Ravina Yadav S13

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30/9/22

→ Operational Research. Mini-Project.

Assignment Problem.

The assignment problem deals with allocating various resources (items) to various activities on a one to one basis. If one task is to be assigned to one person in such a way that the total hours are minimised, the problem is called assignment Problem.

→ Business Problem.

A company is producing a single product and selling it through five agencies situated in different cities. All of the sudden, there is a demand for the product in five more cities that do not have any agency of the company.

→ Solution.

The Company is faced with the problem of deciding on how to assign the existing agencies to dispatch the product to the additional cities in such a way that the travelling distance is minimised.

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(2)

The distances (in Km) between the Surplus and deficit cities are given in the following distance matrix.

deficit city / Surplus city	I	II	III	IV	V
A	160	130	175	190	200
B	135	120	130	160	175
C	140	110	155	170	185
D	50	50	80	80	110
E	55	35	70	80	105

Determine the optimal assignment schedule.

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Solution:- Subtracting the minimum element of each row from every element of that row, we have

	I	II	III	IV	V
A	30	0	45	60	70
B	15	0	10	40	55
C	30	0	45	60	75
D	0	0	30	30	60
E	20	0	35	45	70

Subtracting the minimum element of each column from every element of that column, we have.

	I	II	III	IV	V
A	30	0	35	30	15
B	15	0	0	10	0
C	30	0	35	30	20
D	0	0	20	0	5
E	20	0	25	15	15

we now assign zeroes by drawing rectangles around them as explained in Example 1. Thus we get:

	I	II	III	IV	V
A	30	$\boxed{0}$	35	30	15
B	15	$\cancel{0}$	$\boxed{0}$	10	$\boxed{\cancel{0}}$
C	30	$\cancel{0}$	35	30	20
D	$\boxed{0}$	$\cancel{0}$	20	$\boxed{\cancel{0}}$	5
E	20	$\boxed{\cancel{0}}$	25	15	15

* Since the number of assignments is less than the number of rows (or columns) we proceed from step 5 onwards of the Hungarian method as follows.

(i) we tick mark (✓) the rows in which the assignment has not been made. These are the 3rd and 5th rows.

(ii) We tick mark (✓) the columns which have zeros in the marked rows. This is the 2nd column.

(iii) we tick mark (✓) the rows which have assigments in marked columns. This is the 1st row.

(iv) again we tick mark (✓) the columns which have zeros in the newly marked row. This is the 2nd column, which has already been marked. There is no other such column so, we have.

	I	II	III	IV	V	
A	30	$\boxed{10}$	35	30	15	✓
B	15	$\cancel{0}$	$\boxed{10}$	10	$\cancel{0}$	
C	30	$\cancel{0}$	35	30	20	✓
D	$\boxed{10}$	$\cancel{0}$	20	$\cancel{0}$	5	
E	20	$\cancel{0}$	25	15	15	✓
		✓				

We draw straight lines through ~~unm~~ unmarked rows and marked columns as follows.

	I	II	III	IV	V	
A	30	$\boxed{10}$	35	30	15	✓
B	15	$\cancel{0}$	0	10	$\cancel{0}$	
C	30	$\cancel{0}$	35	30	20	✓
D	0	$\cancel{0}$	20	$\cancel{0}$	5	
E	20	$\cancel{0}$	25	15	15	✓
		✓				

We proceed as follows, as explained in step 6 of the Hungarian method.

(i) we find the smallest element in the matrix not covered by any of the lines. It is 15 in this case.

(ii) we subtract the number '15' from all the uncovered elements and add it to the elements at the intersection of the two lins.

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(iii) other elements covered by the lines remain unchanged. Thus, we have

	I	II	III	IV	V
A	15	0	20	15	0
B	15	15	0	10	0
C	15	0	20	15	5
D	0	15	20	0	5
E	5	0	10	0	0

We repeat steps 1 to 4 of the Hungarian method and obtain the following matrix.

	I	II	III	IV	V
A	15	$\cancel{0}$	20	15	$\boxed{0}$
B	15	15	$\boxed{0}$	20	$\cancel{0}$
C	15	$\boxed{0}$	20	15	5
D	$\boxed{0}$	15	20	$\cancel{0}$	5
E	5	$\cancel{0}$	10	$\boxed{0}$	0

Since each row and each column of this matrix has one and only one assigned 0, we obtain the optimum assignment schedule as follows.

$A \to V$, $B \to III$, $C \to II$,
$D \to I$, $E \to IV$

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Thus, the minimum distance is

200+ 130 + 110 + 50+ 80 = 570 Km.

Here we have founded the minimum travelling distance, so if the 5, five cities will be travelled with such route distance cost will be minimised //.