Haris 14592 Sec A Operation Research

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Q3

	1	2	3	4	Supply
1	20	22	17	4	120
2	24	37	9	7	70
3	32	37	20	15	50
Demand	60	40	30	110	240

Demand = Supply

Balanced transportation Problem

	1	2	3	4				
1	x 20	40 22	x 17	80 4	0 120	13	(13)	—
2	16 24	x 37	30 9	30 7	0 40	2	2	2 (17)
3	50 32	x 37	x 20	x 15	80 0	5	5	5 17
	60 50	40 8	30 0	110 30				
4		(15)	8	3				
4		—	8	3				
8		—	(11)	8				
8		—	—	8				

880 + 320 + 240 + 270 + 210

(40 × 20) + (80 × 4) + (10 × 24) + (30 × 9) + (30 × 7) +

1600

(50 × 32) + [3520]

Q.1-c

$$x_1 + x_2 + a_3 = 10$$
$$x_1, x_2, s_1, e_2, a_2, a_3 \geq 0$$

Tableau before clean up

Z	x_1	x_2	s_1	e_2	a_2	a_3	RHS
1	-2	-3	0	0	-M	-M	0
0	1/2	1/4	1	0	0	0	4
0	1	3	0	-1	1	0	20
0	1	1	0	0	0	1	10

$(MR_3 + R_1)$

after clean up

Z	x_1	x_2	s_1	e_2	a_2	a_3	RHS
1	-2	-3	0	0	-M	-M	30M
0	1/2	1/4	1	0	0	0	4
0	1	3	0	-1	1	0	20
0	1	1	0	0	0	1	10

$(MR_4 + R_1)$

x_2 enters a_2 leaves the basic

Z	x_1	x_2	s_1	e_2	a_2	a_3	RHS
1	(2M-3)/3	0	0	(M-3)/3	(3-4M)/3	0	(30+10M)/3
0	5/12	0	1	1/12	-1/12	0	7/3
0	1/3	1	0	-1/3	-1/3	0	20/3
0	2/3	0	0	1/3	1/3	1	10/3

x_1 enters a_3 leaves the basic

Z	x_1	x_2	s_1	e_2	a_2	a_3	RHS
1	0	0	0	-1/2	(1-2M)/2	(3-2M)/2	25
0	0	0	1	-1/8	1/8		1/4
0	0	1	0	-1/2	1/2	-5/8	5
0	1	0	0	1/2	-1/2	3/2	5

$1R_3 + R_4$

$-\frac{1}{11} R_3 + R_2$

$Z = 25, \quad e_2 = 0, \quad a_2 = 0, \quad a_3 = 0$

$x_1 = 5 \quad x_2 = 5, \quad s_1 = 1/4$

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Q2

For Max & Min (Linear Programming Problem

Step 1 Introduce artificial variables in each row

Step 2 Put artificial variables into objective function

for max Problem $\max Z = C^t x - Ma_1 - Ma_2 - \cdots - Ma_m$

for Min $C^t x + Ma_1 + Ma_2 + \cdots Ma_m$

Step 3 "Clean up" objective function

Step 4 Solve LP by Simplex

$\text{Min } Z = 2x_1 + 3x_2$

$$\text{s.t } (1/2)x_1 + (1/4)x_2 \leq 4$$
$$x_1 + 3x_2 \geq 20$$
$$x_1 + x_2 = 10$$
$$x_1, x_2 \geq 0$$

$$\min Z - 2x_1 - 3x_2 = 0$$
$$\text{s.t. } (1/2)x_1 + (1/4)x_2 + s_1 = 4$$
$$x_1 + 3x_2 - e_2 = 20$$
$$x_1 + x_2 = 10$$
$$x_1, x_2, s_1, e_2 \geq 0$$

Add artificial variables in Constraints 2 & 3

$$\text{Min } Z - 2x_1 - 3x_2 - Ma_2 - Ma_3 = 0$$
$$(1/2)x_1 + (1/4)x_2 + s_1 = 4$$
$$x_1 + 3x_2 - e_2 + a_2 = 20$$

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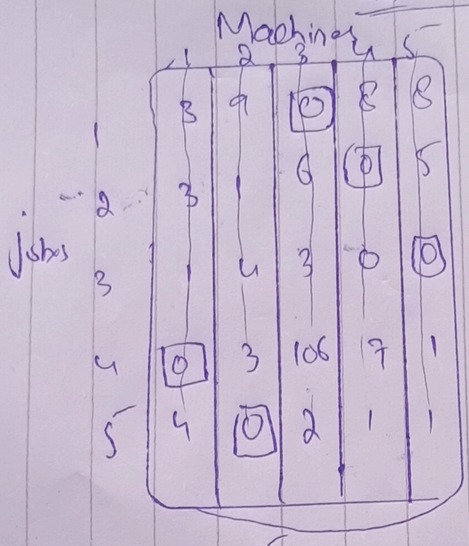

Column Reduction

5 = 5 optimal Solution

Jobs	Machines	Time
1	3	3
2	4	1
3	5	11
4	1	16
5	2	5
		36

Total Processing Time 36 c/hr.

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Q1

Jobs \ Machines	1	2	3	4	5	Row Minimum
1	6	12	[3]	11	[15]	3
2	4	2	7	[1]	10	1
3	8	11	10	7	[14]	7
4	[16]	19	22	23	21	16
5	9	[5]	7	6	10	5

Row Reduction

Jobs \ Machines	1	2	3	4	5
1	3	9	0	8	12
2	3	1	6	0	9
3	1	4	3	0	4
4	0	3	16	7	5
5	4	0	2	1	5
Column Min	0	0	0	0	4