Int. J. Math. And Appl., 6(4)(2018), 257–262
ISSN: 2347-1557
Available Online: http://ijmaa.in/

International Journal of *Mathematics And its Applications*

New Method For Optimal For Transportation Problem (Aditya's Method)

S. Aditya Krishnan[1]*

1 Department of Physics, St. Xavier's college, Thumba, Thiruvananthapuram, Kerala, India.

Abstract: The main aim of this paper is to provide a new method (Aditya's Method) to obtain the optimal solution for transportation by skipping the modi method and obtain the correct result.

Keywords: Vogel's Approximation Method, MODI method, Initial Basic Feasible Solution, Optimality Test, Transportation Problem.

Accepted on: 21.10.2018

1. Introduction

In network analysis, the transportation problem [1], we find the solution to the problem using many methods such as Vogel's Approximation Method [2], North-West corner rule, Least cost method etc. By using any of these method, we obtain Initial Basic Feasible Solution [3] and find the minimum cost required for the transportation of goods. After the initial solution is obtained, we go for Optimality Test [4]. After that we go MODI method [5], to make sure that the optimal solution we obtained is correct or not. But the method that I introduced will allow us to skip the modi method and get the correct answer and this method is called Aditya's method. This method is applicable to find the penalty those having the row or column having two same number.

2. Transportation Problem

Consider a standard transportation problem.

	A_1	A_2	A_3	A_4	Accessibility
N_1	27	50	63	18	21
N_2	80	50	57	72	27
N_3	43	15	91	25	72
Required	20	10	25	65	

Now we are doing according to the rule, first we find the penalty [6] and indicate the row or column with highest penalty.

	A_1	A_2	A_3	A_4	Accessibility	Penalty
N_1	27	50	63	18	21	9
N_2	80	50	57	72	27	7
N_3	43	15	91	25	72	10
Required	20	10	25	65		
Penalty	16	35	6	7		

* *E-mail: adityakrishnanss@gmail.com*

The penalty is 35. Now we continue the procedure.

	A_1	A_3	A_4	Accessibility	Penalty
N_1	27	63	18	21	9
N_2	80	57	72	27	15
N_3	43	91	25	62	18
Required	20	25	65		
Penalty	16	6	7		

The penalty is 18.

	A_1	A_3	A_4	Accessibility	Penalty
N_1	27	63	18	21	9
N_2	80	57	72	27	15
Required	20	25	3		
Penalty	53	6	54		

The Penalty is 54.

	A_1	A_3	Accessibility	Penalty
N_1	27	63	18	36
N_2	80	57	27	23
Required	20	25		
Penalty	53	6		

The penalty is 53.

	A_1	A_3	Accessibility
N_2	80	57	27
Required	2	25	

Now calculating the value.

	A_1	A_2	A_3	A_4	Accessibility
N_1	18 27	0 50	0 63	3 18	21
N_2	2 80	0 50	25 57	0 72	27
N_3	0 43	10 15	0 91	62 25	72
Required	20	10	25	65	

Calculating the cost $27 * 18 + 3 * 18 + 2 * 80 + 25 * 57 + 10 * 15 + 62 * 25 = 3825$. We got the answer as 3825, now we can check whether it is correct or not.

	R_1	R_2	R_3	R_4
T_1	18 27	0 50	0 63	3 18
T_2	2 80	0 50	25 57	0 72
T_3	0 43	10 15	0 91	62 25

$$T_1 + R_1 = 27$$

$$T_1 + R_4 = 18$$

$$T_2 + R_1 = 80$$

$$T_2 + R_3 = 57$$

$$T_3 + R_2 = 15$$

$$T_3 + R_4 = 25$$

Find the values of R_1, R_2, R_3, R_4, T_1, T_2, T_3.

$$R_1 = 27; R_2 = 8; R_3 = 4; R_4 = 18; T_1 = 0; T_2 = 53; T_3 = 7$$

$$\begin{aligned} C_{ij} \quad \text{(the whole bar)} &= C_{ij} - (T_i + R_j) \\ &= 50 - (T_1 + R_2) = 42 \\ &= 63 - (T_1 + R_3) = 59 \\ &= 50 - (T_2 + R_2) = -11 \\ &= 72 - (T_2 + R_4) = 1 \\ &= 43 - (T_3 + R_1) = 9 \\ &= 91 - (T_3 + R_3) = 80 \end{aligned}$$

We got a negative number, which means the table obtained above have some correction. That is $50 - (T_2 + R_2) = -11$, corresponding to (T_2, R_2). In the above table, there are 6 values 18, 3, 2, 25, 10 and 62. Out of this, the smallest number that is 2, as there is error in the position (T_2, R_2). So the required table is

	A_1	A_2	A_3	A_4	Accessibility
N_1	20 / 27	0 / 50	0 / 63	1 / 18	21
N_2	0 / 80	2 / 50	25 / 57	0 / 72	27
N_3	0 / 43	8 / 15	0 / 91	64 / 25	72
Required	20	10	25	65	

Calculating the cost $20 * 27 + 1 * 18 + 2 * 50 + 25 * 57 + 8 * 15 + 64 * 25 = 3803$. Now we can check whether we got the table is correct.

	R_1	R_2	R_3	R_4
T_1	20 / 27	0 / 50	0 / 63	1 / 18
T_2	0 / 80	2 / 50	25 / 57	0 / 72
T_3	0 / 43	8 / 15	0 / 91	64 / 25

$$T_1 + R_1 = 27$$

$$T_1 + R_4 = 18$$

$$T_2 + R_2 = 50$$

$$T_2 + R_3 = 57$$

$$T_3 + R_2 = 15$$

$$T_3 + R_4 = 25$$

Find the values of R_1, R_2, R_3, R_4, T_1, T_2, T_3.

$$R_1 = 27; R_2 = 8; R_3 = 15; R_4 = 18; T_1 = 0; T_2 = 42; T_3 = 7$$

$$\begin{aligned} C_{ij} \ \text{(the whole bar)} &= C_{ij} - (T_i + R_j) \\ &= 50 - (T_1 + R_2) = 42 \\ &= 63 - (T_1 + R_3) = 48 \\ &= 80 - (T_2 + R_1) = 11 \\ &= 72 - (T_2 + R_4) = 12 \\ &= 43 - (T_3 + R_1) = 9 \\ &= 91 - (T_3 + R_3) = 69 \end{aligned}$$

Therefore C_{ij} (the whole bar) values are positive, so the table is correct.

3. Aditya's Method

Now the new method (Aditya's Method) that I am going introduced will allow us to skip the modi method while the last answer is correct. For this Consider the above the question.

	A_1	A_2	A_3	A_4	Accessibility
N_1	27	50	63	18	21
N_2	80	50	57	72	27
N_3	43	15	91	25	72
Required	20	10	25	65	

Now finding the penalty. It is done in a different way that I introduced here, I used a new way instead of difference between two smallest number, but we take the difference of two same number. That is $(50, 50)$, which is done only for column A_2, remaining penalty as normal.

	A_1	A_2	A_3	A_4	Accessibility	Penalty
N_1	27	50	63	18	21	9
N_2	80	50	57	72	27	7
N_3	43	15	91	25	72	10
Required	20	10	25	65		
Penalty	16	0	6	7		

The penalty is 16.

	A_2	A_3	A_4	Accessibility	Penalty
N_1	50	63	18	1	32
N_2	50	57	72	27	7
N_3	15	91	25	72	10
Required	10	25	65		
Penalty	0	6	7		

The penalty is 32.

	A_2	A_3	A_4	Accessibility	Penalty
N_2	50	57	72	27	7
N_3	15	91	25	72	10
Required	10	25	64		
Penalty	35	34	47		

Penalty is 47.

	A_2	A_3	Accessibility	Penalty
N_2	50	57	27	7
N_3	15	91	8	76
Required	10	25		
Penalty	35	34		

The penalty is 76.

	A_2	A_3	Accessibility
N_2	50	57	27
Required	2	25	

So the required table is

	A_1	A_2	A_3	A_4	Accessibility
N_1	20 27	0 50	0 63	1 18	21
N_2	0 80	2 50	25 57	0 72	27
N_3	0 43	8 15	0 91	64 25	72
Required	20	10	25	65	

Calculating the cost $20 * 27 + 1 * 18 + 2 * 50 + 25 * 57 + 8 * 15 + 64 * 25 = 3803$.

4. Conclusion

So I concluded that the table we obtain by skipping the modi method by applying Aditya's method and done by the original way are same.

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