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ID = 14452.

BS (SE - 4) Section A.

(Monday / Wednesday).

Operation Research.

Name = Abdul Mateen khan BSSE-4
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Class timing (Monday / Wednesday)

Q1:- There are total of 5 machines and five employments are to be relegated and the releated ~~are~~ to cost network is as per the following. Locate the best Task.

JOBS	Machines				
	A	B	C	D	E
1	6	12	3	11	15
2	4	2	7	1	10
3	8	11	10	7	11
4	16	19	122	23	21
5	9	5	7	6	10

Sol:- Subtract each number in a row from lowest number in it's row.

→ We don't need dummy row because order of the matrix is right. Which is 5 × 5.

By Hungarian method.

	A	B	C	D	E	
1	3	9	0	8	12	$R_1 - 3$
2	3	1	6	0	9	$R_2 - 1$
3	1	4	3	0	4	$R_3 - 7$
4	0	3	106	7	5	$R_4 - 16$
5	4	0	2	1	5	$R_5 - 5$

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There is one column "E" left with No zeroes. so subtract lowest no in column "E" from Column "E". Which is 4.

	A	B	C	D	E
1	3	9	0	8	8
2	3	1	6	0	5
3	1	4	3	0	0
4	0	3	106	7	1
5	4	0	2	1	1

	A	B	C	D	E
1	3	9	0	8	8
2	3	1	6	0	5
3	1	4	3	0	0
4	0	3	106	7	1
5	4	0	2	1	1

so order
5 = 5

	A	B	C	D	E
1	3	9	[0]	8	8
2	3	1	6	[0]	5
3	1	4	3	~~0~~	[0]
4	[0]	3	106	7	1
5	4	[0]	2	1	1

Jobs	Machines	Cost
1	C	3
2	D	1
3	E	11
4	A	16
5	B	5
	Total Cost =	36

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Q2:- Solve the following Linear Programming Problem.

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

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

$$x_1 + 3x_2 \geq 20$$

$$x_1 + x_2 = 10$$

$$x_1, x_2 \geq 0$$

Sol:- In Standard form.

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

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

$$x_1 + x_2 = 10$$

$$x_1, x_2, S, t \geq 0$$

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

{we have make it equal to zero}

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

Add Artificial variables in constraints 2 and 3.

$$\min \quad z - 2x_1 - 3x_2 - Mb - Mc = 0$$

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

$$x_1 + 3x_2 - t + b = 20$$

$$x_1 + x_2 + c = 10$$

$$x_1, x_2, S, t, b, c \geq 0$$

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Create a simple table

z	x_1	x_2	S	t	b	C	R.H.S
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

After cleanup.

z	x_1	x_2	S	t	b	C	R.H.S
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

x_2 enters and b leaves the basis.

z	x_1	x_2	S	t	b	C	R.H.S
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	10/3

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x_1 enters and c leaves the basis.

z	x_1	x_2	s	t	b	c	R.H.S
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

So there are no negative number in the left side of last row.

$z = 25$, $x_1 = 5$, $x_2 = 5$, $s = 1/4$, $t = 0$, $b = 0$

$c = 0$.

Q 3:- Use Vogel's Approximation Method to obtain the initial feasible solution of

Origin	Destination 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

Sol:-

	Destination					Penalty					
Origin	1	2	3	4	Supply						
1	20	40 22	17	80 4	120	13	13	–	–	–	–
2	10 24	37	30 9	30 7	70 40 20	2	2	2	17	24	24
3	50 32	37	20	15	50	5	5	5	17	32	–
Demand	10 60	40	30	30 110	240						
	4	15	8	3							
	4	–	8	3							
	8	–	11	8							
	8	–	–	8							
	8	–	–	–							
	24	–	–	–							

→ Select the lowest number and second lowest number in the row and column and then subtract them, whatever came, if in row will written in front of that row or if in column will written infront of that column.

The feasible solution is

$x_{12} = 40$

$x_{14} = 40$

$x_{21} = 10$

$x_{23} = 30$

$x_{24} = 30$

$x_{31} = 50$

Minimum cost of transportation =

$= 22 \times 40 + 4 \times 80 + 24 \times 10 + 9 \times 30 + 7 \times 30 + 32 \times 50$

$= \boxed{3520}$.