MINI PROJECT

Roll No: 524

OPERATIONAL RESEARCH

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

The company is faced with the problem of deciding on how to assign the existing agencies to dispatch the product in the additional cities in such a way that the traveling distance is maintained. The distance (in km) between surplus & deficit cities are given in 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 optimum assignment schedule.

Solution: Subtracting minimum elements of each row from every element of that row, we get

	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 elements of each column from every element of that colums we get.

	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. Thus we get

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

Since the number of assignments is less than number of rows we proceed

i) We tick mark the row in which assignment has not been made. These are 3rd & 5th row

ii) We tick the row which have assignment in marked columns. This is 1st row

iii) We tick the columns which have zeros. This is 2nd

iv) Again the columns which have zeros newly marked rows. This is 2nd column, which has already marked. There is no other such column so we have

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

We draw straight lines through unmarked rows & marked columns as follows:

We Proceed further.

i) We find smallest element in matrix covered by any of lines. It is 15 in this case.

ii) We subtract the number '15' from all the uncovered elements & add it to the elements at the intersection of two lines

iii) Other elements covered by 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 1 to 4 of the Hungarian Method & obtain following matrix:

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

Since each row & each column of this matrix has one assign 0 we obtain the optimum assignment schedule as follows:

A → V, B → III, C → II, D → I, E → IV.

Thus, the minimum distance is 200 + 130 + 110 + 50 + 80
= 570 km.

You should have pause here Minimum distance.