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Operations Research use in Transportation Problem

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Abstract:-
Transportation problem involves a large number of shipping routes from several supply origins to several demand destinations. The objective is to determine the number of units of an item that should be shipped from an origin to destination in order to satisfy the required quantity of goods or services at each destination centre

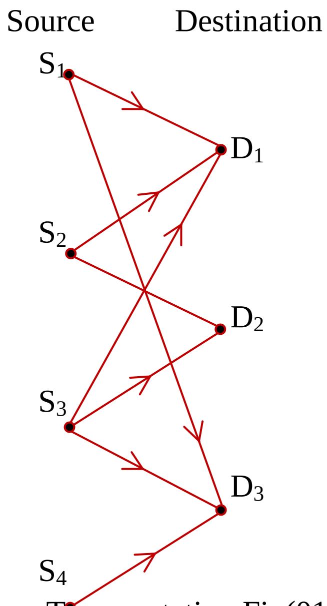
Keyword:- Distance, Time, Balance, Graph, Direct Graph, Multi Graph, Simple Graph, Algorithm

Introduction:-

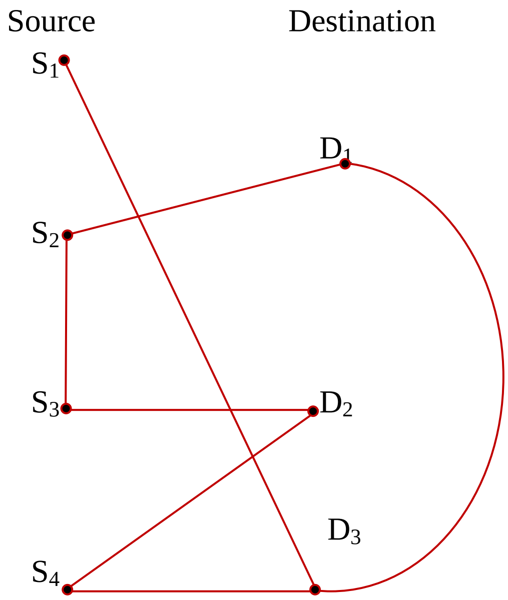
One important application of linear programming is in area of physical transportation of goods and services form several supply centre's to several demand centre's. It is easy to mathematically express a transportation problem. Transportation problem involves a large number of shipping routes from several supply origins to several demand destinations. The objective is to determine the number of units of an item that should be shipped from an origin to destination in order to satisfy the required quantity of goods or services at each destination centre. This should be done within the limited quantity of goods or services available at each supply centre at the minimum transportation cost or time.

1. Trans – Shipment Problem :-

In a transportation problem, the shipment of a commodity takes place among sources and destinations. But instead of direct shipments to destination, the commodity can be transported to a particular destination through one or more intermediate or Trans – shipment points. Each of these points in Trans supply to other points. Thus when the shipments and pass from destination to destination and from source to source, we have a Trans - shipment problem. A problem dealing with four sources and three destinations is shown diagrammatically. Fig. 1 (a) and (b).



Transportation Fig(01)

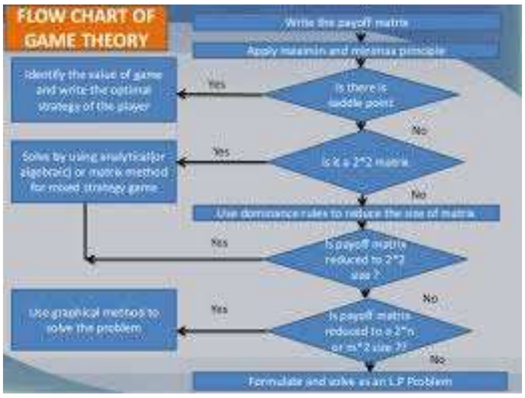


Trans – Shipment Fig(02)

Since the follow of commodity can be both directions, arrows are not shown in fig (b) the solution to this problem can be obtained by using the transportation model. The solution procedure is as follows if there are m sources and n destinations. We shall have a transportation table of size (m+n) x (m+n) instead of m x n as in the usual case. If the total number of units transported from all source to all destination is N. Then the given supply at each source and demand at each destination are added to N. The demand at source and the supply at each destination are set to be equal to N.

1.1 Game Theory :-

Mathematically, a mixed strategy for a player, with two or more possible course of action is the set s of n non-negative real number whose sum is unity, n being the number of pure strategies of the player. If p_j = (j = 1, 2, 3,……….….n) is the probability with which the pure strategy, j would be selected then : s = (p_1, p_2, p_3,…………..…..p_n) where $p_1+p_2+p_3+$……..……..+ p_n = 1 and $p_j \geq$, 0 of is a particular p_j = 1 (j = 1, 2, 3,…………..n) and all others are zero. Then players is said to select pure strategy j. A flow chart using game theory approach to solve a problem is show fig. 03.



Fig(03)

1.2 Transportation Algorithm by Modi Method :

The steps to evaluate unoccupied cells are as follows:

Step 1: For an initial basic feasible solution with m + n – 1 occupied cell, calculate u_i and v_j for rows and columns. The initial solution can be obtained by any of the three methods discussed earlier.

To start with, any one of u_is of v_js is assigned the value zero. It is better to assign zero to a particular u_i or v_j where there are maximum number of allocations in a row or column respectively, as this will reduce the considerably arithmetic work. The complete the calculation of u_is and v_js for other rows and column by using the relation.

$$C_{ij} = u_i + v_j \text{ , for all occupied cells (I, j).}$$

Step 2 : For unoccupied cells, calculate the opportunity cost. Do this by using the relationship

$$d_{ij} = c_{ij} - (u_i + v_j) \text{ , for all i and j}$$

Step 3 : Examine sign of each d_{ij}

(i) If $d_{ij} > 0$, then the current basic feasible solution is optimal.
(ii) If $d_{ij} = 0$, then the current basic feasible solution will remain unaffected but an alternative solution exists.
(iii) If one or more $d_{ij} < 0$, then an improved solution can be obtained by entering unoccupied cell (i , j) in the basis. An unoccupied cell having the largest negative value of d_{ij} is chosen for entering into the solution mix.

Step 4 : Construct a closed-path for the unoccupied cell with largest negative opportunity cost. Start the closed path with the selected unoccupied cell and mark a plus sign (+) in this cell. Trace a path along the rows to an occupied cell, mark the corner with a minus sign (–) and continue down the column to an occupied cell. Then mark the corner with plus sign (+) and minus sign (–) alternatively. Close the path back to the selected unoccupied cell.

Step 5 : select the smallest quantity amongst the cells marked with minus sign on the corners of closed loop. Allocate this value to the selected unoccupied cell and add it to other occupied cells marked with plus signs. Now subtract this from the occupied cells marked with minus signs.
Step 6 : Obtain a new improved solution by allocation units to the unoccupied cell according to step 5 and calculate the new total transportation cost.
Step 7 : Further test the revised solution for optimality. The procedure terminates when all $d_{ij} \geq 0$ for unoccupied cells.

Conclusions:-

The main aim of this paper is to present the importance of operations research theoretical idea in transportation problem.
Researcher may set some information related to operations research and transportation problem and can get some ideas related to their field of research.

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