COURSE: OPERATION RESEARCH

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SEMESTER 4TH

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Q1 There are total of 5 machines and five employments are to be relegated and the related to cost networdk is as per the following locate the best task.

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

Sol: Subtract each number in row from lowest number in It's row

→ we don't need dummy row ~~becuse~~ beacuse order of the matrix is right. which is 5x5

By Hungarin Method.

	A	B	C	D	E	
1	3	9	0	8	12	R1-3
2	3	1	6	0	9	R2-1
3	1	4	3	0	4	R3-1
4	0	3	106	7	5	R4-16
5	4	0	2	1	5	R5-5

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	Machine	Cost
1	C	3
2	D	1
3	E	11
4	A	16
5	B	5

Total Cost = 36

Q2 Solve the following Liner programing Problem.

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

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

$$x_1 + 3x_2 \ge 20$$

$$x_1 + x_2 = 10$$

$$x_1, x_2 \ge 0$$

In Standard form:-

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

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

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

$$x_1 + x_2 = 10$$

$$x_1, x_2, S_1, e_2 \ge 0$$

Add artificial variable in Constraint 2 and 3

$$\min z + 2x_1 - 3x_2 - Ma_2 - Ma_3 = 0$$

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

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

$$x_1 + x_2 + a_3 = 10$$

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

Tablean 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 tablean (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

x_2 enters a_2 leaves the basis. Next tablean

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	10/3

x_1 enters a_3 leaves to basis Next tablean:

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

Q3 Use the vogel's Approximation Method to initial feaseble Solution of:-

	Destination				
origion	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

Solution :- Since the given problem
is balanced T.P therefore
there exists a feasible Solution.

Step 1 :-

Select the lowest and next to lowest Cost for each row and each Column, then the deffience between them for each row and Column displayed them with in first braket against respective rows and colimn. Here all the defferences have been Shown within first Compartmant maximum difference is 15 which is occours at the Second coloumn allocate min (40, 120) in maximum cost cell (1,2)

Step-2 :- Appling the Same techniques we obtained the Initial BFS. where all Capacities and demand have been exhausted

Table initial

Origin	1	2	3	4	Supply	Penalty					
1	20	22	17	4	123	13	13	-	-	-	-
2	24	37	9	7	70	2	2	2	17	24	24
3	32	37	20	15	50	5	5	5	17	32	-
Demand	60	40	30	110	240						
Penalty	4	15	8	3							
	4	-	8	3							
	8	-	11	8							
	8	-	-	8							
	8	-	-	-							
	24	-	-	-							

basic

the Initial basic feasible Solution is $x_{12} = 40$, $x_{21} = 10$, $x_{23} = 30$ $x_{24} = 30$ $x_{31} = 50$ and mainimum cost of transportation = $22 \times 40 + 4 \times 80 + 24 \times 10 + 9 \times 30 + 7 \times 30 + 32 \times 550 = 3520$

Total cost is 3520.