Date: _____

NAME : MIAN DAUD JAN

CLASS: BS - SE, 4th Sem, Sec-A

ID: 14468

SUBJECT: Operation Research

TEACHER: Saif ullah

Class Timing: Monday (08:00 Am - 11:00 am)

Scanned with CamScanner

QUESTION NO 1:
There are total of 5 machines and five employements are to be relegated cost network is as per following. Locate the best possible task

Machines

Jobs	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

Answer NO 1:
To find the best possible task, First we need to do Row Reduction

Step 1 Row Reduction: Subtracting minimum value of row from each entry of row. The operations involved are,

$R_1 - 3$
$R_2 - 1$
$R_3 - 7$
$R_4 - 16$
$R_5 - 5$

Scanned with CamScanner

	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	$R_5 - 5$

Step 2 Column Reduction: Subtracting minimum value of column from each entry of column. The following operations are involved.

$C_1 - 0$

$C_2 - 0$

$C_3 - 0$

$C_4 - 0$

$C_5 - 4$

We get,

	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	$C_5 - 4$

Scanned with CamScanner

Step 3 | Zero Assignment:

Now we have to assign or cross out the zeros.

i) Starting with rows, assigning circle to ~~bracket~~ zero with in that row which have exactly one zero. cross all zeros in the respective assigned column.

ii) Starting with columns, assign circle to zero in that column which have exactly one zero and cross out all in Respective assigned row.

Thus, we get matrix,

Job	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

Here, we have

Total assigned zeros = 5

→ optimal

⇒ 1 → C, 2 → D, 3 → E,

4 → A, 5 → B

Total time = 3 + 1 + 11 + 16 + 5 = 36

Darsi Notes

Scanned with CamScanner

Mian Daud
14488

QUESTION #02

Solve the following linear Programming Problem.

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

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

Answer #02

Using the Big M method to solve linear programming problem The given subject to constraints are,

$$(1/2)x_1 + (1/4)x_2 \leq 4$$
$$x_1 + 3x_2 \geq 20$$
$$x_1 + x_2 = 10$$

Step 1: Converting the above inequalities into Equalities using the Slack and Artificial variables.

If, $\leq$; Then $+S$
If, $\geq$; Then $-S + A$
If, $=$; then A

Thus we get,

Scanned with CamScanner

(1) $1/2x_1 + 1/4x_2 + S_1 = 4$

(2) $x_1 + 3x_2 - S_2 + A_1 = 20$

(3) $x_1 + x_2 + A_2 = 10$

Step 2: Using objective function and set it equal to zero

i) Subtracting slack variable with co-eff zero

ii) Adding Artificial variable with co-efficient 'M'

$\Rightarrow 0 = Z = 2x_1 + 3x_2 - 0S_1 - 0S_2 + MA_1 + MA_2$

$\Rightarrow Z - 2x_1 - 3x_2 + 0S_1 + 0S_2 - MA_1 - MA_2$

Step 3: Creating the table

Z	x_1	x_2	S_1	S_2	A_1	A_2	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

Scanned with CamScanner

Operation: $(R_3 + R_4)M + R_1 \rightarrow R_1$

$1, 2M-2, 4M-3, 0, 0, -M, 0, 30M \rightarrow R_1$

Z	x_1	x_2	S_1	S_2	A_1	A_2	R.H.S
1	2M-2	4M-3	0	0	-M	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

Operation: $R_3/3$, ~~$R_4 + R_3$~~

Z	x_1	x_2	S_1	S_2	A_1	A_2	R.H.S
1	2M-2	4M-3	0	0	-M	0	30M
0	1/2	1/4	1	0	0	0	4
0	1/3	1	0	-1/3	1/3	0	20/3
0	1	1	0	0	0	1	10

Operation: $R_4 - R_3$

Z	x_1	x_2	S_1	S_2	A_1	A_2	R.H.S
1	2M-2	4M-3	0	0	-M	0	30M
0	1/2	1/4	1	0	0	0	4
0	1/3	1	0	-1/3	1/3	0	20/3
0	2/3	0	0	1/3	-1/3	1	10/3

Scanned with CamScanner

Z	x_1	x_2	S_1	S_2	A_1	A_2	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

Finally, we obtain,

Z	x_1	x_2	S_1	S_2	A_1	A_2	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

In the optimal solution, we have

$$\{Z, S_1, x_1, x_2\} = \{25, 1/4, 5, 5\}.$$

As we don't have any of the artificial variables a_1 and a_2 in the solution, thus the solution is feasible.

Scanned with CamScanner

QUESTION # 03

Use Vogel's Approximation Method to obtain the Initial feasible Solution of.

	Destination				Supply
Origin	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	

Answer # 03

Demand = 60 + 40 + 30 + 110 = 240

Supply = 120 + 70 + 50 = 240

⇒ Demand = Supply

It is a balanced transportation problem thus no need of Addition of Dummy row and column

Scanned with CamScanner

Date:

Mian Daud
14468

	D_1	D_2	D_3	D_4	Supply				
	X	40	X	80	~~80~~ 120	13	(13)	-	-
S_1	20	22	17	4					
	10	X	30	30	~~40~~ 70	2	2	2	(17)
S_2	24	37	9	7					
	50	X	X	X	~~50~~	5	5	5	17
S_3	32	37	20	15					
Demand	~~80~~ 60	~~40~~	~~30~~	~~110~~					
	4	(15)	8	3					
	4	-	8	3					
	8	-	(11)	8					
	8	-	-	8					

Total cost:

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

$$T.C = 880 + 320 + 240 + 270 + 210 + 1600$$

$$\boxed{T.C = 3520}$$

Darsi Notes

Scanned with CamScanner