Application The Linear Programming According To Transportation Problem On Real Data

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Abstract: In this paper, the transport models were applied on a real data, which was drawn from a domestic company for food products. The company aims to market its product to four different geographic positions through three of its branches. Therefore, the company has suffered from the high cost of transporting and marketing its products. The company does not has scientific approach to face this problem. Instead, it has depended upon the personal experience of staffs. The target of this paper is to satisfy minimum transporting cost through three methods, the minimum cell cost method, Vogel approximate method and compare between these methods with a new technique for finding initial basic solution. Then, the obtained solutions should be assessed by using the stepping – stone test in order to obtain the optimum transporting method.

Keyword: the transportation problem, the minimum cell cost method, Vogel's approximate method, the stepping -stone method, a new technique.

1 Introduction:

THIS Begin Scientific studies to the transportation model for a long time because represent especially case in linear programming, the first to study these models was F.henshkok in 1941 and T.Kwemanz in 1947, we apply on the model all suppose special to linear programming from where linear in goal and constrain. The solution in this model by two-step:

a) The initial basic feasible solution (IBFS)
b) Optimal solution (OS)

2 Aim of Study

Application the transportation models on real data to arrival to optimize solution by three methods and compare them, add test of the optimal solution by stepping-stone method.

3 The Transportation Model :

The transportation models are concerned with determining the optimal strategy for distribution a commodity from supply center such as factories to reception center such as location called destinations in a way that reduces the overall distribution cost of these models. Can be expression mathematical formula as the following:

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Source \ Destination	D_1	D_2	D_3	...	D_n	Supply
ς_1	c_{11} x_{11}	c_{12} x_{12}	c_{13} x_{13}	...	c_{1n} x_{1n}	ς_1
ς_2	c_{21} x_{21}	c_{22} x_{22}	c_{23} x_{23}	...	c_{2n} x_{2n}	ς_2
ς_3	c_{31} x_{31}	c_{32} x_{32}	c_{34} x_{33}	...	c_{3n} x_{3n}	ς_3
.	..	...	...	...	...	..
.	...	...	...	...	...	...
ς_m	c_{m1} x_{m1}	c_{m2} x_{m2}	c_{m3} x_{m3}	...	c_{mn} x_{mn}	ς_m
Demand	D_1	D_2	D_3	...	D_n	

***Table (1):** represent the mathematical formula to the Transportation Model*

$$min\ z = \sum_{j=1}^{n} \sum_{i=1}^{m} c_{ij}\, x_{ij}$$

Subject to:

$$\sum_{j=1}^{n} x_{ij} = \varsigma_i \quad for\ i = 1, \dots m \quad , \sum_{i=1}^{m} x_{ij} = d_j \quad for\ j = 1, \dots n, x_{ij} \geq 0 \quad for\ all\ \ i, j$$

x_{ij} : The number of unite to be distribution from source i to destinations or location j
ς_i : Supply from source i
d_j: demand the destination j
c_{ij}: cost per unit distribution from source i to destination j

If $\sum_{i=1}^{m} \varsigma_i = \sum_{j=1}^{n} d_j$ call the transportation model is balance but if $\sum_{i=1}^{m} \varsigma_i \neq \sum_{j=1}^{n} d_j$ then call the transportation is unbalance, in this paper we discuss balance transportation model , this is a linear programming with $m * n$ decision variable, $m + n$ function constraints, and $m * n$ nonnegative constraint We can be arrived to initial solution by several methods these methods (the minimum cell cost method, the Vogel approximate method, a new technique [5]):

4 The Minimum Cell Cost Method:

The Minimum Cell Cost Method used, to obtain the initial feasible solution for the transportation problem, begin with the cell which has the minimum cost in row or column , the lower cost cell are choses over the higher cost cell with the objective to have the least total cost of transportation.

5 VOGEL APPROXIMATE METHOD[4] :

The Vogel approximate method other methods to obtain the initial feasible basic solution, these method concept of penalty, Step Vogel approximate as the following:

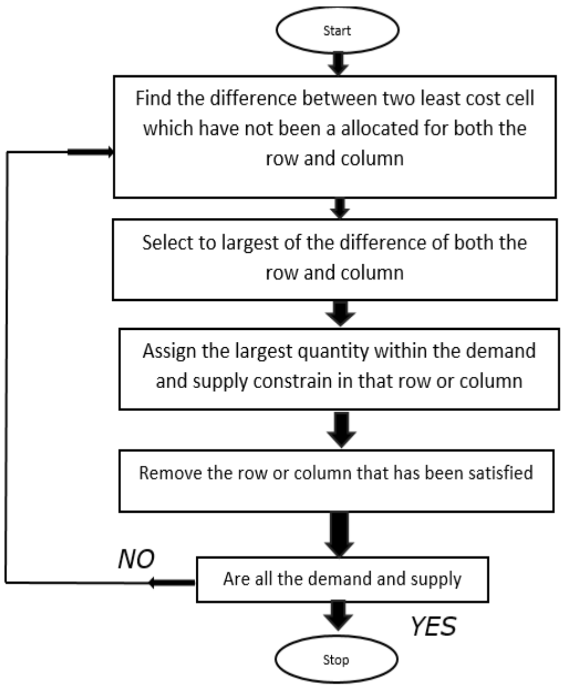

Fig 1: *represent algorithm the Vogel approximate method*

6 THE STEEPING STONE SOLUTION METHOD:[4]

The steeping stone method is used to check the optimality solution of the initial feasible cost determined by using of the previous methods (minimum cost method and Vogel approximate method). The steeping-stone method is procedure for finding of any non-basic variables (empty cell) in objective function, this method determine whether the solution is optimal or not, the basic condition to solution is check the following equation:

$$m + n - 1 = occupied\ cell$$

The steps this method:

1. Build up the closed loop start with empty cell and return to the same cell with the signal change +or –in each transition from one cell to another
2. Only vertical and horizontal movement is allowed
3. Repeat these steps again until all empty cells are evaluated
4. If all the computed cost in all the closed loops are positive or equal to zero then the optimal solution ,if one of the cost appears negative value then, select the lowest cost value in the negative cells, take algebraic sum of that value with the other cells
5. repeat the step 4 to arrive the optimal solution(minimum total cost)

7 A NEW TECHNIQUE[5] :

1- Select the least value in the supply or demand and make allocation in the cell having lest cost in the row or column
2- Delete the roe or column that completed the value
3- Repeat the above steps to get the total cost transportation problem

8 APPLICATION:

To application the theoretical part, we use the transportation model for the real data to arrive at total minimum cost transportation:

TABLE 2: *REPRESENT COST TRANSPORTATION PROBLEM OF REAL DATA IN IRAQ DINNER*

	D1	D2	D3	D4	Supply
S1	130	180	300	80	8
S2	550	200	250	400	10
S3	300	60	500	100	11
demand	4	7	6	12	

TABLE 3: *REPRESENT THE INITIAL BASIC SOLUTION BY THE MINIMUM CELL COST METHOD*

	D1	D2	D3	D4	Supply
S1	130 0	180 0	300 0	80 8	8
S2	550 4	200 0	250 6	400 0	10
S3	300 0	60 7	500 0	100 4	11
demand	4	7	6	12	29

TABLE 4: *REPRESENT THE INITIAL BASIC SOLUTION BY VOGEL APPROXIMATE METHOD*

	D1	D2	D3	D4	Supply
S1	130 4	180	300	80 4	8
S2	55	200	250 6	400 4	10
S3	300	60 7	500	100 4	11
demand	4	7	6	12	29

MIN $z = 4760$ BY THE VOGEL APPROXIMATE METHOD
MIN $z = 5160$ BY THE MINIMUM CELL COST METHOD

The Vogel's method is given total minimum cost so that we applied the stepping-stone to check the basic initial solution

***TABLE 5:** REPRESENT THE OPTIMAL SOLUTION BY THE STEPPING-STONE METHOD*

	D1	D2	D3	D4	Supply
S1	130 4	180 0	300 0	80 4	8
S2	55 0	200 4	250 6	400 0	10
S3	300 0	60 3	500 0	100 8	11
demand	4	7	6	12	29

$Min\ z = 4120$ *THE TOTAL COST TO TRANSPORTATION MODEL*

***TABLE 6:** REPRESENT THE INITIAL BASIC SOLUTION BY THE NEW TECHNIQUE*

	D1	D2	D3	D4	Supply
S1	130 4	180 0	300 0	80 4	8
S2	55 0	200 4	250 6	400 0	10
S3	300 0	60 3	500 0	100 8	11
demand	4	7	6	12	29

$Min\ z = 4120$ *THE TOTAL COST TO TRANSPORTATION MODEL*

9 CONCLUSION:

Depending on the results shown in table 5, the Vogel approximation method will give the lowest value form the minimum cell cost method and it is very nearer to optimum solution. also the solution can be enhance by applying the stepping-stone method as shown in table 6, where the total cost of transportation of the food products has been reduced from 4760 to 4120,but we compare the result with the new technique [5]we found:

- More efficient way to finding (IBFS)
- Ease of calculus
- It can be used as an alternative to previous methods of the primary basic solution

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