

Roll No. :

Total No. of Printed Pages: 05

Total No. of Questions : 4 + 3 = 7

Maximum Marks :

Duration (hrs.) : 3 hours (Section I & II)

30 + 30 = 60

Section, if any : 1 (Each section 1 & 2 to be solved on separate Answer Book)

Note : Q-1 is compulsory for 20 marks. Solve any two from Q-2 to Q-4, each for 10 marks.

Q-1 a) Solve the following LPP by any simplex method. (12)

Maximize $Z = x_1 - 3x_2 + 3x_3$

STC $3x_1 - x_2 + 2x_3 \leq 7$

$2x_1 + 4x_2 \geq -12$

$-4x_1 + 3x_2 + 8x_3 \leq 10$ and NNC $x_1, x_2, x_3 \geq 0$

b) What is degeneracy in transportation problem and how it is avoided ? (2)

c) The captain of cricket team has to allot five middle batting positions to five batsmen. The average runs scored by each batsman at these positions are given in following matrix. Find the assignment of batsman to positions which would give the maximum number of runs.

(6)

	Batting Position				
	I	II	III	IV	V
P	40	40	35	25	50
Q	42	30	16	25	27
R	50	48	40	60	50
S	20	19	20	18	25
T	58	60	59	55	53

Q-2 Solve any Two, 5 marks each

a) Explain the concept of Queuing Theory and its structure with examples.

b) A firm produces three products processed in three different machines. The time to produce one unit and capacity of each of the three machines are given in the table. Determine the daily number of units to be manufactured for each product. The profit per unit for product 1, 2 and 3 is Rs. 4, Rs. 3 and Rs. 6 resp. It is assumed that all the amounts produced are consumed in the market. Formulate the model of LPP that will maximize the daily profit.

Machine	Time per unit (minutes)			Machine capacity (Min/ Day)
	Product 1	Product 2	Product 3	
M1	2	3	2	440
M2	4	-	3	470
M3	2	5	-	430

c) Draw only simplex table for the following LP problem

Minimize Total cost $Z = 9x_1 + 10x_2$

Subject to constraints $2x_1 + 4x_2 \geq 50$
 $4x_1 + 3x_2 = 24$
 $3x_1 + 2x_2 \leq 60$ and NNC $x_1, x_2 \geq 0$

Q-3 Solve any Two , 5 marks each

- a) Customers arrive at the ticket counter of a theater at the rate of 12 per hour. There is a clerk serving the customers at the rate of 30 per hour. What is the probability that there is no customer at the counter and what is the system utilization rate?
- b) The following table shows availability of supply to each warehouse, the requirement of each market and unit transportation cost (in Rs.) from each warehouse to each market. Find the given solution is optimum or not by using MODI method

	P	Q	R	S	Supply
A	6	3 (12)	5 (2)	4 (8)	22
B	5	9	2 (15)	7	15
C	5 (7)	7	8	6 (1)	8
Demand	7	12	17	9	45

- c) Use the graphical method to solve the following LP problem

$$\text{Max } Z = 2x_1 + x_2$$

Subject To Constraints:

$$x_1 + 2x_2 \leq 10$$

$$x_1 + x_2 \leq 6$$

$$x_1 - x_2 \leq 2$$

$$x_1 - 2x_2 \leq 1 \quad \text{and NNC } x_1, x_2 \geq 0$$

Q-4 Solve any One, 10 marks each

- a) What is Game theory? Find the value of game and optimal strategies for the following game. Also determine whether the game is fair or strictly determinable?

		B			
		I	II	III	IV
A	I	-4	-2	-2	3
	II	1	2	-1	0
	III	-6	-5	-2	-4
	IV	3	1	-6	0

- b) The following information shows the necessary information of supply to each warehouse, the requirement of each market and unit transportation cost (in Rs.) from each warehouse to each market.

	A	B	C	Supply
W	4	8	8	76
X	16	24	16	82
Y	8	16	24	77
Demand	72	102	41	235

-----ALL THE BEST-----

mark: 30

Section 2

1. Each of the questions have three sub questions, attempt any two of them
2. Attempt any two out of following three questions

Q.1]a) Mr. Howard Wolowitz has his office on 21st floor of Maker Chamber V in Nariman Point. He has been observing the time taken by the elevator of the building to reach 21st floor for the past two months. According to him it's a function of no. of other passengers in it. Following is the data of the collected by him. Passenger Probability distribution & time required to reach 21st floor is as follows:

Time taken to reach 21 st Floor in Sec	No. Of passengers present in the lift	Probability of No. of passengers in the lift
60	0	0.05
90	2	0.10
120	4	0.30
150	6	0.30
180	8	0.15
210	10	0.10

58 24 97 14 97 77 45 85 50 51

Simulate the average time taken to reach the 21st floor for Mr. Howard on a given day using following random number sequence.

Q.1] b) Determine the optimal sequence of performing 5 jobs on 4 machines. The machining of each job is required in the order ABCD and the process timing is as follows:

<u>Job</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>
<u>Machine A</u>	8	9	6	12	7
<u>Machine B</u>	3	2	4	5	1
<u>Machine C</u>	4	5	5	1	2
<u>Machine D</u>	7	5	8	9	3

Also determine the total time elapsed in doing the 5 jobs on 4 machines.

Q.1] c) A book store wishes to carry "Ramayana" in stock. Demand is probabilistic and replenishment of stock takes 2 days. The probabilities of the demand are as follows:

<u>Demand</u>	<u>0</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>
<u>Probability</u>	0.05	0.10	0.30	0.45	0.10

Each time an order is placed, the store incurs an ordering cost of Rs. 10 per order. The store also incurs a carrying cost of Rs. 0.50 per book per day. The carrying cost is calculated on the basis of stock at the end of the day.

: 3 :

The manager of the book store is contemplating 2 options for his inventory decision.

- A. Order 5 books when the inventory at the beginning of the day plus orders outstanding is less than 8 books.
- B. Order 8 books when the inventory at the beginning of the day plus orders outstanding is less than 8 books.

Currently (1st day) the store has a stock of 8 books plus 6 books that were ordered previously are expected to arrive next day.

Help the store manager to take the decision using Monte Carlo simulation.

Random Numbers: 89 34 78 63 61 81 39 16 13 73

Q.2] Following is the precedence relationship between the activities of a particular project.

Activity Code	A	B	C	D	E	F	G	H	I
Preceding Activity	-	-	-	A	A	B	C	D	F,E
Optimistic (a)	5	18	26	16	15	6	7	7	3
Most Likely (m)	8	20	33	18	20	9	10	8	4
Pessimistic (b)	10	22	40	20	25	12	12	9	5

Answer any of the two questions for 5 marks each

- a) Present these activities on PERT network & find critical path.
- b) Calculate total float for each activity
- c) If a 45 week target is imposed, what is the probability that the project will be completed in that deadline?

Q.3] a) Each unit of an item costs a company Rs.40. Annual holding costs are 18 percent of unit cost for interest charges on working capital loan, 1 percent for insurance, 2 percent allowances for obsolescence, Rs.2 for building overheads, Rs 1.50 for damage & loss and Rs.4 for miscellaneous costs. The annual demand is constant at 1000 units. Ordering cost is Rs.100.

Calculate EOQ and variable and total cost associated with the material order.

Q.3] b) For a machine, the following is the cost data:

Year	0	1	2	3	4	5	6
Cost of Spares	-	200	400	700	1000	1400	1600
Salary of the	-	1200	1200	1400	1600	2000	2600

maintenance staff							
Losses due to breakdown	-	600	800	700	1000	1200	1600
Resale Value	12000	6000	3000	1500	800	400	400

Assuming that the life of the machine deteriorates with time at the rate of 10%, calculate the optimum maintenance period for this machine.

Q.3] c) Write a short note on Inventory Management