MP Home Assignment -1 CO-1

1. A hotel has requested a manufacturer to produce pants and jackets for their boys. For materials, the manufacturer has 750 m^2 of cotton textile and 1,000 m^2 of silk. Every pair of pants (1 unit) needs 2 m^2 of silk and 1 m^2 of cotton. Every jacket needs 1.5 m^2 of cotton and 1 m^2 of silk. The price of the pants is fixed at \$50 and the jacket, \$40. What is the number of pants and jackets that the manufacturer must give to the hotel so that these items obtain a maximum sale? Formulate the problem using mathematical modeling of LPP and solve the LPP using Simplex Method.

1) Formulate the problem using mathematical modeling of LPP

Step-1 : Decision variables

Let

x = number of pants produced

y = number of jackets produced

Step-2 : Objective function

Maximize the total revenue

$$Z = 50x + 40y$$

Step-3 : constraint 1) cotton

$$x + 1.5y \leq 750$$

2) ~~Stribl~~ silk

$$2x + y \leq 1000$$

3) Non - negativity

$x \geq 0, \quad y \geq 0$

Solve the LPP using simplex

$$\text{Max } Z = 50x_1 + 40x_2 + 0S_1 + 0S_2$$

subject to

$$x_1 + 1.5x_2 + S_1 = 750$$
$$2x_1 + x_2 + S_2 = 1000$$

and $x_1, x_2, S_1, S_2 \geq 0$

Iteration-1		c_j	50	40	0	0	
B	C_B	X_B	x_1	x_2	S_1	S_2	Min Ratio $\frac{X_B}{X_1}$
S_1	0	750	1	1.5	1	0	$\frac{750}{1} = 750$
S_2	0	1000	2	1	0	1	$\frac{1000}{2} = 500$ small
		Z_j	0	0	0	0	
		$c_j - Z_j$	50 Big	40	0	0	

∴ Pivot element is 2

R_2 (old)	1000	2	1	0	1
R_2(new) = R_2 (old) ÷ 2	500	1	$\frac{1}{2}$	0	$\frac{1}{2}$

R_1 (old)	750	1	1.5	1	0
R_2 (new)	500	1	$\frac{1}{2}$	0	$\frac{1}{2}$
1 × R_2(new)	500	1	$\frac{1}{2}$	0	$\frac{1}{2}$
R_1(new) = R_1(old) − 1×R_2(new)	250	0	1	1	$-\frac{1}{2}$

Iteration-2		c_j	50	40	0	0	
B	CB	XB	x_1	x_2	S_1	S_2	Min Ratio XB/x_2
S_1	0	250	0	1	1	$-\frac{1}{2}$	$\frac{250}{1}$ = 250 small
x_1	50	500	1	$\frac{1}{2}$	0	$\frac{1}{2}$	$\frac{500}{\frac{1}{2}}$ = 1000
		z_j	50	25	0	25	
		$c_j - z_j$	0	15 big	0	-25	

∴ Pivot element is 1

$R_1(old)$	250	0	1	1	$-\frac{1}{2}$
$R_1(new) = R_1(old) \div 1$	250	0	1	1	$-\frac{1}{2}$

$R_2(old)$	500	1	$\frac{1}{2}$	0	$\frac{1}{2}$
$R_1(new)$	250	0	1	1	$-\frac{1}{2}$
$\frac{1}{2} \times R_1(new)$	125	0	$\frac{1}{2}$	$\frac{1}{2}$	$-\frac{1}{4}$
$R_2(\cancel{old}\ new) = R_2(old) - \frac{1}{2} R_1(new)$	375	1	0	$-\frac{1}{2}$	$\frac{3}{4}$

Iteration-3		C_j	50	40	0	0	
B	CB	XB	x_1	x_2	S_1	S_2	min Ratio
x_2	40	250	0	1	1	$-\frac{1}{2}$	
x_1	50	375	1	0	$-\frac{1}{2}$	$\frac{3}{4}$	
		Z_j	50	40	15	$\frac{35}{2}$	
		$C_j - Z_j$	0	0	-15	$-\frac{35}{2}$	

since all $c_j - z_j \le 0$

$\cancel{x_1 = 25}$ $x_1 = 375$, $x_2 = 450$

$z = 50x_1 + 40x_2$

$= 50(375) + 40(450)$

$= 28750$

Max $z = 28750$

2.The distribution manager of a company needs to minimize global transport costs between a set of three factories (supply points) S1, S2, and S3, and a set of four distributors (demand points) D1, D2, D3, and D4. The following table shows the transportation cost from each supply point to every demand point, the supply of the product at the supply points, and the demand of the product at the demand points F/D D1 D2 D3 D4 Supply S1 19 30 50 10 7 ;S2 70 30 40 60 9; S3 40 8 70 20 18 Demand 5 8 7 14 34 Solve Transportation problem using row and Column Minimum method in Linear Programming

Solution:
TOTAL number of supply constraints : 3
TOTAL number of demand constraints : 4
Problem Table is

	D_1	D_2	D_3	D_4	Supply
S_1	19	30	50	10	7
S_2	70	30	40	60	9
S_3	40	8	70	20	18
Demand	5	8	7	14	

Table-1

	D_1	D_2	D_3	D_4	Supply
S_1	19(5)	30	50	10	2
S_2	70	30	40	60	9
S_3	40	8	70	20	18
Demand	0	8	7	14	

Table-2

	D_1	D_2	D_3	D_4	Supply
S_1	19(5)	30	50	10	2
S_2	70	30	40	60	9
S_3	40	8(8)	70	20	10
Demand	0	0	7	14	

Table-3

	D_1	D_2	D_3	D_4	Supply
S_1	19(5)	30	50	10	2
S_2	70	30	40(7)	60	2
S_3	40	8(8)	70	20	10
Demand	0	0	0	14	

Table-4

	D_1	D_2	D_3	D_4	Supply
~~S_1~~	~~19(5)~~	~~30~~	~~50~~	~~10(2)~~	0
S_2	70	30	40(7)	60	2
S_3	40	8(8)	70	20	10
Demand	0	0	0	12	

Table-5

	D_1	D_2	D_3	D_4	Supply
~~S_1~~	~~19~~ **(5)**	~~30~~	~~50~~	~~10~~ **(2)**	0
S_2	70	30	40 **(7)**	60	2
~~S_3~~	~~40~~	~~8~~ **(8)**	~~70~~	~~20~~ **(10)**	0
Demand	0	0	0	2	

Table-6

	D_1	D_2	D_3	D_4	Supply
~~S_1~~	~~19~~ **(5)**	~~30~~	~~50~~	~~10~~ **(2)**	0
~~S_2~~	~~70~~	~~30~~	~~40~~ **(7)**	~~60~~ **(2)**	0
~~S_3~~	~~40~~	~~8~~ **(8)**	~~70~~	~~20~~ **(10)**	0
Demand	0	0	0	0	

Initial feasible solution is

	D_1	D_2	D_3	D_4	Supply
S_1	19 **(5)**	30	50	10 **(2)**	7
S_2	70	30	40 **(7)**	60 **(2)**	9
S_3	40	8 **(8)**	70	20 **(10)**	18
Demand	5	8	7	14	

The minimum total transportation cost $= 19 \times 5 + 10 \times 2 + 40 \times 7 + 60 \times 2 + 8 \times 8 + 20 \times 10 = 779$