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Procedure for solving Transportation problem —

Step 2. Determination of optimum solution
Two methods are widely used for Testing the solution for optimality.

1. Stepping stone Method
2. Modified Distribution Method (MODI)

using the Stepping Stone method, solve the following transportation problem (costs in ₹) for minimum cost of transportation :-

factory	Depot				capacity
	D	E	F	G	
A	4	6	8	6	700
B	3	5	2	5	400
C	3	9	6	5	600
Required	400	450	350	500	1700

Step 1 write the transportation table incorporating the original supply, demand and costs of transportation.

Step 2 Determine an initial basic feasible solution by using any one of the method (prefer the vogel's approximation method, as it provides either optimum or nearest to the optimum solution)

Initial Feasible solution by VAM is presented below :-

Depot / Factory	D	E	F	G	capacity	Unit Penalties			
A	4	6 (400)	8	6 (300)	~~700~~ ~~400~~ 0	2	2	0	0
B	3	5 (50)	2 (350)	5	~~400~~ ~~50~~ 0	1	2	0	0
C	3 (400)	9	6	5 (200)	~~600~~ ~~200~~ 0	2	2 ←	4 ←	–
Required	~~400~~ 0	~~450~~ ~~400~~	~~350~~ 0	~~500~~ ~~300~~ 0	1,700				
Unit penalties	0	1	4↑	0					
	0	1	–	0					
	–	1	–	0					
	–	1	–	1					

Total initial cost = 6 X 400 = 2400
6 X 300 = 1800
5 X 50 = 250
2 X 350 = 700
3 X 400 = 1200
5 X 200 = 1000
₹ 7,350

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Initial feasible solution by VAM is presented below :-

Depot / Factory	D	E	F	G	capacity	Unit Penalties			
A	4	6 (400)	8	6 (300)	~~700~~ ~~400~~ 0	2	2	0	0
B	3	5 (50)	2 (350)	5	~~400~~ ~~50~~ 0	1	2	0	0
C	3 (400)	9	6	5 (200)	~~600~~ ~~200~~ 0	2	2 ←	4 ←	–
Required	~~400~~ 0	~~450~~ ~~400~~	~~350~~ 0	~~500~~ ~~300~~ 0	1,700				
∞	0	1	4↑	0					
Unit penalties	0	1	–	0					
	–	1	–	0					
	–	1	–	1					

Total initial cost = 6 X 400 = 2400
6 X 300 = 1800
5 X 50 = 250
2 X 350 = 700
3 X 400 = 1200
5 X 200 = 1000
₹ 7,350

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Testing of optimality by stepping stone methed

Number of occupied cells = 6
Rim requirement = m + n - 1
= 3 + 4 - 1 = 6

Since number of occupied cells is equal to rim requirement, hence initial solution is non-degenerate.

un-occupied cell	closed Path	Opportunity cost
AD	+AD - AG + CG - CD	4 - 6 + 5 - 3 = 0
AF	+AF - BF + BE - AE	8 - 2 + 6 - 6 = 5
BD	+BD - BE + AE - AG + CG - CD	3 - 5 + 6 - 6 + 5 - 3 = 0
BG	+BG - AG + AE - BE	5 - 6 + 6 - 5 = 0
CE	+CE - AE + AG - CG	9 - 6 + 6 - 5 = 4
CF	+CF - BF + BE - AE + AG - CG	6 - 2 + 5 - 6 + 6 - 5 = 4

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Step 3. Make sure that the number of allocations (occupied cells) are $m+n-1$, where, m is the number of rows and n is the number of columns. These $m+n-1$ allocations should be in independent positions.

Step 4. Evaluate cost change of shipping goods via each unoccupied cell; which can be done as follows :-

(a) Select an unoccupied cell to be evaluated.

(b) Starting from this unoccupied cell, trace a closed loop using the most direct route through at least three allocated cells used in the solution and then come back to the starting unoccupied cell.

(c) After tracing the closed path, place plus (+) and minus (-) signs alternatively in the cells on each turn of the loop, beginning with a plus (+) sign in the empty cell.

(d) calculate the net change in cost for all the empty cells.

Since all the opportunity costs are positive which implies that solution cannot be improved further. Hence the initial solution is the optimum solution. Thus optimum solution is :-

Factory	Depot	units	unit cost	Total cost
			₹	₹
A	E	400	6	2,400
A	G	300	6	1,800
B	E	50	5	250
B	F	350	2	700
C	D	400	3	1,200
C	G	200	5	1,000
Total minimum Transportation cost				₹ 7,350

Step 5. Go back to step 3 and repeat the procedure until an optimum solution is obtained.