MP-1 TUTORIAL-10

1. Demonstrate the Initial Basic Solution in Transportation problem using Vogel method in Linear Programming (U-V method)., Least time Transportation problem.

QUESTION:

Factory/Warehouse	W_1	W_2	W_3	W_4	Factory Capacity
F_1	19	30	50	10	7
F_2	70	30	40	60	9
F_3	40	8	70	20	18
Warehouse Requirement	5	8	7	14	

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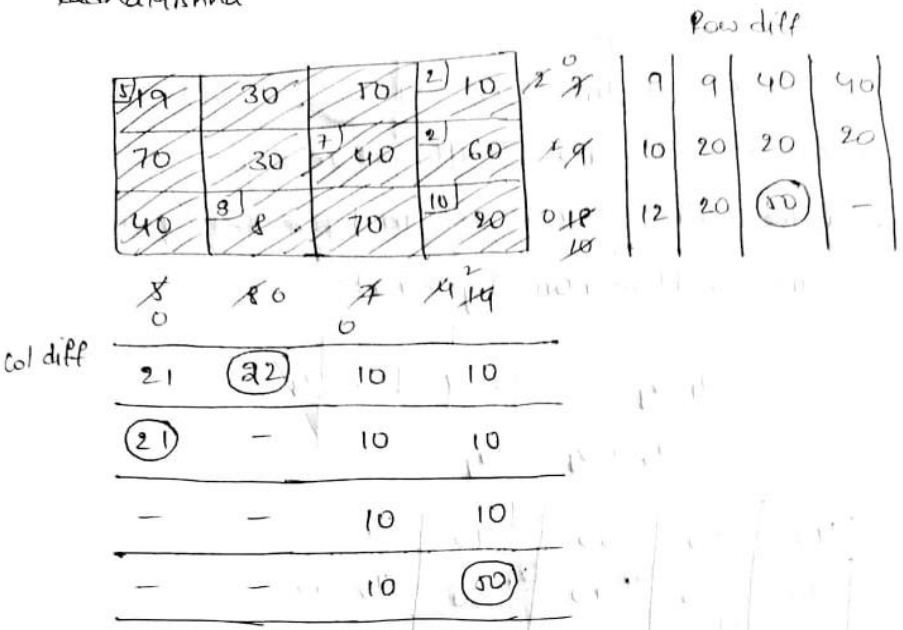

Transportation Cost :-

$= 5*19 + 8*8 + 7*40 + 2*10 + 10*20 + 2*60$

$= 95 + 64 + 280 + 20 + 200 + 120$

$= 779$

U-V method

	W_1	W_2	W_3	W_4	
	19	30	50	10	7
	70	30	40	60	9
	40	8	70	20	18
	5	8	7	14	

Step : 1

m = no of origins = 3

n = no of destinations = 4

$m+n-1 = 6$ ⇒ no of allocation = 6

And the allocations are independent positions

∴ The problem is non-degenerate

Step : 2

u_i, v_j – allocated cells.

$u_i + v_j = c_{ij}$

[5] 19	30	50	[2] 10	$u_1 = 0$
70	30	[7] 40	[2] 60	$u_2 = 50$
40	[8] 8	70	[10] 20	$u_3 = 10$
$v_1 = 19$	$v_2 = -2$	$v_3 = -10$	$v_4 = 10$	

cell	eqns	values
(1,1)	$u_1 + v_1 = 19$	$v_1 = 19$
	$0 + v_1 = 19$	
(1,4)	$u_1 + v_4 = 10$	$v_4 = 10$
	$0 + v_4 = 10$	
(2,4)	$u_2 + v_4 = 60$	$u_2 = 50$
	$u_2 + 10 = 60$	
(2,3)	$u_2 + v_3 = 40$	$v_3 = -10$
	$50 + v_3 = 40$	
(3,4)	$u_3 + v_4 = 20$	$u_3 = 10$
	$u_3 + 10 = 20$	
(3,2)	$u_3 + v_2 = 8$	$v_2 = -2$
	$v_2 + 10 = 8$	

Step :- 3

				u_i
(1) 19	(32) 30	(60) 50	2 10	0
(0) 70	(-18) 30	7 40	1 60	50
(11) 40	8 8	(70) 70	10 20	10
v_j 19	-2	-10	10	

Cell	Eqn	cell evaluation
(1,2)	$30-(u_1+v_2)$ $30-(0-2)$	32
(1,3)	$50-(u_1+v_3)$	60
(2,1)	$70-(u_2+v_1)$	1
(2,2)	$30-(u_2+v_2)$	-18
(3,1)	$40-(u_3+v_1)$	11
(3,3)	$70-(u_3+v_3)$	70

If all the cells evaluations are non-negative then the solution is optimal

The cell evaluation -18 is negative so sol is not optimal

∴ Entering cell (2,2)

19	30	50	2 10
70	30	7 40	1 60 (2-θ)
40	8 8 (8-θ)	70	10 20 (10+θ)

Form a loop starting from cell (2,2)

$\theta = \min\{2-\theta, 8-\theta\}$

$2-\theta = 0$

$\theta = 2$

[5] 19	30	50	[2] 10
70	[2] 30	[7] 40	[4] 60 ← leaving cell
40	[6] 8	70	[12] 20

Updated allocations u_i

[5] 19	(22) [2] 30	(42) 50	[2] 10	0
(19) 70	[2] 30	[7] 40	(18) 60	32
40 (11)	[6] 8	(12) 70	[12] 20	10

$v_j \rightarrow$ 19 -2 8 10

Now all the cell evaluations are non-negative

Transportation cost

$5*19 + 2*10 + 2*30 + 7*40 + 6*8 + 12*20$

$95 + 20 + 60 + 280 + 48 + 240$

743