Research Journal of Recent Sciences ISSN 2277-2502
Vol. **6(6),** 57-58, June **(2017)** *Res. J. Recent Sci.*

Short Review Paper

Comparison between transportation technique and linear programming technique for any problem

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Available online at: www.isca.in, www.isca.me
Received 29th April 2017, revised 16th May 2017, accepted 30th May 2017

Abstract

In this paper comparison between transportation technique and linear programming technique for any problem is presented. Though the transportation problems are the particular form of the linear programming problem, therefore the same can be solved by the simplex method but when the number of unknown quantities x_{ij} is large, then the procedure of finding the solution becomes very lengthy and cumbersome therefore we shall use the convenient method to solve the transportation problem. First of all initial basic feasible solution is obtained for the problem and then it is improved by iteration.

Keywords: Transportation, Linear programming problem, Basic feasible solution, Constraints.

Introduction

Though the transportation problems are the particular form of the linear programming problem, therefore the same can be solved by the simplex method but when the number of unknown quantities x_{ij} is large, then the procedure of finding the solution becomes very lengthy and cumbersome therefore we shall use the convenient method to solve the transportation problem[1,2]. First of all initial basic feasible solution is obtained for the problem and then it is improved by iteration.

Comparison between two techniques

Since transportation problem (TP) is special case of Linear Programming Problem (L.P.P.), so a B.F.S. of a transportation problem has the same definition as for L.P.P. However, it is noteworthy that in case of a T.P., there are only $(m+n-1)$ basic variables out of the total mn unknowns, therefore a B.F.S. of a T.P. will consist of at most $(m+n-1)$ positive variables, others being zero.(by fundamental theorem of LPP , one of the BFS's will be the optimum solution)[3-5].

The solution procedure of transportation problem consists of the following main steps: i. Step 1 to find an initial B.F.S., ii. Step 2 to obtain an optimal solution by making successive improvements to the initial BFS (obtained in step 1) until no further decrease in the transportation cost is possible.

In a transportation problem with m x n matrix, we have, i. mn variables, ii. $m+n$ constraints, iii. In balanced problem, $\sum a_i = \sum b_j \; i = 1,2 \dots m; \; j = 1,2 \dots . n$ and we have $m+n-1$ constraints.

Limitations of Linear Programming Problem are the computational work in problems having a large number of variables and constraints becomes enormous inspite of help being taken of computers[6].

Transportation problem is linear as Linear Programming Problem. Linear programming problem helps in making the best use of all available resources and thus helps in increasing the profit or reducing the cost of its products. It improves quality of decisions[7].

Linear Programming Problem is an important Operations research technique which is used in many practical problems as petroleum refineries, paper industries, iron and steel industries etc. It is used in deciding the units of a homogeneous commodity to be transported at certain demand centers from the places o its production with minimum transportation costs[8].

Problem of minimizing the linear (objective) cost function $Z = \sum_{i=1}^{m} \sum_{j=1}^{n} c_{ij} \, x_{ij}$ of $m \, x \, n$ variables x_{ij} subject to $m + n - 1$ equality constraints is known as a balanced transportation problem.

As the objective function Z is linear in the variables x_{ij} and the $(m+n)$ constraints given by equations are b=$\sum_{j=1}^{n} b_j$ and m equations are a=$\sum_{i=1}^{m} a_i$ are also linear in the variables x_{ij}≥0 so it may also be posed as a linear programming problem in which all the constraints are given in the form of equations.

Because of condition $\sum a_i$=$\sum b_j$ the number of constraints is reduced by 1, making them to be equal to $m+n-1$, instead of $(m + n)$.

If m be 3, $n = 4$ then the number of variables will be $m \, x \, n = 12$ with 6 independent constraints. So the solution by L.P. will be very lengthy[9,10]. However there exists simple methods known as transportation techniques by which the solution is found is less number of steps only a few and in a very simple and easy way.

Origin \ Destination	D_1	D_2	D_3	Supply
o_1	$X_{11}(C_{11})$	$X_{12}(C_{12})$	$X_{13}(C_{13})$	a_1
o_2	$x_{21}(c_{21})$	$x_{22}(c_{22})$	$x_{23}(c_{23})$	a_2
Demand	b_1	b_2	b_3	$\sum_{i=1}^{2} a_i = N$ $\sum_{j=1}^{3} b_j = N$

The problem may be expressed as,
(Total cost) $Min\ Z = \sum_{i=1}^{2}\sum_{j=1}^{3} c_{ij}\, x_{ij}$
Subject to, $x_{11}+x_{21}=b_1$
$x_{12}+x_{22}=b_2$
$x_{13}+x_{23}=b_3$
And $x_{11}+x_{12}+x_{13}=a_1$
$x_{21}+x_{22}+x_{23}=a_2$
And $a_1+a_2=b_1+b_2+b_3$
With, $x_{ij}\geq 0$ for i=1, 2; j=1, 2, 3

Conclusion

When the number of variables and constraints are more in the given problem then the solution by Linear Programming will be very lengthy. However simple method known as transportation technique exists by which the solution is found is less number of steps only a few and in a very simple and easy way.

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