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BS (SE-4) Section A

~~Ar~~ Dep : Computer Science

Assignment Operation Research

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

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 5x5

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	3	5	R_5-5

Their is one Column E left with No zeroes So Substract lowest no in column "E" from Column "E" which is 4 ~~four~~

	A	B	C	D	E
1	3	9	0	8	8
2	3	1	36	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

S = S

	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

Date:

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

Q2: Solve the following linear Programming Problem

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

$$\text{s.t}\ \left(\tfrac{1}{2}\right)x_1 + \left(\tfrac{1}{4}\right)x_2 \le 4$$

$$x_1 + 3x_2 \ge 20$$

$$x_1 + x_2 = 10$$

$$x_1, x_2 \ge 0$$

Sol: Standard form

$$\text{s.t}\ \left(\tfrac{1}{2}\right)x_1 + \left(\tfrac{1}{4}\right)x_2 + S = 4$$

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

$$x_1 + x_2 = 10$$

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

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

{we have make it equal to zero}

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

Date:

[redacted]

Add Artifical variable in constants 2 and 3

min $Z - 2x_1 - 3x_2 - Mb - Mc = 0$

S.t

$(\frac{1}{2})x_1 + (\frac{1}{4})x_2 + s = 4$

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

$x_1 + x_2 + c = 10$

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

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 Clean up

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

Date:

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	$\frac{1}{12}$	$-\frac{1}{12}$	0	$7/3$
0	$1/3$	1	0	$-\frac{1}{3}$	$-\frac{1}{3}$	0	$20/3$
0	$2/3$	0	0	$\frac{1}{3}$	$\frac{1}{3}$	1	$10/3$

x_1 enters and c leaves the basis

Z	x_1	x_2	s	t	b	c	R.H.S
1	0	0	0	$-\frac{1}{2}$	$(1-2m)/2$	$(3-2m)/2$	25
0	0	0	1	$-\frac{1}{8}$	$\frac{1}{8}$	$-\frac{5}{8}$	$\frac{1}{4}$
0	0	1	0	$-\frac{1}{2}$	$\frac{1}{2}$	$-\frac{1}{2}$	5
0	1	0	0	$\frac{1}{2}$	$-\frac{1}{2}$	$\frac{3}{2}$	5

So their are no negative numbers in the left side of last row

$Z = 25$, $x_1 = 5$, $x_2 = 5$, $s = \frac{1}{4}$, $t = 0$, $b = 0$
$c = 0$

Q3 Use Vogel's Approximation method to Obtain the initial feasible Solution of

Origin	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 / 240

Demand = Supply
(Blanced Transportation problem)

Origin	1	2	3	4	Supply				
1	X 20	[40] 22	X 17	[80] 4	~~120~~ ~~80~~ 0	13	(13)	–	–
2	[10] 24	X 37	[30] 9	[30] 7	~~70~~ ~~40~~ ~~10~~ 0	2	2	2	(17)
3	[50] 32	X 37	X 20	X 15	~~50~~ 0	5	5	5	17
Demand	~~60~~ ~~50~~ 0	~~40~~ 0	~~30~~ 0	~~110~~ ~~30~~ 0					
	4	(15)	8	3					
	4	–	8	3					
	8	–	(11)	8					
	8	–	–	8					

Total cost : $40(22) + 80(4) + 10(24) + 30(9) + 30(7) + 50(32)$

$= 3520$

The feasible solution is

$x_{12} = 40$

$x_{14} = 40$

$x_{21} = 10$

$x_{23} = 30$

$x_{24} = 30$

$x_{31} = 50$