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Section → BS (SE) B

Paper → operation resecreh

Semester → 4th

class Timing → WED : 8⇒ 11)

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Q: There are total of 5 machines and five employments are to be relegated and the related cost network is as per the following locate the best possible task.

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

Phas: 1:→

Ans: steps 1: subtract the minimum value of each row from the entries of that row.

Machines

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

Row Reduction.

Step 2 : subtract the minimum value of each column from the entries of that column

Machines

Jobs	A	B	C	D	E
1	3	9	0	8	12
2	3	1	6	0	9
3	1	4	3	0	4
4	0	3	106	7	5
5	4	0	2	1	5
column min	0	0	0	0	4

Phase 2: optimation of the problem

step 1: Draw a minimum no of lines to cover all the zeros of the matrix

I) (Row scanning:) i) starting from the first row, ask the following equation is there exactly one zero in that row! If yes mark a square around that zero entry and draw a vertical line passing through that zero. otherwise skip row.

column Reduction

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	A	b	c	d	E
1	3	9	[0]	8	8
2	3	1	6	[0]	5
3		4	3	0	[0]
4	[0]	3	106	7	1
5	4	[0]	2	1	1

Jobs

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

total processing time = 36 hr.

Machines timing

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

Jobs

==x ==x ==x ==x

22 Solve the following Linear programing problem:

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

subject to : $\frac{1}{2}x_1 + \frac{1}{4}x_2 \le 4$

$x_1 + 3x_2 \ge 20$

$= x_1 + x_2 = 10$

$= x_1, x_2 \ge 0$

Ans→ 5 **Step 1:- Add surpuls voriable and artifiled voriable.**

$\frac{1}{2}x + \frac{1}{4}x_2 + s_1 = 4$

$x_1 + 3x_2 - s_2 + a_1 = 20$

$x_1 + x_2 + a_2 = 10$

Step 2:- Add slack voriable and set the objective function equal to 0.

$\text{Min } Z = 2x_1 + 3x_2 + Ma_1 + Ma_2$

$Z - 2x_1 - 3x_2 - Ma_1 - Ma_2 = 0$

slep 3:: crect simple lible::

Z	x1	x2	S1	S2	a1	a2	
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

In the abve lable "a1" and "a2" both are basic variable and having coifficient af "m" in the objective function. but according to the definition of basic variable.

(MR3 + R1)

Z	x1	x2	S1	S2	a1	a2	
1	M-2	3M-3	0	-M	0	-M	20M
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

(MR4 + R1)

Z	x1	x2	S1	S2	a1	a2	
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

Now step 4: to find povit column, step5 to find povit Rows, step 6: to find povit value.

Z	x1	x2	S1	S2	a1	a2		
1	2M-2	4M-3	0	-M	0	0	30M	
0	1	1/4	1	0	0	0	4	$4 : \frac{4}{1/4} = 8$
0	1	(3)	0	-1	1	0	20	$\frac{20}{3}$
0	1	1	0	0	0	1	10	$\frac{10}{1} = 10$

step 4 ↗

pivot column — step 6: pivot value — step 5 pivot Row.

Step 7: Perform row operations to make pivotequal to 1 and the $(\frac{1}{3} R3)$ remaining elements in the pivot column equal to zero

Z	x1	x2	S1	S2	a1	a2	
1	2M-2	4M-3	0	-M	-M	0	30M
0	1/2	1/4	1	0	0	0	4
0	1/3	1	0	-1/3	-1/3	0	20/
0	1	0	0	0	0	1	10

$(-1R3 + R4)$

Z	x_1	x_2	S_1	S_2	a_1	a_2	
1	$2M-2$	$4m-3$	0	$-M$	0	0	$30M$
0	$1/2$	$1/4$	1	0	0	0	4
0	$1/3$	1	0	$-\frac{1}{3}$	$1/3$	0	$20/3$
0	$2/3$	0	0	$1/3$	$-1/3$	1	$10/3$

$(-\frac{1}{4}R2 + R2)$

Z	x_1	x_2	S_1	S_2	a_1	a_2	
1	$2M-2$	$4M-3$	0	$-M$	0	0	30
0	$5/12$	0	1	$1/12$	$-1/12$	0	$7/3$
0	$1/3$	1	0	$\frac{-1}{3}$	$1/3$	0	$20/3$
0	$2/3$	0	0	$1/3$	$-1/3$	1	$10/3$

$((-4M+3)R3 + R1)$

Z	x_1	x_2	S_1	S_2	a_1	a_2	
1	$(\frac{2}{3})^{M-2}$	0	0	$(\frac{1}{3})M-1)$	$(1-\frac{4}{3}M)$	0	$20+\frac{10M}{3}$
0	$5/12$	0	1	$1/12$	$\frac{-1}{12}$	0	$7/3$
0	$1/3$	1	0	$-1/3$	$\frac{1}{3}$	0	$20/3$
0	$2/3$	0	0	$1/3$	$\frac{-1}{3}$	1	$10/3$

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Step 8:-

Repeat process again find pivot column pivot Row and pivot value. step 4.5.6.

Z	x_1	x_2	S_1	S_2	a_1	a_2	
1	$(\frac{2}{3})M-1$	0	0	$(\frac{1}{3})M-1$	$1-\frac{4}{3}M$	0	$20+\frac{10}{3}M$
0	$\frac{5}{12}$	0	1	$\frac{1}{12}$	$-\frac{1}{12}$	0	$\frac{7}{3} = 5.6$
0	$\frac{1}{3}$	1	0	$-\frac{1}{3}$	$\frac{1}{3}$	0	$\frac{20}{3} = 20$
0	$\frac{2}{3}$	0	0	$\frac{1}{3}$	$-\frac{1}{3}$	1	$\frac{10}{3} = 3$

step 7:- operation to make pivt value to 1 and remaining elements in the pivot column eqalto •

$C(\frac{3}{2}) R4]$

Z	x_1	x_2	S_1	S_2	a_1	a_2	
1	$\frac{2}{3}M-1$	0	0	$\frac{1}{3}M-1$	$1-\frac{4}{3}M$	0	$20+\frac{10M}{3}$
0	$\frac{5}{12}$	0	1	$\frac{1}{12}$	$\frac{-1}{12}$	0	$\frac{7}{3}$
0	$\frac{1}{3}$	1	0	$-\frac{1}{3}$	$\frac{1}{3}$	0	$\frac{20}{3}$
0	1	0	0	$\frac{1}{2}$	$-\frac{1}{2}$	$\frac{3}{2}$	5

$(-\frac{2}{3}M+1)\, R4 + R1$

Z	x_1	x_2	s_1	s_2	a_1	a_2	
1	0	0	0	$-1/2$	$1/2 - M$	$3/2 - M$	25
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	1	0	0	$1/3$	$-1/2$	$3/2$	5

$(-\frac{5}{12})\, R4 + R2)$

Z	x_1	x_2	s_1	s_2	a_1	a_2	
1	0	0	0	$-\frac{1}{2}$	$(\frac{1}{2} - M)$	$\frac{3}{2} - M$	25
0	0	0	1	$-\frac{1}{8}$	$1/8$	$-\frac{5}{8}$	$1/4$
0	$1/3$	1	0	$-1/3$	$1/3$	0	$20/3$
0	1	0	0	$1/2$	$-1/2$	$3/2$	5

$(-\frac{1}{3}\, R4 + R3)$

Z	x_1	x_2	s_1	s_2	a_1	a_2	
1	0	0	0	$-\frac{1}{2}$	$(\frac{1}{2} - M)$	$\frac{3}{2} - M$	25
0	0	1	1	$-\frac{1}{8}$	$1/8$	$-\frac{5}{8}$	$1/4$
0	0	0	0	$-\frac{1}{2}$	$1/2$	$-\frac{1}{2}$	5
0	1	0	0	$1/2$	$-1/2$	$3/2$	5

Minimum $z = 25$

	z	x_1	x_2	s_1	S_2	a_1	a_2	
z	1	0	0	0	$-\frac{1}{2}$	$(\frac{1}{2}-M)$	$\frac{3}{2}-M$	25
s_1	0	0	0	1	$-\frac{1}{8}$	$\frac{1}{8}$	$-\frac{5}{8}$	$\frac{1}{4}$
x_2	0	0	1	0	$-\frac{1}{2}$	$\frac{1}{2}$	$-\frac{1}{2}$	5
x_1	0	1	0	0	$\frac{1}{2}$	$-\frac{1}{2}$	$\frac{3}{2}$	5

Min $Z = 25$ $\qquad x_1 = 5$ $\qquad s_2 = 0$

$s_1 = \frac{1}{4}$ $\qquad x_2 = 5$ $\qquad a_1 = 0$

$a_2 = 0$

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Q3 Use vogel's Approximation Method obtain the initial feasibe solution

Solution:

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

Demand = Supply

Balanced transportation probl

				Supply				
X / 20	40 / 22	X / 17	80 / 4	~~120~~ ~~80~~ 0	13	13	-	-
10 / 24	X / 37	30 / 9	30 / 7	~~700~~ ~~40~~	2	2	2	17
50 / 32	X / 37	X / 20	X / 15	~~50~~ 0	5	5	5	17
~~60~~ ~~50~~ 0	~~40~~ 0	~~30~~ 0	~~110~~ 0					
4	(18)	8	3					
4	-	8	3					
8	-	(11)	8					
8	-	-	8					

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$(40\times22)+(80\times4)+(10\times24)+(30\times9)+(30\times7)+(50\times32)$

$= 3520$

$880 + 320 + 240 + 270 + 210 + 1600 = \boxed{3520}$

Ans 3520

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