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A New Approach for Solving Assignment Problem by using Divided Star Graph – DSG Method

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Abstract

In this paper introduced solving Assignment problem in another way by using divided star graph directly with algorithm and solution steps. The edges are represented the cost of assigning person to task after divided method, the nodes are represented the tasks and persons after divided method. The solution will be by choosing the minimum cost (edge) from the costs (edges) and delete the selected edge as well as nodes associated with the corresponding edge, then delete all other edges associated with the nodes.

Keywords: Assignment Problem, Divided Method, Star graph Optimization.

1. INTRODUCTION:

The assignment problem arises because available resources (such as men, machines etc.) have varying degree of efficiency for performing different activity. Therefore, cost, profit or time of performing different activity is different. Thus, the problem is how the assignments should be made so as to optimize the given objective. The assignment problem is completely specified by its two components, the assignment which represents the underlying combinatorial structure and the objective function to be optimized which models "the best possible way."

The assignment problem is a particular type of the transportation problem where the objective is to assign a number of resources to an equal number of activities so as to as to minimize total profit of allocation. In the assignment model, worker s represent sources and jobs destination. The supply (demand) amount at each source (destination) exactly equal 1. The cost of "transporting" worker to job is. In effect, the assignment model can be solved directly as a regular transportation model (or as a regular linear programming problem). Nevertheless, the fact

Vol.11.no.3(2020):3024-3029
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that all the supply and demand amounts equals 1 has led to the development of a simple solution method called Hungarian method.

Divided Star Graph – Method:

In this section we introduce a new approach for solving Assignment problem with the help of divided star graph method and this new method is easy procedure to solve Assignment problem. Also an example is solved by this method.

Algorithm of Divided Star Graph Method - DSG Method:

Step 1: First divide all the numbers by two and write the whole number.

Example: $[\frac{19}{2}] = 9$.

Step 2: Find the smallest number (cost) of each row. Subtract this smallest number from every number in that row. Next, find the smallest number (cost) of each column. Subtract this smallest number from every number in that column.

If there are some rows and columns without assignment, then we cannot get the optimum solution. Then we go to the next step.

Step 3: Converting the problem into star graph.

		Jobs				
		J_1	J_2	J_3	.....	J_n
Workers	W_1	C_{11}	C_{12}	C_{13}	.....	C_{1n}
	W_2	C_{21}	C_{22}	C_{23}	.....	C_{2n}
	W_3	C_{31}	C_{32}	C_{33}	.....	C_{3n}
	.					
	.					
	.					
	.					
	W_n	C_{n1}	C_{n2}	C_{n3}	.....	C_{nn}

Vol.11.no.3(2020):3024-3029
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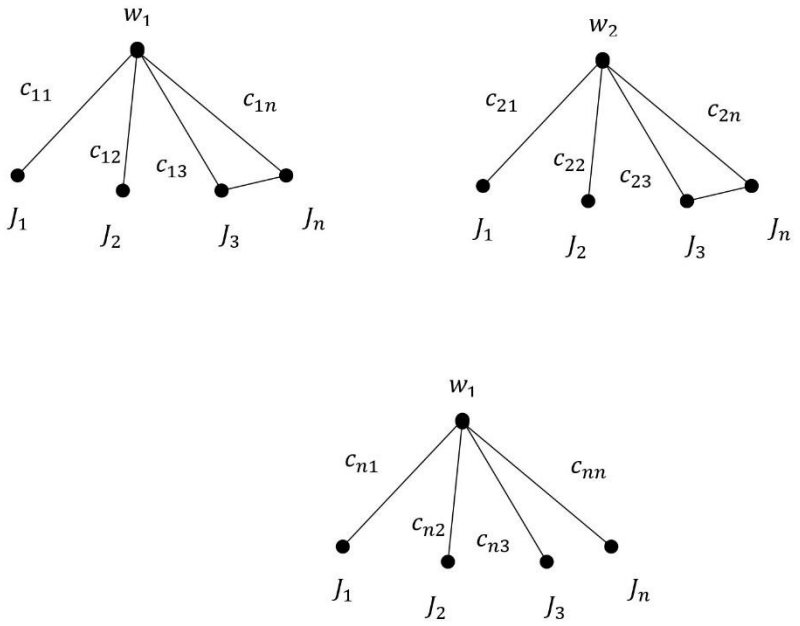

1. Choose the lowest cost $C_{ij} = 0$ between workers and tasks. Delete the selected edge as well as the nodes associated with edge.
2. Repeat the previous step to obtain each worker associated with only one task.
3. When more than one zero exist in C_{ij}, select the edge which contains minimum value associated with zero node. Next delete the selected edge as well as the nodes associated with edge.
4. Find the optimal solution.

3. Numerical Methods with Proposed Method:

Consider the problem of assigning four jobs to four persons. The assignment costs are given below.

	1	**2**	**3**	**4**
A	10	12	19	11
B	5	10	7	8
C	12	14	13	11
D	8	12	11	9

Vol.11.no.3(2020):3024-3029
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Step 1: First divide all the numbers by two and write the whole number.

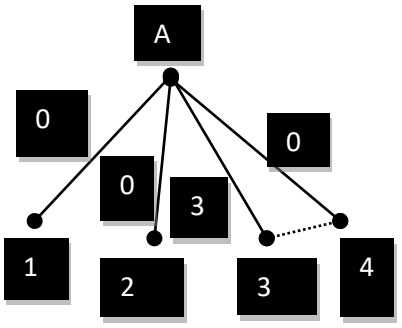
	1	**2**	**3**	**4**
A	5	6	9	5
B	2	5	3	4
C	6	7	6	5
D	4	6	5	4

Step 2: Find the smallest number (cost) of each row. Subtract this smallest number from every number in that row. Next, find the smallest number (cost) of each column. Subtract this smallest number from every number in that column.
If there are some rows and columns without assignment, then we cannot get the optimum solution. Then we go to the next step.

	1	**2**	**3**	**4**
A	0	1	4	0
B	0	3	1	2
C	1	2	1	0
D	0	2	1	0

	1	**2**	**3**	**4**
A	0	0	3	0
B	0	2	0	2
C	1	1	0	0
D	0	1	0	0

Step 3: Converting the problem into star graph .



Vol.11.no.3(2020):3024-3029
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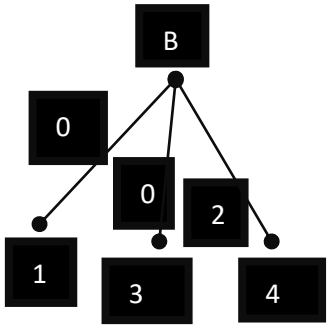
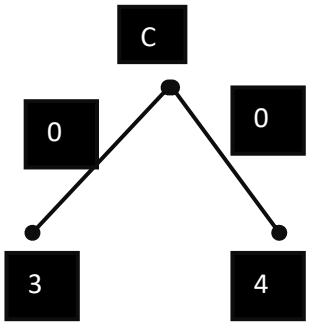
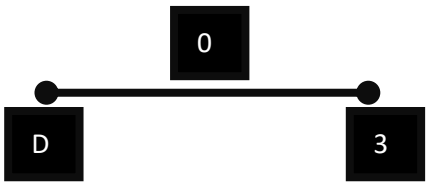
Assigning A to 2, delete node 2 corresponding edges in all graphs. Then the resultant graph is



Assigning B to 1, delete node 1 corresponding edges in all graphs. Then the resultant graph is



Assigning C to 4, delete node 4 and corresponding edges in all graphs. Then the resultant graph is



A – 2, B – 1, C – 4 , D - 3

The optimal solution is 12 + 5 + 11 + 11 = 39.

Vol.11.no.3(2020):3024-3029
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Conclusion

A numerical example has been presented for demonstrating the solution procedure of the proposed method.

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