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MP-1 TUTORIAL-9

1. Demonstrate the Initial Basic Solution in Transshipment problem in Linear Programming., Post optimality analysis.

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	S1	S2	S3	S4	D1	D2	Supply
S1	0	6	24	7	24	10	200
S2	10	0	6	12	5	20	250
S3	15	20	0	8	45	7	300
S4	18	25	10	0	30	6	450
D1	15	20	60	15	0	10	
D2	10	25	25	23	4	0	
Demand					600	600	$\boxed{1200}$ B

Steps to solve Transhipment problem:-

Step-1 :- Check whether the problem is balanced or unbalanced

B => Supply = Demand

B = 1200

Step-2 : Add the value of B to all the rows and columns

	S1	S2	S3	S4	D1	D2	Supply
S1	0	6	24	7	24	10	200+1200 = 1400
S2	10	0	6	12	5	20	1450
S3	15	20	0	8	45	7	1500
S4	18	25	10	0	30	6	1650
D1	15	20	60	15	0	10	1200
D2	10	25	25	23	4	0	1200
Demand	1200	1200	1200	1200	1800	1800	1200 B

Step-3 :- Find out total transportation cost by using vogel's Approximation method

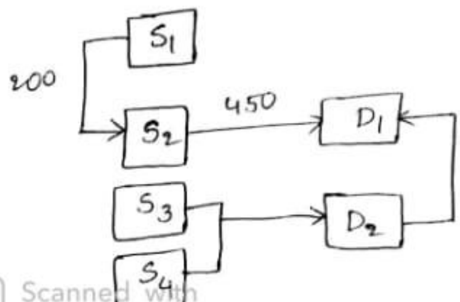
	S1	S2	S3	S4	D1	D2	supply	Row diff				
S1	[1200] 0	6	24	7	24	10	~~1400~~ 0	6	6	1	1	4
S2	10	[1000] 0	6	12	5	20	~~1450~~ 0	5	5	5	5	5
S3	15	20	[1200] 0	8	45	7	~~1500~~ 0	7	7	7	1	13
S4	18	25	10	[1200] 0	30	6	~~1650~~ 0	6	6	6	6	19
D1	15	20	60	15	[1200] 0	10	~~1200~~ 0	10	-	-	-	-
D2	10	25	28	23	[150] 4	[1050] 0	~~1200~~ 0	4	4	4	4	4
	~~1200~~ 0	~~1200~~ 0	~~1200~~ 0	~~1200~~ 0	~~600~~ 0	~~600~~ 0						
column diff	10	6	6	7	4	6						
	10	6	6	7	1	6						
	-	6	6	7	1	6						
	-	6	-	7	1	6						
	-	6	-	-	1	6						

Transportation cost = 200 * 6 + 450 * 5 + 300 * 7 + 450 * 6 + 150 * 4

Transportation cost = 8,850

The allocations in the main diagonal cells are ignored

Shipping pattern :-



2) <u>post optimality Analysis</u> :-

Sensitivity of the solution towards changes in the techno - economic changes, composition in profit composition and addition of new constraint If these changes have no effect on the optimal solution, the solution is said to be insensitive. The post optimality analysis mainly focuses on

1. changes effecting feasibility.
2. changes affecting optimality.

<u>procedure</u> :-

1. compute the dual prices vector $y = C_B B^{-1}$ using the new vector C_B, if it has been changed.
2. compute $z_j - c_j = y P_j - c_j$ for all current non - basic x_j

→ If optimality condition is satisfied the current solution will remain same, but at a new optimum value of objective function. If C_B is unchanged, the optimal objective value will remain same.

→ If optimality condition is not satisfied, we apply the (primal) simplex method to recover optimality.

Maximize $Z = 3x_1 + 5x_2$

Subject To $x_1 + x_2 \leq 1$

$2x_1 + 2x_2 \leq 1$

$x_1, x_2 \geq 0$

obtain variations in c_j $(j = 1,2)$ which are permitted without changing the optimum solutions.

First convert the inequalities into equalities by adding slack variables $s_1 \geq 0$ and $s_2 \geq 0$ and then solve the LPP by simplex method

c_j	3	5	0	0			
x_j	x_1	x_2	s_1	s_2	x_B	y_B	c_B
	$1/3$	0	1	$-1/3$	$1/3$	s_1	0
	$7/3$	1	0	$1/3$	$1/3$	s_2	5
$z_j - c_j$	$1/3$	0	0	$5/3$	$5/3$		

Case-1 :- Variation in c_1

when c_k is not in c_B (c_2 f c_B), the current solution results in the same optimum solution

i.e $\Delta c_1 \leq z_1 - c_1$ (or) $\Delta c_1 \leq 1/3$ i.e

$-\infty \leq c_1 \leq c_1 + \Delta c_1$

$-\infty \leq c_1 \leq 3 + 1/3$

i.e., $-\infty \leq c_1 \leq 10/3$

Case-2 :- variation in c_2

when c_k is in c_B ($c_2 \in c_B$) the range of Δc_2 is given by :

$$\underset{Y_{2j} > 0}{\text{Max}} \left\{ \frac{-(z_j - c_j)}{Y_{2j}} \right\} \leq c_2 \underset{Y_{2j} > 0}{\text{Min}} \left\{ \frac{-(z_j - c_j)}{Y_{2j}} \right\}$$

$$\text{i.e} \quad \text{Max} \left\{ \frac{-1/3}{2/3}, \frac{-5/3}{1/3} \right\} \leq \Delta c_2 \leq \infty$$

(or)

$$-1/2 \leq \Delta c_2 \leq \infty$$

the range over which c_2 can vary maintaining the condition of optimally is given by $c_2 \leq c_2 + \Delta c_2$

Thus we get $5 - 1/2 \leq c_2 \leq 5 + \infty$ i.e, $9/2 \leq c_2 \leq \infty$