A NEW REVISED ZERO's TO ONE's METHOD FOR SOLVING ASSIGNMENT PROBLEM

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Abstract

In this paper, an innovative method, namely a New Revised Zero's to One's Method (NRZOM) will be proposed to find the optimal solution for any assignment problem involving the zero cost occurs in any rows or columns to form as ones and apply the procedure. The optimization of the result occurred by this method has been checked by Maximum Difference Cost method (MDCM), Bottleneck Cost Method (BCM) and Hungarian method (HM). This method (NRZOM) is easy to convert zeros as ones to make the assignment and to attain the optimal solution.

Keywords: Assignment problem, Maximum difference cost method, Bottleneck Cost method, Hungarian method and Proposed method (NRZOM), Optimization.

Introduction

The assignment problem is a particular case of the transportation problem in which the objective is to assign a number of tasks to an equal number of facilities at a minimum cost. Many articles have been published under this topic in different concepts. The optimal solution obtained by this method is easy and compare the result with other methods. An assignment problem finds numerous applications in production planning, VLSI design, telecommunication, economics etc.

Numerical Example

Consider the following assignment problem to minimize the total assignment time.

Machines \ Jobs	J1	J2	J3	J4	J5
M1	8	5	2	6	1
M2	0	9	5	5	4
M3	3	8	9	2	6
M4	4	3	1	0	3
M5	9	5	8	5	9

Maximum Difference Cost method (MDCM)

Jobs / Machines	J1	J2	J3	J4	J5	Difference				
M1	8	5	2	6	1	1	1	1	1	--
M2	0	9	5	5	4	4	--	--	--	--
M3	3	8	9	2	6	1	4	--	--	--
M4	4	3	1	0	3	1	1	2	2	1
M5	9	5	8	5	9	3	3	3	--	--
Difference	3	2	1	2	2	**Minimum assignment time =1+0+2+1+5 = 9 Unit**				
	--	2	1	2	2					
	--	2	1	--	2					
	--	--	1	--	2					
	--	--	1	--	--					

Bottleneck Cost Method (BCM)

$C^* = $ Maxi(1,0,2,0,5,0,3,1,0,1) =5

Replace all those cost by ∞ which are greater than C^*

Jobs / Machines	J1	J2	J3	J4	J5
M1	∞	5	2	∞	1
M2	0	∞	5	5	4
M3	3	∞	∞	2	∞
M4	4	3	1	0	3
M5	∞	5	∞	5	∞

Now apply Hungarian method, we get

Jobs / Machines	J1	J2	J3	J4	J5
M1	∞	4	0	∞	0
M2	0	∞	4	5	4
M3	1	∞	∞	0	∞
M4	4	3	0	0	3
M5	∞	0	∞	0	∞

Hungarian method (HM)

Jobs / Machines	J1	J2	J3	J4	J5
M1	7	4	0	5	0
M2	0	9	4	5	4
M3	1	6	6	0	4

M4	4	3	0	0	3
M5	4	0	2	0	4

In both the methods the minimum assignment is 9 unit

Now I apply the new method which is known as newly revised zeros to one's method. The algorithm is as follows.

New Revised Zeros to One's Method algorithm

Step 1: Find any zero cost occurs in the cost matrix. Suppose zero cost occurs then add 1 to the entire cost matrix. If not go to step2

Step 2: Find the minimum cost element in each row and write it on the right side of the cost matrix. Then divide each element of the row by that minimum cost.

Step 3: Check each row and column has at least ones and has to make an assignment in terms of one. Otherwise, goo to step4

Step 4: Find the minimum cost element in each column and write it on the bottom side of the cost matrix. Then divide each element of the column by that minimum cost Now each row and column has at least ones and to make the assignment in terms of one. If no optimal assignment occurs then, go to step5

Step 5: Draw the minimum number of lines passing through all ones by using the following procedure:

(a). Mark (√) the rows that do not have any assignments.

(b). Mark (√) the columns that have crossed ones in that marked rows.

(c). Mark (√) the rows that have assignments in marked columns.

(d). Repeat (b) and (c) till no more rows or columns can be marked.

(e). Draw straight lines through all unmarked rows and marked columns. If the number of lines drawn is equal to the number of rows or columns, then the current solution is the optimal solution. Otherwise, go to next step.

Step6: Select the smallest cost of the reduced cost matrix not covered by the lines. Divide all the uncovered numbers by this smallest cost. Other cost covered by the lines remains unchanged. Then we get some new ones in row and column. Again make the assignment in terms of ones.

Step 7: If we cannot get the optimal assignment in each row and column. Then repeat this process successively till an optimum solution is obtained.

The above problem is solved by using newly revised zeros to one's method algorithm

Step:1

Jobs / Machines	J1	J2	J3	J4	J5	Minimum cost
M1	9	6	3	7	2	2
M2	1	10	6	6	5	1
M3	4	9	10	3	7	3
M4	5	4	2	1	4	1
M5	10	6	9	6	10	6

Step:2

Jobs / Machines	J1	J2	J3	J4	J5
M1	4.5	3	1.5	3.5	1
M2	1	10	6	6	5
M3	1.3	3	3.3	1	2.3
M4	5	4	2	1	4

M5	1.7	1	1.5	1	1.7

Step:3

Jobs / Machines	J1	J2	J3	J4	J5
M1	4.5	3	1.5	3.5	1
M2	1	10	6	6	5
M3	1.3	3	3.3	1	2.3
M4	5	4	2	1	4
M5	1.7	1	1.5	1	1.7
Minimum cost	1	1	1.5	1	1

Step:4

Jobs / Machines	J1	J2	J3	J4	J5	
M1	4.5	3	1	3.5	1	
M2	1	5	4	6	5	
M3	1.3	1.5	2.2	1	2.3	☺
M4	5	2	1.3	1	4	☺
M5	2.5	0.8	1	1	1.7	
				☺		

Step:5

Jobs / Machines	J1	J2	J3	J4	J5
M1	4.5	3	1	3.5	1
M2	1	5	4	6	5
M3	1	1.2	1.7	1	1.8
M4	3.8	1.5	1	1	3.1
M5	2.5	0.8	1	1	1.7
Minimum cost	1	0.8	1	1	1

Step:6

Jobs / Machines	J1	J2	J3	J4	J5
M1	4.5	3.8	1	3.5	1

M2	1	6.3	4	6	5
M3	1	1.5	1.7	1	1.8
M4	3.8	1.9	1	1	3.1
M5	2.5	1	1	1	1.7

In a new revised zero to ones method, the assignment scheduled is
M1→ J5, M2→ J1, M3→J4,M4→J3,M5→J2.and also the optimal assignment is 9 unit.

Conclusion:

Finally, I conclude that in all the above four methods the schedule of allocations is the same and the optimal assignment is also the same unit. The proposed method of an algorithm is very easy to convert zeros as ones and to make the assignment and to get the optimal solution. This method can be used to maximize as well as to minimize the objective function of the balanced and the unbalanced assignment problem.

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