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**Operations research**

**Third Stage**

**Dept. of Agricultural Economics**

**Tenth Lecture**

**Transportation Problems/ Vogel's method**

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## Vogel s Approximation Method:

The Vogel method is better than the first and second methods when extracting S.B.F.S because of the advantages of this method that enable us to obtain the optimal solution of the transfer model directly or after applying a very small number of cycles of iterative calculations.

The basic steps of the Vogel method:

1- Calculating the difference between the two smallest costs from each row and column of the cost schedule. This difference is called the penalty cost.

2- We choose the largest difference from among the penalty costs for both rows and columns, and in the event that some differences are equal, we choose the row or column corresponding to the highest difference at random.

3- After determining the corresponding row or column with the largest difference, we assign a value to the variable whose transportation cost is the least possible in that row and column, or the allocated quantity is the largest available quantity to meet the needs of the site concerned.

4- We delete the row or column whose sum is zero, that is, the one that has been achieved.

5- We repeat the above four steps and continue until we distribute all the offered units to the required units.

Example:

You have the following transportation problem, which is required to extract the lowest cost using the Vogel method

	$S_1$	$S_2$	$S_3$	$S_4$	Supply
$D_1$	4	6	2	4	5
$D_2$	3	0	5	6	25
$D_3$	7	8	9	10	20
Demand	10	5	15	20	50

From \ To	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	S <sub>4</sub>	Supply	
D <sub>1</sub>	4 X	6 X	2) 5 X	4 X	5/0	(2) (2)
D <sub>2</sub>	3) 10 X	0) 5 X	5) 10 X	6 X	<del>2/2</del> <del>10/10</del>	(3) (2) (2) (1)
D <sub>3</sub>	7 X	8 X	9 X	10) 20	2/0	(1) (2) (2) (1)
Demand	10/0 X	5/0 X	15/10	2/0	50	

  

(1)	(6)	(3)	(2)
(1)		(3)	(2)
(4)		(4)	(4)
		(4)	(4)

1- The difference between the two lowest costs in rows and columns:

1st row =  $4 - 2 = 2$

2nd row =  $3 - 0 = 3$

3rd row =  $8 - 7 = 1$

First column =  $4 - 3 = 1$

Second column =  $6 - 0 = 6$

3rd column =  $5 - 2 = 3$

Fourth column =  $6 - 4 = 2$

2- We choose the largest number in the numbers extracted in the first step, and here we will choose the number 6 in the second column. And then we choose the lowest cost in the second column, which is zero, and then we continue with the same steps that were used in the previous two methods (the northwest corner method and the least cost method). Deletes the second column after it has been zeroed.

3- We continue with the previous steps, excluding the second column, as follows:

$$1\text{st row} = 4 - 2 = 2$$

$$2\text{nd row} = 5 - 3 = 2$$

$$3\text{rd row} = 9 - 7 = 2$$

$$1\text{st column} = 4 - 3 = 1$$

Column 2: Excluded

$$3\text{rd column} = 5 - 2 = 3$$

$$\text{Fourth column} = 6 - 4 = 2$$

4- Extracting the largest number in the extracted numbers, and here we choose the number 3 and choose the third column, and the lowest cost in it is 2. Then the first row is excluded because it has become zero.

5- We continue with the same steps after excluding the first row and second column.

1st row: Excluded

2nd row =  $5-3=2$

3rd row =  $9-7=2$

First column =  $7-3=4$

Column 2: Excluded

3rd column =  $9-5=4$

Fourth column =  $10-6=4$

6- We choose the largest number in the extracted numbers, and here the number 4 has been repeated three times. Here we choose the number 4 in the first column because it contains the number 3, which is less expensive than the other columns. Then the first column is excluded because it has become zero.

7- We continue with the same steps

1st row: Excluded

2nd row =  $6-5=1$

3rd row =  $10-9=1$

Column one: Excluded

Column 2: Excluded

3rd column =  $9-5=4$

Fourth column =  $10-6=4$

8- We choose the largest number in the extracted numbers, which is the number 4 and it has been repeated twice, and we choose the number 4 in the third column (the least cost in it is 5)

9- Delete the second row and third column

10- We continue solving until the numbers become zero at the end

We extract the lowest cost, as follows:

$$\begin{aligned} \text{Least Cost} &= (10 \times 3) + (5 \times 0) + (5 \times 2) + (10 \times 5) + (20 \times 10) \\ &= 290 \end{aligned}$$

Examples about the Vogel method:

You have the following transportation forms required to extract the lowest cost by Vogel method:

To From	$S_1$	$S_2$	$S_3$	Supply
$D_1$	2	4	9	14
$D_2$	5	7	5	12
$D_3$	3	6	7	10
Demand	12	11	13	36

To From	$S_1$	$S_2$	$S_3$	Supply
$D_1$	15	7	5	25
$D_2$	12	8	18	26
$D_3$	16	12	16	20
$D_4$	10	17	14	24
Demand	35	36	24	95

REFERENCES:

- 1- Chiang, A.C; Fundamental Methods of Mathematical Economics. McGraw Hill. 1984.
- 2- Heady,E.O., Candler .Linear Programming Methods. The Iowa state university Press. Ames, Iowa,U.S.A.1973.
- 3- Jacques . Jan. Mathematics for Economics and Business. 5<sup>th</sup> edition. Prentice Hall. 2006.
- 4- Linear Programming. Published on line [www.college.cengage.com](http://www.college.cengage.com)
- 5- The Simplex Solution Method. Published on line [wps.prenhall.com](http://wps.prenhall.com)