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NAME:-

TALHA HANDEED

ID:-

14526 (BS(SE))

SECTION:-

#(A)

(PAGE) (2)

## QUESTION NO # 1

There are total 5 machines on and paper five employment are to be related and the related cost network is per the following. locate the best possible task.

		MACHINES				
		A	B	C	D	E
J	1	6	12	3	11	15
O	2	4	2	7	1	10
B	3	8	11	10	7	11
S	4	16	19	122	23	21
	5	9	5	7	6	10

P(3)

ANSWER:-

SOLUTION:-

	MACHINES					Row minimum
	1	2	3	4	5	
Job 1	6	12	13	11	15	3
Job 2	4	2	7	2	10	1
Job 3	8	17	10	7	11	7
Job 4	16	19	122	23	21	16
Job 5	9	15	7	6	10	5

Row Reduction

	MACHINES				
	1	2	3	4	5
Job 1	3	9	0	8	12
Job 2	3	1	6	0	9
Job 3	1	4	3	0	4
Job 4	0	3	106	7	5
Job 5	4	0	2	1	5
	0	0	0	0	4

$P(4)$

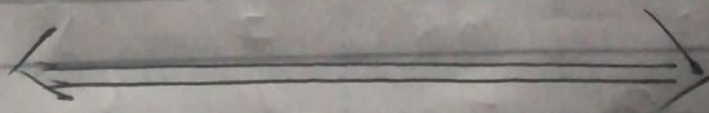
(column reduction)

		MACHINES				
		1	2	3	4	5
JOBS	1	3	9	0	8	8
	2	3	1	6	0	5
	3	1	4	3	0	0
	4	0	3	10	7	1
	5	4	0	2	1	1

$\sum = 5$  optimal solution

JOBS	MACHINES	TIME
1	3	3
2	4	1
3	5	11
4	1	16
5	2	5
		<u>36</u>

Total processing time = 36 hours



QUESTION No:- 2

Solve the following linear programming problem -

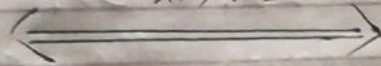
$$\min z = 2x_1 + 3x_2$$

$$S.T. (1/2)x_1 + (1/4)x_2 \leq 4$$

$$x_1 + 3x_2 \geq 20$$

$$x_1 + x_2 = 10$$

$$x_1, x_2 \geq 0$$

ANSWER:-

SOLUTION:-

Big M method for a max/min linear programming problem.

\* Introduce artificial variables in each row (with no basic variable).

Put the artificial variable into the objective function. For max problem

$$\max z = c^T x - M a_1 - M a_2 - \dots - M a_m$$

(For minimum problem  $\min z = c^T x + M a_1 + M a_2 + \dots + M a_m$ .)

P(6)

\* "clean up" the objective function.

\* Solve the LP by Simplex.

If at optimum all  $a_i = 0$  we got the optimal solution for the original LP otherwise (some  $a_i > 0$  at opt)

the original LP is infeasible

$$\min z = 2x_1 + 3x_2$$

$$\text{s.t. } (1/2)x_1 + (1/4)x_2 \leq 4$$

$$x_1 + 3x_2 \geq 20$$

$$x_1 + x_2 = 10$$

$$x_1, x_2 \geq 0$$

In Standard Form:-

$$\min z - 2x_1 - 3x_2 = 0$$

$$\text{s.t. } (1/2)x_1 + (1/4)x_2 + S_1 = 4$$

$$x_1 + 3x_2 - C_2 = 20$$

$$x_1 + x_2 = 10$$

$$x_1, x_2, S_1, C_2 \geq 0$$

\* Add artificial variable in constraints

2 and 3

$$\min z = 2x_1 - 3x_2 - M a_2 - M a_3 = 0$$

$$s.t \quad (1/2)x_1 + (1/4)x_2 + S_1 = 4$$

$$x_1 + 3x_2 - e_2 + a_2 = 20$$

$$x_1 + x_2 + a_3 = 10$$

$$x_1, x_2, S_1, e_2, a_2, a_3 \geq 0$$

\* 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

\* First tableau (after "clean up")

Z	$x_1$	$x_2$	$S_1$	$e_2$	$a_2$	$a_3$	RHS
1	$2M-2$	$4M-3$	0	-M	0	0	$30M$
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

P(8)

\*  $x_2$  enters  $a_2$  leaves the basis

Next tableau.

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	$(60+10m)/3$
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	$60/3$

\*  $x_1$  enters  $a_3$  leaves the basis. Next tableau.

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	$-1/8$	$1/8$	$-5/8$	$1/4$
0	0	1	0	$-1/2$	$1/2$	$-1/2$	5
0	1	0	0	$1/2$	$-1/2$	$3/2$	5

Required Answer



QUESTION NO:- 3

Use Vogel's Approximation method to obtain the initial feasible solution of. ---

**ANSWER:-**

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

SOLUTION:-

	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	40	X	80	<del>080</del>				
	20	22	17	4	<del>120</del>	13	(13)	-	
2	10	X	30	30	<del>016</del>				
	24	37	9	7	<del>40</del>	2	2	2	(17)
3	50	X	X	X	<del>560</del>				
	32	37	20	15		5	5	5	17
	<del>60</del>	<del>40</del>	<del>30</del>	110					
	<del>80</del>	0	0	<del>300</del>					
4	(15)	8	3						
4	-	8	3						
8	-	(11)	8						
8	-	-	8						

$$880 + 320 + 240 + 270 + 210 + (40 \times 22) + (80 \times 4) + (10 \times 24) + (30 \times 9) + (30 \times 7) + 1600$$

$$(50 \times 32) \text{ F } \boxed{3520}$$

