

[Time: 03.00 Hrs]		[Marks:75]
Please check whether you have got the right question paper.		
N.B:	<ol style="list-style-type: none"> 1. Q.1 is compulsory and carries 20 Marks. 2. Q. 8 is compulsory and carries 15 Marks. 3. Attempt any four questions from Q.2, Q.3, Q.4, Q.5, Q6 and Q7. Each of these questions carry 10 Marks. 4. Figures to the right indicate full marks. 	

Q.1	(A)	<p>Select the correct option for the following statements/questions:</p> <ol style="list-style-type: none"> 1. If total demand is not equal to total supply, then the transportation problem is a/an _____ transportation problem. (balanced, unbalanced, feasible) 2. Total Transportation Cost = $20(30) + 30(20) + 10(60) + 40(30) + 60(30) + 10(10) =$ _____ (4900, 5900, 6900) 3. Penalty is the difference between two _____ cost values. (minimum, maximum, zero) 4. In the North West Corner Method, the process of transportation of goods starts from the _____ of the matrix. (Lower right corner, lower left corner, upper left corner) 5. If $m + n - 1 = 6$ and Number of Allocations are 6 then it is called _____ feasible solution. (Basic, Degenerate Basic, Infeasible) 6. The vertical arrangement of cells in the matrix is termed as _____. (row, column, table) 7. Penalty is the difference between two _____ cost values. (minimum, maximum, zero) 8. _____ refers to a process of applying mathematical technique to use the resources of organization effectively and efficiently using optimization method. (Game Theory, Linear Programming Problem, Assignment Problem) 9. Assumptions of Linear Programming Model do not include _____. 	(20)
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		(Linearity, Continuity or Divisibility, Unlimited Choices)																																		
		10. The _____ states that the values of objective function are in the multiple of assumed variables. (Continuity assumption, Proportionality assumption, Both- Continuity assumption and Proportionality assumption)																																		
Q.2		<p>Solve any TWO of the following:</p> <p>(A) A manufacturer produces 2 products A and B, whose profits are Rs. 3 and Rs. 4 per unit respectively. Production data (weekly) is as indicated below: 1) Product A requires 4 hours of machine while Product B requires 2 hours of machine. Total machine hours available is 100. 2) Product A requires 4 hours of labour while Product B requires 6 hours of labour. Total Labour hours available is 180. 3) 1 Kg of the same raw material is required for manufacturing each unit of product A as well as Product B. A total of 40 kgs of raw material is available. Due to trade restrictions, Product A cannot be produced more than 20 units in a week and due to agreement with customer, at least 10 units of Product B must be produced. How many units of Product A and B should be produced?</p> <p>(B) A retired person wants to invest up to an amount of 30,000 rupees in fixed income securities. His broker recommends investing in two bonds: Bond A yielding 7% and Bond B yielding 10%. After some consideration, he decides to invest at most 12,000 rupees in Bond B and at least 6000 rupees in Bond A. He also wants the amount invested in Bond A to be at least equal to the amount invested in Bond B. What should the broker recommend if the investor wants to Maximize his return on investment? Formulate the problem.</p> <p>(C) Solve the following game directly.</p> <table><tr><td></td><td></td><td colspan="4">Player B</td></tr><tr><td></td><td></td><td>B1</td><td>B2</td><td>B3</td><td>B4</td></tr><tr><td rowspan="4">Player A</td><td>A1</td><td>7</td><td>6</td><td>8</td><td>9</td></tr><tr><td>A2</td><td>-4</td><td>-3</td><td>9</td><td>10</td></tr><tr><td>A3</td><td>3</td><td>0</td><td>4</td><td>2</td></tr><tr><td>A4</td><td>10</td><td>5</td><td>-2</td><td>0</td></tr></table>			Player B						B1	B2	B3	B4	Player A	A1	7	6	8	9	A2	-4	-3	9	10	A3	3	0	4	2	A4	10	5	-2	0	(10)
		Player B																																		
		B1	B2	B3	B4																															
Player A	A1	7	6	8	9																															
	A2	-4	-3	9	10																															
	A3	3	0	4	2																															
	A4	10	5	-2	0																															

Q.3

Solve any TWO of the following:

(10)

- (A) Solve the following transportation problem using North West Corner method.

	D1	D2	D3	D4	Supply
S1	4	6	8	8	40
S2	6	8	6	7	60
S3	5	7	6	8	50
Demand	20	30	50	50	150

- (B) Solve the following transportation problem using North West Corner method.

	D1	D2	D3	D4	Supply
S1	2	3	11	7	6
S2	1	0	6	1	1
S3	5	8	15	9	10
Demand	7	5	3	2	17

- (C) Solve the following transportation problem using Column Minima Method.

	D1	D2	D3	Supply
S1	3	2	1	20
S2	2	4	1	50
S3	3	5	2	30
S4	4	6	7	25
Demand	40	30	55	125

Q.4

Solve any TWO of the following:

(10)

- (A) A company operates in 4 territories and 4 salesmen are available for an assignment. The territories are not equally rich in their sales potential. It is estimated that a typical salesman operating in each territory would bring in the following annual sales:

Territory	I	II	III	IV
Annual Sales (Rs.)	126000	105000	84000	63000

The 4 salesmen also differ in their ability. It is estimated that working under the same conditions, their yearly sales would be proportionately as follows:

Salesman	A	B	C	D
Proportion	7	5	5	4

If the criteria are maximum expected total sales, the intuitive answer is to assign the best salesman to the richest territory, the next best salesman to the second richest, and so on, verify this answer by the assignment technique.

- (B) A television repairman finds that the time spent on his jobs has an exponential distribution with a mean of 30 minutes. If he repairs the sets in the order in which they came in, and if the arrival of sets follows a Poisson distribution with an approximate average rate of 10 per 8-hour day, what is the repairman's expected idle time each day? How many jobs are ahead of the average set just brought in?

- (C) Weldon Company has taken the 3rd floor of a multi-storeyed building for rent with a view to locate one of the zonal offices. There are 5 main rooms in this to be assigned to the 5 managers. Each room is different. Each of the 5 Managers were asked to rank their room preferences amongst the rooms - 301, 302, 303, 304, 305. Their preferences are as follows:

Manager 1	Manager 2	Manager 3	Manager 4	Manager 5
302	302	303	302	301
303	304	301	305	302
304	305	304	304	304
	301	305	303	
		302		

Assuming that their preferences can be quantified by numbers, find out as to which manager should be assigned to which room so that their total preference ranking is a minimum.

Q.5

Solve any TWO of the following:

(10)

- (A) Solve the following transportation problem using North West Corner method.

	D1	D2	D3	D4	Supply
S1	2	3	11	7	6
S2	1	0	6	1	1
S3	5	8	15	9	10
Demand	7	5	3	2	17

(B) Solve the following LPP graphically:

Objective: Maximize $Z = 4A + 8B$

Subject to Constraints:

$$A + B < 10$$

$$B < 15$$

$$3A + 6B < 18$$

$$A \text{ and } B > 0$$

(C) Solve the following game directly and by using Principle of Dominance.

		Player Y				
		1	2	3	4	5
Player X	I	1	3	2	7	4
	II	3	4	1	5	6
	III	6	5	7	6	5
	IV	2	0	6	3	1

Q.6

Solve any TWO of the following:

(10)

(A) Solve the following transportation problem using Row Minima method.

	D1	D2	D3	D4	Supply
S1	20	30	40	30	50
S2	10	20	30	10	60
S3	20	40	60	10	70
Demand	30	50	30	70	180

(B) A job requires four different activities- Sorting, Washing, Finishing and Assembling. Four workers are assigned all these activities. The time required by each worker to complete four different activities: Sorting, Washing, Finishing and Assembling are given below:

	Worker 1	Worker 2	Worker 3	Worker 4
Sorting	31	25	33	25
Washing	25	24	23	21
Finishing	19	21	23	24
Assembling	38	36	34	40

How should these activities be arranged to the workers so that the job is completed in minimum time?

(C) A firm manufactures three types of products. The fixed and variable costs are given below:

Fixed Cost (in rupees)	Variable Cost per unit
Product A 25000 rupees	12
Product B 35000 rupees	9
Product C 53000 rupees	7

The likely demand (units) of the products is given below:

Poor demand: 3,000

Moderate demand: 7,000

High demand: 11,000

If the sale price of each type of product is Rs. 25, then prepare the payoff matrix.

Q.7

Solve any TWO of the following:

(10)

(A) A food products' company is contemplating the introduction of a revolutionary new product with new packaging or replacing the existing product at much higher price (S1). It may even make a moderate change in the composition of the existing product, with a new packaging at a small increase in price (S2), or may make a small change in the composition of the existing product, backing it with the word 'New' and a negligible increase in price (S3). The three possible states of nature or events are:

(i) high increase in sales (N1), (ii) no change in sales (N2) and (iii) decrease in sales (N3).

The marketing department of the company worked out the payoffs in terms of yearly net profits for each of the strategies of three events (expected sales). This is represented in the following table:

Strategies	States of Nature	States of Nature	States of Nature
	N1	N2	N3
S1	700	300	150
S2	500	450	0
S3	300	300	300

Which strategy should the concerned executive choose on the basis of

1) Maximin criterion

2) Maximax criterion

(B) A department has 5 employees with 5 jobs to be performed. The time taken in hours that each man takes to perform each job is given on the effectiveness matrix.

	Employee 1	Employee 2	Employee 3	Employee 4	Employee 5
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Job A	10	5	13	15	16
Job B	3	9	18	13	6
Job C	10	7	2	2	2
Job D	7	11	9	7	12
Job E	7	9	10	4	12

How should the Jobs be allocated or assigned, one per employee, so as to minimize total man hours?

- (C) Formulate the Problem.
 Objective: Maximize $Z = 10A + 20B$
 Subject to Constraints:
 $2A + B < 40$
 $5A - 2B < 20$
 $A > 25$
 $A, B > 0$

Q.8

Solve any **THREE** of the following:

(15)

- (A) Solve the following transportation problem using Least Cost Method.

	D1	D2	D3	D4	Supply
S1	2	3	11	7	6
S2	1	0	6	1	1
S3	5	8	15	9	10
Demand	7	5	3	2	17

- (B) The advertising manager of Sky Ltd. Has a budget of Rs.2,00,000 for the annual sales campaign for a particular year. The current advertising proposal is to promote the baggies through two leading fashion magazines Fashion Today and Look. The unit cost of an ad in Fashion Today is rupees 2,000 and that of Look is rupees 3,500. Past experience shows that during the sales campaign the company will need at least 25 ads to appear in Look. Fashion Today is a monthly magazine and not more than one insertion is desired in one issue. The expected effective readership for unit ad in Fashion Today is 40,000 and that of Look is 55,000. Formulate a suitable linear programming which will maximize effective readership for the company ad and present it graphically.

- (C) Solve the following transportation problem using Row Minima Method.

	D1	D2	D3	Supply
S1	3	2	1	20
S2	2	4	1	50
S3	3	5	2	30
S4	4	6	7	25
Demand	40	30	55	125

- (D) Mr. X flies quite often from town A to town B. He can use the airport bus which costs Rs. 25 but if he takes it, there is a 0.08 chance that he will miss the flight. The stay in a hotel costs Rs. 270 with a 0.96 chance of being on time for the flight. For Rs. 350 he can use a taxi which will make 99 per cent chance of being on time for the flight. If Mr. X catches the plane on time, he will conclude a business transaction that will produce a profit of Rs. 10,000, otherwise he will lose it. Which mode of transport should Mr. X use? Answer on the basis of the EMV criterion.