UNIT-II

UNIT II DUALITY AND NETWORKS 9

Definition of dual problem – Primal – Dual relation ships – Dual simplex methods – Post optimality analysis – Transportation and assignment model - Shortest route problem

1. Define transportation problem.

It is a special type of linear programming model in which the goods are shipped from various origins to different destinations. The objective is to find the best possible allocation of goods from various origins to different destinations such that the total transportation cost is minimum.

2. Define the following: Feasible solution

A set of non-negative decision values xij (i=1,2,….m; j=1,2…n) satisfies the constraint equations is called a feasible solution.

3. Define the following: basic feasible solution

A basic feasible solution is said to be basic if the number of positive allocations are m+n-1.(m-origin and n-destination).If the number of allocations are less than (m+n-1) it is called degenerate basic feasible solution.

4. Define optimal solution in transportation problem

A feasible solution is said to be optimal, if it minimizes the total transportation cost.

5. What are the methods used in transportation problem to obtain the initial basic feasible solution.

- North-west corner rule
- Lowest cost entry method or matrix minima method
- Vogel's approximation method

6. Write down the basic steps involved in solving a transportation problem.

- To find the initial basic feasible solution
- To find an optimal solution by making successive improvements from the initial basic feasible solution**.**

7. What do you understand by degeneracy in a transportation problem? (NOV '07)

If the number of occupied cells in a m x n transportation problem is less than (m+n-1) then the problem is said to be degenerate.

8. What is balanced transportation problem& unbalanced transportation problem?

When the sum of supply is equal to demands, then the problem is said to be balanced transportation problem.

A transportation problem is said to be unbalanced if the total supply is not equal to the total demand.

9. How do you convert an unbalanced transportation problem into a balanced one?

The unbalanced transportation problem is converted into a balanced one by adding a dummy row (source) or dummy column (destination) whichever is necessary. The unit transportation cost of the dummy row/ column elements are assigned to zero. Then the problem

is solved by the usual procedure.

10. Explain how the profit maximization transportation problem can be converted to an equivalent cost minimization transportation problem. (MAY '08)

If the objective is to maximize the profit or maximize the expected sales we have to convert these problems by multiplying all cell entries by -1.Now the maximization problem becomes a minimization and it can be solved by the usual algorithm

11. Determine basic feasible solution to the following transportation problem using least cost method. (MAY '09)

	A	B	C	D	SUPPLY
P	1	2	1	4	30
Q	3	3	2	1	50
R	4	2	5	9	20
Demand	20	40	30	10	

12. Define transshipment problems?

A problem in which available commodity frequently moves from one source to another source or destination before reaching its actual destination is called transshipment problems.

13. What is the difference between Transportation problem & Transshipment Problem?

In a transportation problem there are no intermediate shipping points while in transshipment problem there are intermediate shipping points

14. What is assignment problem?

An assignment problem is a particular case of a transportation problem in which a number of operations are assigned to an equal number of operators where each operator performs only one operation, the overall objective is to maximize the total profit or minimize the overall cost of the given assignment.

15. Explain the difference between transportation and assignment problems?

	Transportation problems	Assignment problems
1)	supply at any source may be a any positive quantity.	Supply at any source will be 1.
2)	Demand at any destination may be a positive quantity.	Demand at any destination will be 1.
3)	One or more source to any number of destination.	One source one destination.

16. Define unbounded assignment problem and describe the steps involved in solving it?

If the no. of rows is not equal to the no. of column in the given cost matrix the problem is said to be unbalanced. It is converted to a balanced one by adding dummy row or dummy column with zero cost**.**

17. Explain how a maximization problem is solved using assignment model?

The maximization problems are converted to a minimization one of the following method.

(i) Since max z = min(-z)

(ii) Subtract all the cost elements all of the cost matrix from The Highest cost element in that cost matrix.

18. What do you understand by restricted assignment? Explain how you should overcome it?

The assignment technique, it may not be possible to assign a particular task to a particular facility due to technical difficulties or other restrictions. This can be overcome by assigning a very high processing time or cost (it can be ∞) to the corresponding cell.

19. How do you identify alternative solution in assignment problem?

Sometimes a final cost matrix contains more than required number of zeroes at the independent position. This implies that there is more than one optimal solution with some optimum assignment cost.

20. What is a traveling salesman problem?

A salesman normally must visit a number of cities starting from his head quarters. The distance between every pair of cities are assumed to be known. The problem of finding the shortest distance if the salesman starts from his head quarters and passes through each city exactly once and returns to the headquarters is called Traveling Salesman problem**.**

21. Define route condition?

The salesman starts from his headquarters and passes through each city exactly once.

22. Give the areas of operations of assignment problems?

Assigning jobs to machines.

Allocating men to jobs/machines.

Route scheduling for a traveling salesman.

PART-B

1. How do you convert the unbalanced assignment problem into a balanced one? (MAY '08)

Since the assignment is one to one basis , the problem have a square matrix. If the given problem is not square matrix add a dummy row or dummy column and then convert it into a balanced one (square matrix). Assign zero cost values for any dummy row/column and solve it by usual assignment method.

1.Find the minimum cost distribution plan to satisfy demand for cement at three	To constmetium sites	Capacity tones/months

cremation sites from available capacities at three cement plants given the following transportation costs(in Rs) per tone of cements moved from plants to sites From				
P1	Rs.300	Rs.360	Rs.425	Rs.600
P2	Rs.390	Rs.340	Rs.310	Rs.300
P3	Rs.255	Rs.295	Rs.275	Rs.1000
Demand tones/months	400	500		800

2.Solve the following assignments problems

I	II	III	IV	V	
A	10	5	9	18	11
B	13	19	6	12	14
C	3	2	4	4	5
D	18	9	12	17	15
E	11	6	14	19	10

3.Solve the TP where cell entries are unit costs. Use vogel's approriments method to fnd the initial basic solution

D1	D2	D3	D4	D5	AVAILABLE
O1	68	35	4	74	15	18
O2	57	88	91	3	8	17
O3	91	60	75	45	60	19
O4	52	53	24	7	82	13
O5	51	18	82	13	7	15
Required	16	18	20	14	14	

4.A small garments making units has five tailors stitching five different types of garments all the five tailors are capable of stiching all the five types of garments .the output per day per tailor and the profit(Rs.)for each type of garments are given below.

	2	3	4	5
A	7	9	4	8	6
B	4	9	5	7	8
C	8	5	2	9	8
D	6	5	8	10	10
E	7	8	10	9	9
PROFIT per garment	2	3	2	3	4

Which type of garments should be assigned to which tailor in order to maximize profit, assuming that there are no others constructs

5. Solve the following TP to maximize profit

	A	B	C	D	SUPPLY
1	40	25	22	33	100
2	44	35	30	30	30
3	38	38	28	30	70
DEMANDS	40	20	60	30	

6. Five workless are available to work with the machines and respective cost associated with each worker –machine assignments is given below.A sixth machine is available to replace one of the existing machines and the associated cost are also given below.

	M1	M2	M3	M4	M5	M6
W1	12	3	6	-	5	8
W2	4	11	-	5	-	3
W3	8	2	10	9	7	5
W4	-	7	8	6	12	10
W5	5	8	9	4	6	-

Determine whether the new machine can be accepet ans also determine optmal assignments and the associated saving in cost

7. Solve the following TP using Vogel's approximation method

	A	B	C	D	SUPPLY
I	6	1	9	3	70
II	11	5	2	8	55
III	10	12	4	7	70
DEMAND	85	35	50	45	

8. Solve the assignment problem

	1	2	3	4	5	6
A	12	10	15	22	18	8
B	10	18	25	15	16	12
C	11	10	3	8	5	9
D	6	14	10	13	13	12
E	8	12	11	7	13	10

9. Find the IBFS of the following TP by VAM and hence find the optimum solutions

	P	Q	R	SUPPLY
A	5	1	7	10
B	6	4	6	80
C	3	2	5	15
DEMAND	45	20	40	

10. Solve the following assignment problems

	M1	M2	M3	M4
J1	18	24	28	32
J2	8	13	17	18
J3	10	15	19	22

11. Solve the following TP

	D1	**D2**	**D3**	**D4**	**SUPPI**
S1	6	1	9	3	70
S2	11	5	2	8	55
S3	10	12	4	7	70
DEMANDS	85	35	50	45	