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ROW-COLUMN (RC) Method for Transportation Problem for finding an Initial Basic Feasible Solution (IBFS)

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ABSTRACT-**_Transportation Problem (TP) deals with finding an Initial basic Feasible Solution (IBFS) and then checking its optimality so that the goods can be deliver from corresponding supply stations to the corresponding demanding points/destinations. This paper presents another possible model for getting the IBFS for TP. The present model do not requires balancing the TP. Subsequently, the model is capable of delivering the IBFS with lesser number of steps. Two significant insight is shown: (1) no matter the given problem is balanced or unbalanced, the present model treats both cases in the same way without balancing the TP[1]; (2) uses row-column approach; (3) easy to implement.**

KEYWORDS-**_Balanced TP, IBFS (Initial Basic Feasible Solution), Degeneracy, FIFS (First In First Served), Minimum Demand/Supply Value (V_{max}), Least Cell Cost (C_{min}).**

I INTRODUCTION

The work of SAUL I. GASS [2] described the earlier history of TP all the way long from simplex method implementation to Dantzig's adaptation of the simplex method to the TP as the primal simplex transportation method. The work got further extended to C.S. Ramakrishnan[3], that described a variation of Vogel's approximation method (VAM)[4], for finding a first feasible solution to the TP, works of Shafaat and Goyal[5] and Arsham and Kahn[6] for solving degenerate TPs. VAM is consider to give a better IBFS among all the existing techniques, with a unique penalty technique approach which gives a better convergence rate for getting optimal solution.. The present paper describes another technique for getting the IBFS.

II TRANSPORTATION PROBLEM

The TP is a special kind of the Linear Programming Problem. The basic idea is to present the Supply-Demand in a Tabular structure and to find an optimal cost route for each production/delivery center to the corresponding destinations within its reach so that the goods gets delivered with the least shipping charges called as the optimal path comprising each production/delivery center. The idea behind this is not to find the lowest cost path for each route but an ideal path so that the overall shipping cost is the optimal one. Suppose there are m points of origins/supply M_1,.,M_i, . . ., M_m and n destinations N_1, . . ,N_j, . . .,Nn. The point Mi(i = 1, . . .,m) can supply a_i units, and the destination Nj(j = 1, . . ., n) requires n_j units. Whereby, the cost of shipping a unit from M_i to N_j is computed as C_{ij}, where $C^{ij} \geq 0$. If total supply equals total demand then the problem is a balanced TP also called as Rim condition i.e. Rim condition is satisfied if total demand equals total supply else Rim condition is not satisfied. If Rim condition is unsatisfied than, a Dummy row/column get introduce as per the condition. The basic steps to solve transportation problem are:
Step1. Finding the IBFS,
Step2. Checking optimality of the solution obtained from Step 1.

TP can be solved by using simplex methods, but it is time-consuming process and because of this there are some specialized algorithms for transportation problem that are much more efficient than the simplex algorithm like

1. Northwest Corner Method (NWCM)
2. Minimum Cost Method (MCM)
3. Vogel's Approximation Method (VAM)
4. Row Minimum Method (RMM)
5. Column Minimum Method (CMM)

All the above-mentioned methods differ on the process to handle the problem.

Some are easy to implement like NWCM and MCM whereas some are complex compared to others, but the focus is the same for all such methods to find the best IBFS with less time consumption (referred to as time complexity in computer terminology). The proposed model provides another possible way for finding the IBFS using row-column technique. It does not require the problem to be a balanced one as degeneracy condition could be achieve without need for balancing the TP.

III RESEARCH METHODOLOGY

1. TP does not require balancing.
2. Start process by assigning maximum possible value to least cell cost for first row than same process for column.
3. Easy to implement.

The details of above three methodologies are as follows:

1. Its well known that an unbalanced TP is equivalent to an ordinary balanced TP with one dummy row/column with zero costs added. The need to balance the TP, in case of unbalanced condition, is to create an arbitrary route so that neither total supply nor total demand remains in the final table but also to avoid any extra cost to a cell because of unbalancing. However, this gives only an arbitrary solution and not a actual solution if dummy row/column gets consider in the final table. This shows that introduction of dummy row or dummy column can be omitted if there exists a different way to get this condition of optimal shipment fulfilled. This only shows the need for degeneracy condition required during Optimality check. Different works like that .of C.S.Ramakrishnan[3] tried to overcome with the problem of Dummy Row/Column.
2. The proposed method takes care for both supply routes as well as for demand routes equally by making assignments row wise and then column wise alternatively. The basic idea behind this is to make maximum possible assignment for each row and column right from the first row and column so that the supply-demand for each route get fulfilled from top to bottom without increasing the complexity.
3. The process used for finding the IBFS is a straightforward process with no complex steps involved and just requires the least demand/supply value and highest cell value for corresponding least demand/supply value.

IV ALGORITHM

Step1. Check for the minimum value between demand and supply value, V_{max} for first row.

Step2. Make assignment to the least cost cell, C_{min} for the corresponding row. Use FIFS (First-In First Served) approach in case for non-uniqueness for C_{min}.

Step3. Reduce corresponding demand and supply by amount V_{max} and strikeout the corresponding row or column for which supply or demand becomes equal to zero.

Step4. Repeat steps 1-3 for first column. If first column gets strikeout than do, the same process for second column until demand or supply or both becomes zero.

Step5. Repeat Steps 1-3 for row and column alternatively always starting from the top most row/column left until demand, supply or both becomes equal to zero.

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