

[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	<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). <ol style="list-style-type: none"> (a) Continuity assumption (b) Proportionality assumption (c) Both a and b 2. $2A + B < 100$ then What is the Value of A and B? <ol style="list-style-type: none"> (a) 50,0 (b) 0,40 (c) 20,40 3. $100X + 200Y < 4000$ then what is the Value of X and Y? <ol style="list-style-type: none"> (a) 0,20 (b) 0,24 (c) 0,30 4. If $m + n - 1 = 6$ and Number of Allocations are 5 then it is called _____ feasible solution. <ol style="list-style-type: none"> (a) Basic (b) Degenerate Basic (c) Infeasible 5. HAM stands for _____. <ol style="list-style-type: none"> (a) Hungarian Assignment Method (b) Hunn Assignment Method (c) Hyper Assignment Method 6. If total demand is not equal to total supply, then the transportation problem is an _____ transportation problem. <ol style="list-style-type: none"> (a) balanced (b) unbalanced (c) feasible 7. Total Transportation Cost = $20(30) + 30(20) + 10(60) + 40(30) + 60(30) + 10(10) =$ _____ 	(20)
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	<p>(a) 4900 (b) 5900 (c) 6900</p> <p>8. Penalty is the difference between two _____ cost values. (a) minimum (b) maximum (c) zero</p> <p>9. In the North West Corner Method, the process of transportation of goods starts from the _____ of the matrix. (a) Lower right corner (b) Lower left corner (c) Upper left corner</p> <p>10. If $m + n - 1 = 6$ and Number of Allocations are 6 then it is called _____ feasible solution. (a) Basic (b) Degenerate Basic (c) Infeasible</p>	
Q.2	<p>Attempt any Two of the following:</p> <p>(a) 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.</p> <p>(b) The advertising manager of Sky ltd. Has a budget of rupees 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 atleast 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</p>	(10)

55,000. Formulate a suitable linear programming which will maximize effective readership for the company ad and present it graphically.

(c) Solve the following game directly:

		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

Attempt any Two of the following:

(10)

(a) 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

(b) 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

(c) 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?

Q.4

Attempt any Two of the following:

(10)

- (a) 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.

- (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 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.5

Attempt any Two of the following:**(10)**

- (a) Two competing firms A and B are in the local market. They use different strategies to maximize the profit. Firm A uses two strategies A1 and A2. Firm B uses three strategies B1, B2 and B3. Their corresponding pay off matrix is given in the following table as

	Firm B1	Firm B2	Firm B3
Firm A1	2	8	4
Firm A2	7	10	6

Solve it using Game Theory.

(b) 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

(c) Solve the following LPP graphically:

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

Subject to Constraints:

$$A + B < 10$$

$$B < 15$$

$$3A + 6B < 18$$

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

Q.6

Attempt any Two of the following:

(10)

(a) 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.

(b) 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		
	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

- (i) Maximin criterion
- (ii) Maximax criterion

(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

Attempt any Two of the following:

(10)

(a) Formulate the Problem.

Objective: Maximize $Z = 10A + 20B$

Subject to Constraints:

$$2A + B < 40$$

$$5A - 2B < 20$$

$$A > 25$$

$$A, B > 0$$

(b) A dentist schedules all his patients for 30-minute appointments. Some of the patients take more 30 minutes some less, depending on the type of dental work to be done. The following summary shows the various categories of work, their probabilities and time actually needed to complete the work:

Category of Service	Time (minutes)	Probability of Category
Filling	45	0.40
Crown	60	0.15
Cleaning	15	0.15
Extraction	45	0.10
Checkup	15	0.20

Simulate the dentist's clinic for four hours and determine the average waiting time for the patients as well as the idleness of the doctor. Assume that all the patients show up at the clinic at exactly their scheduled arrival time starting at 8.00 a.m.

Use the following random numbers for handling the above problem:

40 2 11 34 25 66 17 79

(c) 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?

Q.8

Attempt any Three of the following:

(15)

(a) Solve the following transportation problem using Least Cost 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 Row Minima Method.

	D1	D2	D3	Supply
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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) Solve following transportation problem using Vogels' Approximation 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) 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 atleast equal to the amount invested in Bond B. What should the broker recommend if the investor wants to Maximise his return on investment. Formulate the problem.