Note on Assignment Algorithm with Easy Method of Drawing Lines to Cover All Zeros

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ABSTRACT

The Assignment algorithm is around 54 years old and a lot of work has been done on this algorithm. In this study various aspect of assignment algorithm has been considered. The endeavor of this note is to make solution of assignment problem so simple that even class tenth student can easily solve it. One of the most important aspects of assignment algorithm (Hungarian Algorithm) is to draw lines to cover all the zeros, in this study a new and easy method has been proposed to cover all the zeros, which helps to make this algorithm easy.

Keywords: Algorithms, Applications of Assignment Problem, Assignment Problem, Hungarian Method, Method to Cover All Zeros

INTRODUCTION

The assignment problem is a special type of linear programming problem where assignees are being assigned to perform task. It can also be defined as a special type of transportation problem in which each source should have capacity to fulfill the demand of any of the destinations. In other words, any operator should be able to perform any job regardless of his skills, although cost will be more if the job does not match with the worker’s skill. An example of assigning workers to jobs in a factory is given in Table 1.

In Table 1 n jobs has to be distributed to n-persons in such a way total cost is minimum.

The Assignment Problem Model

The mathematical model for the assignment problem uses the following decision variables:

\[ x_{ij} = \begin{cases} 1 & \text{if assignee } i \text{ performs task } j, \\ 0 & \text{if not} \end{cases} \]

For i= 1, 2,…, n and j=1, 2,…, n. Thus \( x_{ij} \) is a binary variable (it has value 0 or 1).

Let Z denote the total cost, the assignment problem model is

Minimize

\[ Z = \sum_{i=1}^{n} \sum_{j=1}^{n} c_{ij} x_{ij}, \]
subject to

\[ \sum_{i=1}^{n} x_{ij} = 1 \text{ for } j = 1, 2, \ldots, n \]

\[ \sum_{j=1}^{n} x_{ij} = 1 \text{ for } i = 1, 2, \ldots, n \]

and

\[ x_{ij} \geq 0, \text{ for all } i \text{ and } j \]

(\( x_{ij} \) binary, for all \( i \) and \( j \))

**LITERATURE REVIEW**

The Hungarian method is a combinatorial optimization algorithm which solves the assignment problem in polynomial time and which anticipated later primal-dual methods. It was developed and published by Kuhn (1955), who gave the name “Hungarian method” because the algorithm was largely based on the earlier works of two Hungarian mathematicians: Dénes König and Jenő Egerváry.

Munkres (1957) reviewed the algorithm and observed that it is (strongly) polynomial. Since then the algorithm has been known also as Kuhn-Munkres algorithm or Munkres assignment algorithm. Gross (1959) has discussed bottleneck assignment problem. Held and Karp (1962) developed a dynamic programming approach to sequencing problems. Porschling (1963) studied a matrix assignment and associated min-max problem.

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