Q.P. Code: 00005269

[Time: 03.00 Hrs]	**[Marks:75]**
Please check whether you have got the right question paper.	
N.B:	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) **Select the correct option for the following statements/questions:** **(20)**

1. _____ 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)

2. Assumptions of Linear Programming Model do not include _____.
(Linearity, Continuity or Divisibility, Unlimited Choices)

3. The _____ states that the values of objective function are in the multiple of assumed variables.
(Continuity assumption, Proportionality assumption, Both of the above)

4. _____ is the first solution to the transportation problem.
(An initial feasible solution, An initial infeasible solution, An initial feasible or infeasible solution)

5. In the North West Corner Method, the process of transportation of goods starts from the _____ of the matrix.
(Upper right corner, Lower right corner, Upper left corner)

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. HAM stands for _____.
(Hungarian Assignment Method, Hunn Assignment Method, Hyper Assignment Method)

9. VAM stands for _____.

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(Vogels' Approximation Method, Vital Approximation Method, Visible Approximation Method)

10. The basic feasible solution exists when _____.
(number of occupied cells are equal to number of rows and number of columns minus one, number of occupied cells are less than number of rows and number of columns minus one, number of occupied cells are greater than number of rows and number of columns minus one)

Q.2 **Solve any TWO of the following:** **(10)**

(A) 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.

(B) Solve the following LPP graphically:

Objective: Maximize Z = 15A + 30B

Subject to Constraints:

4A + 8B > 24

2A + 10B > 15

A, B > 0

(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 **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 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) 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) 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.

(B) 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.

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

(A) Solve the following LPP graphically:

Objective: Maximize Z = 4A + 8B
Subject to Constraints:
A + B < 10
B < 15
3A + 6B < 18
A and B > 0

(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

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(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.

i) Find the average time a ship must wait before beginning to deliver its cargo to the refinery.
ii) What is the average number of idle berths at any specified time?

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

(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.

(B) 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.

(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

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Q.7 **Solve any TWO of the following:** **(10)**

(A) 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?

(B) Formulate the Problem.

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

Subject to Constraints:

$2A + B < 40$

$5A - 2B < 20$

$A > 25$

$A, B > 0$

(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) 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) Solve following transportation problem using Vogels' Approximation 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 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) 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 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.