



A study of balanced transportation problem and use of object oriented programming

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ABSTRACT

In this paper, the south east corner [SEM] procedure is successfully coded and tested via many randomly generated problem instances. Based on the results we can conclude that the correctness of the newly coded SEM is promising as compared with the previously coded one.

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Keywords

Transportation problem,
LPP, Optimal solution,
South east corner rule,
Object oriented programming.

Introduction

The term 'OR' was coined in 1940 by M. C. Closky & T.ref then in a small town of Bawdsey in England. It is a science that came into existence in a military content. During world war II, the military management of UK called an Scientists from various disciplines & organized them into teams to assist it in solving strategic & tactical problems relating to air & land defence of the country.

The transportation problem is a special class of LPP that deals with shipping a product from multiple origins to multiple destinations. The objective of the transportation problem is to find a feasible way of transporting the shipments to meet demand of each destination that minimizes the total transportation cost while satisfying the supply & demand constraints. The two basic steps of the transportation method are

Step 1: Determine the initial basic feasible solution

Step 2: Obtain the optimal solution using the solution obtained from step 1.

In this paper the corrected coding of SEM in C++ is implemented. Then its correctness is verified via many randomly generated instances. The remainder of this paper is organized as follows :

Section II deals with the mathematical formulation of the transportation problem. In section III SEM is summarized. In section IV potential significance of the new object oriented program of VAM is illustrated with a numerical example.

Finally, conclusion by highlighting the limitations and future research scope on the topic is made in section V.

Mathematical formulation of the transportation problem

A. In developing the LP model of the transportation problem the following notations are used

a_i - Amounts to be shipped from shipping origin i ($a_i \geq 0$).

b_j - Amounts to be received at destination j ($b_j \geq 0$).

c_{ij} - Shipping cost per unit from origin i to destination j ($c_{ij} \geq 0$).

x_{ij} - Amounts to be shipped from origin i to destination j to minimize the total cost ($x_{ij} \geq 0$).

We assumed that the total amount shipped is equal to the total amount received, that is,

$$\sum_{i=1}^m a_i \geq \sum_{j=1}^n b_j$$

B. Transportation problem

$$\text{Min } \sum_{i=1}^m \sum_{j=1}^n c_{ij} x_{ij}$$

Subject to $\sum_{j=1}^n x_{ij} \leq a_i, i = 1, 2, \dots, m$

$$\sum_{i=1}^m x_{ij} \leq b_j, j = 1, 2, \dots, n, \text{ where } x_{ij} \geq 0 \forall i, j.$$

Feasible solution : A set of non negative values $x_{ij}, i = 1, 2, \dots, m$ and $j = 1, 2, \dots, n$ that satisfies the constraints is called a feasible solution to the transportation problem.

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

Non degenerate basic feasible solution: A basic feasible solution to a $(m \times n)$ transportation problem that contains exactly $m + n - 1$ allocations in independent positions.

Degenerate basic feasible solution: A basic feasible solution that contains less than $m + n - 1$ non negative allocations.

Balanced and Unbalanced Transportation problem: A Transportation problem is said to be balanced if the total supply from all sources equals the total demand in the destinations and is called unbalanced otherwise.

Thus, for a balanced problem, $\sum_{i=1}^m a_i = \sum_{j=1}^n b_j$ and for unbalanced problem, $\sum_{i=1}^m a_i \neq \sum_{j=1}^n b_j$

South east corner rule

The steps involved in VAM in producing the initial feasible solution are described below :

This method starts at the south east corner cell (route) of the table variable (x_{43}).

Step 1: Construct the transportation table for the given TPP.

Step 2: Allocate as much as possible to the selected cell and adjust the associated amounts of supply and demand by subtracting the allocated amount.

Step 3: Cross out the row or column with zero supply or demand to indicate that no further assignments can be made in

that row or column. I both a row and column net to zero simultaneously, cross out one only and leave a zero supply (demand in the uncrossed out row - column).

Step 4: If exactly one row or column is left uncrossed out, stop. Otherwise, move to the cell to the right if a column has just been crossed out. Go to step 2 [8].

Numerical Illustration

The following 4 × 3 numerical example [8] is used to illustrate the newly developed coding of SEM

Table I. The initial solution obtained by newly coded vam

From / To	D ₁	D ₂	D ₃	D ₄	Availability
S ₁	11	13	17	14	250
S ₂	16	18	14	10	300
S ₃	21	24	13	10	400
Requirement	200	200	275	250	950/ 950

The Initial cost obtained by the newly coded SEM is 16,800 which is also an optimal to this problem. But, if we use the coded SEM then we will not be able to get any solution for this problem. There are many other problems which are not given in this paper. That is there is something wrong with his object oriented programming of SEM .

Conclusion

In this paper, the SEM is successfully coded in C++ and tested via many randomly generated problem instances. Future research might be carried out in proposing an efficient better solution procedure which can provide a better initial solution

than SEM for solving transportation problems. We intend to devote ourselves in this direction.

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