

OPTIMIZING THE TOTAL COST IN JOB ALLOCATION

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ABSTRACT

The objective of this paper is to assign a number of resources like computer centers, departmental stores, manufacturing firms etc., to an equal number of activities like expert programmers, skilled and unskilled workers etc., so as to minimize the total cost or maximize the total profit of allocation. The assignment problem is one of the fundamental combinatorial optimization problems in the branch of operations research or optimization in mathematics. The problem of assignment arises because of assigning the available resources having multitudinal degrees of efficiency for performing different activities. These kinds of problems are solved by Hungarian algorithm.

Keywords: *fundamental combinatorial, optimization, minimize cost, maximize profit, optimal solution, Hungarian algorithm.*

INTRODUCTION:

An assignment problem is a particular case of transportation problem where the objective is to assign a number of resources to an equal number of activities so as to minimize total cost or maximize total profit of allocation. The problem of assignment arises because available resources such as men, machines, etc. have varying degrees of efficiency for performing different activities. Therefore, cost, profit or time of performing the different activities is different. Thus, the problem is how the assignments should be made so as to optimize the given objective. The assignment problem is one of the fundamental combinatorial optimization problems in the branch of optimization or operations research in Mathematics. It consists of finding a maximum weight matching in a weighted bipartite graph.

TRANSPORTATION METHOD

Since an assignment problem is a special case of the transportation problem, it can also be solved by transportation methods. However, every basic feasible solution of a general assignment problem having a square payoff matrix of order n should have more $m+n-1 = n+n-1 = 2n-1$ assignments. But due to the special structure of this problem, any solution cannot have more than n assignments. Thus, the assignment problem is inherently degenerate. In order to remove degeneracy, $(n-1)$ number of dummy allocations will be required in order to proceed with the transportation method. Thus, the problem of degeneracy at each solution makes the transportation method computationally inefficient for solving an assignment problem.

HUNGARIAN METHOD:

Assignment problems can be formulated with techniques of linear programming and transportation problems. As it has a special structure, it is solved by the special method called Hungarian method. This method was developed by D. Konig, a Hungarian mathematician and is therefore known as the Hungarian method of assignment problem. In order to use this method, one needs to know only the cost of making all the possible assignments. Each assignment problem has a matrix (table) associated with it. Normally, the objects (or people) one wishes to assign are expressed in rows, whereas the columns represent the tasks (or things) assigned to them. The number in the table would then be the costs associated with each particular assignment. It may be noted that the assignment problem is a variation of transportation problem with two characteristics. (i) The cost matrix is a square matrix, and (ii) The optimum solution for the problem would be such that there would be only one assignment in a row or column of the cost matrix. Hungarian method is based on the principle that if a constant is added to the elements of cost matrix, the optimum solution of the assignment problem is the same as the original problem. Original cost matrix is reduced to another cost matrix by adding a constant value to the elements of rows and columns of cost matrix where the total completion time or total cost of an assignment is zero. This assignment is also referred as the optimum solution since the optimum solution remains unchanged after the reduction.

EXAMPLES SUMS:

A departmental store wants to assign 4 jobs to 4 persons with minimization of total cost.

	A	B	C	D
18	26	17	11	
18	28	14	26	
38	19	18	15	
19	26	24	10	

ROW WISE SMALL VALUE

18	26	17	11
18	28	14	26
38	19	18	15
19	26	24	10

COLUMN WISE SMALL VALUE

7	15	6	0
0	15	1	13
23	4	3	0
9	16	14	0

ROW WISE ONLY ZERO

7	11	5	0
0	11	0	13
23	0	2	0
9	12	13	0

that the Hungarian method of solving assignment problem should be adopted by the institutions and agencies for tender/contractor placement and selection planning.

2	6	0	0
0	11	0	18
2	0	2	5
4	7	8	0

The transportation path is

E----C

F----A

G----B

H----D

CONCLUSION:

Application of this method gives a systematic and transparent solution to a problem.

The algorithm finds an optimal assignment for a given “n x n” cost matrix. “Assignment problems deal with the question how to assign n items (e.g. jobs) to n machines (or workers) in the best possible way.

Hungarian method gives an optimal results for the firms .Therefore, recommends