scooters. The daily production varies from 140 to 155 depending upon the availability of raw materials and other working conditions: (10)

Production per day	Probability
146	0.04
147	0.09
148	0.12
149	0.14
150	0.11
151	0.10
152	0.20
153	0.12
154	0.08

The finished scooters are transported in a specially arranged lorry accommodating 150 scooters. Using the random numbers 80, 81, 76, 64, 43, 18, 26, 10, 12, 65, 68, 69, 61, 57, simulate the process to find out:

- What will be the average number of scooters waiting in the factory?
- What will be the average number of empty space on the lorry?

- (B) A manufacturer of a hand grinder requires a special roller bearing at the rate of 300 nos per year. Each bearing costs the company Rs.36. The procurement cost and the inventory carrying cost have been calculated at Rs. 30 and 20 % respectively. (10)

If the supplier offers discounts of Rs. 2 per bearing on an order of 200 or above, should the higher quantity be purchased?
