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South–East Corner Rule of a Transportation Problem

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ABSTRACT

In this paper, an attempt is made to find the initial basic feasible solution under NWCR Method as well as the optimal solution to the problem by taking an example. At the same time taking into account of the assumptions of a transportation model, a comparative study is made by an imaginary thinking of, instead of North–West corner rule, why cannot we solve the same problem with South–East Corner Rule?

Keywords: *Models, research, transport*

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INTRODUCTION

Transportation Model in Operation Research deals with the problems concerning as to what happens to the effectiveness of the function when we associate each of a number of sources with each of a different number of destinations. The total movement from each origin and the total movement to each destination is given and it is desired to find how the associations be made subject to the limitations on the total. The assumptions in the transportation model are that the total quantity of the items available at different sources is equal to the total requirement at different destinations. Items can be transported conveniently from all sources to destinations. Key decision to be arrived at is to find how much quantity from which source to which destination center is transported so as to satisfy the constraints and minimize the cost. North–West Corner Method or North–West Corner Rule or NWCR Method is one of the methods of finding an Initial Basic Feasible Solution to a Transportation Problem to arrive at the total transportation cost. To find the optimal solution in order to know the further reduction in the transportation problem Modified Distribution Method is used [1].

NWCR METHOD (STEPPING STONE METHOD)

Initial Solution

Destination origin	D1	D2	D3	Availability a_i
O1	5 2	7	4	~~5~~ 0
O2	2 3	6 3	1	~~8~~ ~~6~~ 0
O3	5	3 4	4 7	~~7~~ ~~4~~ 0
O4	1	6	14 2	~~14~~ 0
Demand b_j	~~7~~ ~~2~~ 0	~~9~~ ~~3~~ 0	~~18~~ ~~14~~ 0	34

m + n – 1 = no of allocations (m stands for number of rows and n for number of columns)
4+ 3 – 1 = 6 non-degenerate.

[1]. Here $\sum a_i = \sum b_j$ (34=34)
[2]. The first allocation is made to the top left hand corner cell (x_{11}). North–West cell.The minimum of (a_1 and b_1) is selected and this value is entered in the cell (x_{11}).
[3]. If $b_j > a_i$ move horizontally downwards and make the second allocation minimum of (b_j a_i)
[4]. If $b_j < a_i$ move horizontally to the left or right and allocate to the cell min of (b_j a_i)
[5]. Ensure that (a_i and b_j) are exhausted simultaneously.
[6]. Starting from the North–West corner of the transportation table, repeat the above steps down until all the requirements are satisfied [2] .

The total transportation cost will be

From		To				Rs.
O_1	→	D_1	5 x	2	=	10
O_1	→	D_1	2 x	3	=	6
O_2	→	D_2	6 x	3	=	18
O_3	→	D_2	3 x	4	=	12
O_3	→	D_3	4 x	7	=	28
O_4	→	D_3	14 x	2	=	28
		Total				102

SOUTH–EAST CORNER RULE METHOD – INITIAL SOLUTIONS
Stepping up Stone Method

Destination origin	D1	D2	D3	Availability a_i
O1	[5] 2	7	4	~~5~~ 0
O2	[2] 3	[6] 3	1	~~8~~ ~~2~~ 0
O3	5	[3] 4	[4] 7	7 ~~3~~ 0
O4	1	6	[14] 2	~~14~~ 0
Demand b_j	~~7~~ ~~5~~ 0	~~9~~ ~~6~~ 0	~~18~~ ~~4~~ 0	34

m + n – 1 = no of allocations (m stands for number of rows and n for number of columns)
4 + 3 – 1 = 6 non-degenerate.

[1]. Here $\sum a_i = \sum b_j$ (34=34)
[2]. The first allocation is made in the cell occupying the lower left hand (South-East) corner of the transportation table (X_{43}). The minimum of a_4 and b_3 is then entered in the cell ($X_{4,3}$).
[3]. If $b_j > a_i$ move vertically upwards to the third row and make the second allocation the minimum (a_3 and b_3) in the cell ($X_{3,3}$).
[4]. If $b_j < a_i$ move horizontally to the left side or right and allocate to the cell min of (b_j and a_i)
[5]. Starting from South- East corner of the transportation table, repeat the above steps till all the availabilities and requirements are satisfied.

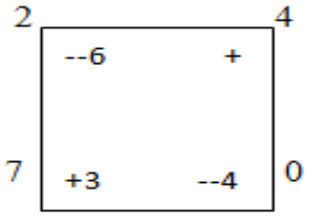
SOUTH–EAST CORNER RULE METHOD – INITIAL SOLUTIONS
Stepping up Stone Method

The total transportation cost will be						
From		To				Rs.
O_4	→	D_3	14	x 2	=	28
O_3	→	D_3	4	x 7	=	28
O_3	→	D_2	3	x 4	=	12
O_1	→	D_1	2	x 3	=	6
O_2	→	D_2	6	x 3	=	18
O_1	→	D_1	5	x 2	=	10
		Total	102			

OPTIMAL SOLUTIONS NWCR Method

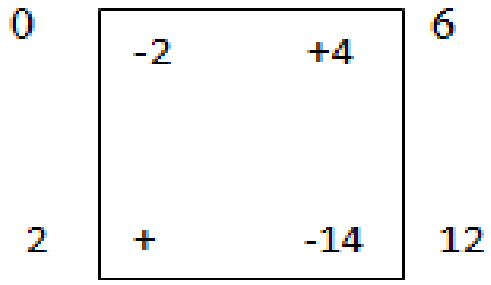
	D_1	D_2	D_3	a_i	U_i
O_1	[5] 2	7 [3]	4 [-1]	5 ~~0~~	--1
O_2	[2] 3	[6] 3	1 [-5]	~~8~~ 6	0
O_3	5 [1]	[3] 4	[4] 7	~~7~~ ~~4~~	1
O_4	1 [2]	6 [7]	[14] 2	14 0	--4
b_j	~~7~~ ~~2~~ 0	~~9~~ ~~3~~ 0	~~18~~ ~~14~~ 0	(34)	
V_j	3	3	6		

Here, the formula used is $U_i + V_j = C_{ij}$ and $C_{ij} - U_i - V_j = {}_{ij}$
Same formula is used for all further iterations in optimal solutions.
Here the entering cell X_{23} (–5) [3]



Similar method is used in further solutions

	D_1	D_2	D_3	a_i	U_i
O_1	[5] 2	7 [5]	4 [4]	5	--1
O_2	[2] 3	[2] 3	[4] 1	8	0
O_3	5 [1]	[7] 4	7 [5]	7	1
O_4	1 [-3]	6 [2]	[14] 2	14	1
b_j	7	9	18	(34)	
V_j	3	3	1		



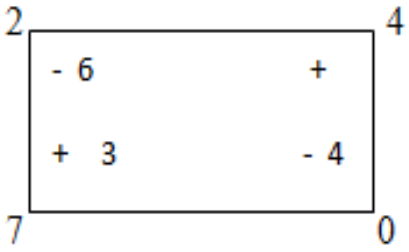
	D_1	D_2	D_3	a_i	U_i
O_1	5 2	7 2	4 1	5	2
O_2	3 3	2 3	6 1	8	0
O_3	5 4	7 4	7 5	7	1
O_4	2 1	6 2	12 2	14	1
b_j	7	9	18	34	
V_j	0	3	1		

The total transportation cost will be

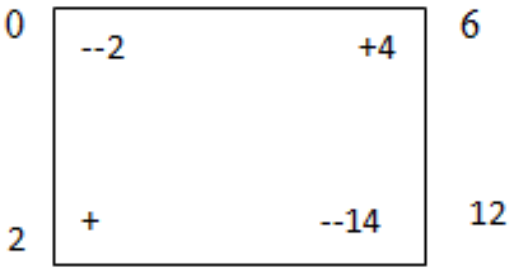
From		To		Rs.
O_1	→	D_1	5 x 2 =	10
O_2	→	D_2	2 x 3 =	6
O_2	→	D_3	6 x 1 =	6
O_1	→	D_1	2 x 3 =	6
O_3	→	D_2	7 x 4 =	28
O_4	→	D_3	12 x 2 =	24
		Total =		76

SOUTH–EAST CORNER RULE

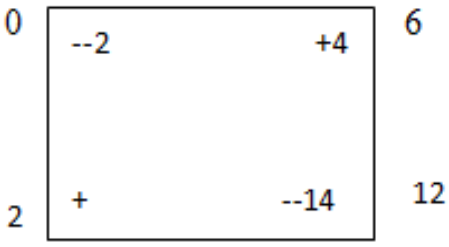
	D_1	D_2	D_3	a_i	U_i
O_1	5 2	7 5	4 -1	5	--1
O_2	2 3	6 3	1	8	0
O_3	5 1	3 4	4 7	7	1
O_4	1 2	6 7	14 2	14	--4
b_j	7	9	18	34	
V_j	3	3	6		



	D_1	D_2	D_3	a_i	U_i
O_1	5 2	7 5	4 4	5	--1
O_2	2 3	2 3	4 1	8	0
O_3	5 1	7 7	7 5	7	1
O_4	1 -3	6 2	14 2	14	1
b_j	7	9	18	34	
V_j	3	3	1		



	D_1	D_2	D_3	a_i	U_i
O_1	5 2	7 5	4 4	5	--1
O_2	2 3	2 3	4 1	8	0
O_3	5 1	7 7	7 5	7	1
O_4	1 -3	6 2	14 2	14	1
b_j	7	9	18	34	
V_j	3	3	1		



	D_1	D_2	D_3	a_i	U_i
O_1	[5] 2	7 [2]	4 [1]	5	2
O_2	3 [3]	[2] 3	[6] 1	8	0
O_3	5 [4]	[7] 4	7 [5]	7	1
O_4	[2] 1	6 [2]	[12] 2	14	1
b_j	7	9	18	(34)	
V_j	0	3	1		

The total transportation cost will be

From		To			
O_4	→	D_3	12 x 2	=	24
O_4	→	D_1	2 x 1	=	2
O_3	→	D_2	7 x 4	=	28
O_2	→	D_3	6 x 1	=	6
O_2	→	D_2	2 x 3	=	6
O_1	→	D_1	5 x 2	=	10
		Total	= 76		

CONCLUSION

We see that there is no change in transportation cost under both the methods of initial basic feasible solution and there is no change in transportation cost at the optimal solutions. The only change we observe is the difference in the quantities exhausted at the origins and the demands at the destinations in the initial basic feasible solutions [4]. The South-East Corner Rule (Stepping up stone method) of transportation is only an imaginary by the author. Similar imagination may be made under South–West and North–East methods.

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