

[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. _____ states that the values of decision variables are either positive values or zero values (non-negative values). (Continuity assumption, Proportionality assumption, Both- Continuity assumption and Proportionality assumption) 2. $2A + B < 100$ then What is the Value of A and B? (50,0 / 0,40 / 20,40) 3. $10X + 20Y < 400$ then what is the Value of X and Y? (0,20 / 0,24 / 0,30) 4. If $m + n - 1 = 6$ and Number of Allocations are 5 then it is called _____ feasible solution. (Basic, Degenerate Basic, Infeasible) 5. HAM stands for _____. (Hungarian Assignment Method, Hunn Assignment Method, Hyper Assignment Method) 6. 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) 7. _____ is the first solution to the transportation problem. (An initial feasible solution, An initial infeasible solution, An initial feasible or infeasible solution) 8. In the North West Corner Method, the process of transportation of goods starts from the _____ of the matrix. 	(20)
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		<p>(Upper right corner, Lower right corner, Upper left corner)</p> <p>9. The vertical arrangement of cells in the matrix is termed as _____. (row, column, table)</p> <p>10. Penalty is the difference between two _____ cost values. (minimum, maximum, zero)</p>	
Q.2		<p>Solve any TWO of the following:</p> <p>(A) Solve the following LPP graphically: Objective: Maximize $Z = 15A + 30B$ Subject to Constraints: $4A + 8B > 24$ $2A + 10B > 15$ $A, B > 0$</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) 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.</p> <p>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>	(10)

Q.3

Solve any TWO of the following:

(10)

- (A) 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

- (B) 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

- (C) Given the following payoff tables where the table represents profits:

Alternatives	States of Nature			
	S1	S2	S3	S4
A1	3	5	8	-1
A2	6	5	2	0
A3	0	5	6	4

Calculate the payoff using:

(a) Maximax, (b) Maximin

Q.4

Solve any TWO of the following:

(10)

- (A) Weldon Company has taken the 3
- rd
- 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.

- (B) A computer centre has 3 expert programmers. The centre wants 3 application programs to be developed. Estimate the computer time in minutes required by the experts for the application programmes as follows:

	Programmer A	Programmer B	Programmer C
Program 1	120	100	80
Program 2	80	90	110
Program 3	110	140	120

Assign the Programmers to the Programmes in such a way that the time in minimum.

- (C) 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.

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) A petroleum company is considering expansion of its one unloading facility at its refinery. Due to random variations in weather, loading delays and other factors, ships arriving at the refinery to unload crude oil arrive at a rate of 5 ships per week. The service rate is 10 ships per week. Assume arrivals follow a Poisson Process and the service time is exponential.
- Find the average time a ship must wait before beginning to deliver its cargo to the refinery.
 - What is the average number of idle berths at any specified time?

Q.6**Solve any TWO of the following:****(10)**

- (A) 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?

- (B) A firm is engaged in producing two products A and B. Each unit of Product A requires 2 kgs of raw material and 4 hours of labour. Each unit of Product B requires 3 kgs of raw material and 3 hours of labour. Every week the firm has an availability of 60 kgs of raw materials and 96 labour hours. One unit of product A sold yields 40 rupees and one unit of product B sold gives 35 rupees as profit. How many units of each of the products should be produced per week so that the firm can earn the Maximum Profit. Assume there is no marketing constraint so that all that can be produced is sold. Formulate a suitable linear programming and present it graphically.

- (C) 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

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
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) Solve the following transportation problem using North West Corner 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.8

Solve any THREE of the following:

(15)

- (A) 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.

(B) 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

(C) 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.

(D) 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