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Operational Reasearch T1

Q.1.

	I	II	III	IV
A	8	10	12	16
B	11	11	15	8
C	9	6	5	14
D	15	14	9	7

	I	II	III	IV
A	0	2	4	8
B	3	3	7	0
C	4	1	0	9
D	8	7	2	0

	I	II	III	IV
A	[0]	1	4	8
B	3	2	7	[0]
C	4	[0]	~~[0]~~	9
D	8	6	2	~~[0]~~

no of assignment = 3. number of rows = 4

	I	II	III	IV
A	[0]	1	4	8
B	3	2	7	[0]
C	4	[0]	~~[0]~~	9
D	8	6	2	~~[0]~~

	I	II	III	IV
1	[0]	1	4	10
2	1	[0]	5	~~0~~
3	4	~~0~~	[0]	11
4	8	4	~~0~~	[0]

number of assignment = 4, number of row = 4

so solution is optimal

∴ optimal soln is $8 + 11 + 5 + 7 = \underline{\underline{31}}$

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Q-2.

→

	I	II	III	IV	Supply	
A	8 (25)	10 (2)	7	6 (25)	~~50~~ 27	[1] [1] [1] [2] [3] [10] [10]
B	12	9	4 (40)	7	40	[3] ←
C	9	11 (30)	10	8	30	[1] [1] [1] [2] [1]
	25	32	40	23		
	[1]	[1]	[3]	[1]		
	[1]	[1]	[3]	[2]		
	[1]	[1]		[2]		
	[1]	[1]				
		[1]				
		[10]				

The minimum total transportation cost

$= 8\times25 + 10\times2 + 6\times23 + 4\times40 + 11\times30$

$= 848$

Here the allocated cells = 5, which is less than $m+n-1 = 3+4-1 = 6$

∴ The solⁿ is degenerate

	I	II	III	IV	u_i
A	8 (25)	10 (2)	7 (8)	6 (23)	50 → 0
B	12	9	4 (40)	7	40 → −3
C	9	11	10	8	30 → 1
	25	32	40	23	
v_j	8	10	7	6	

	I	II	III	IV	u_i
A	8 (25)	10 (2)	7 (8)	6 (23)	50 → 0
B	12 (17)	9 (12)	4 (40)	7 (15)	40 → −3
C	9 (10)	11 (30)	10 (12)	8 (11)	30 → 1
Demand	25	32	40	23	
v_j	8	10	7	6	

Since all Δ_{ij} are positive solution is optimal

∴ optimal soln is

	I	II	III	IV	
A	8 (25	10 (2)	7 (8)	6 (23)	50
B	12	9	4 (40)	7	40
C	9	11 (30)	10	8	30
	25	32	40	23	

∴ The minimum ~~soln is~~ TTC is = $8 \times 25 + 10 \times 2 + 7 \rightarrow 6 \times 23 + 4 \times 40 + 11 \times 30$

$= 848$

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Q. 3

Job	1	2	3	4	5
machine A	5	1	9	3	10
machine B	2	6	7	8	4

Optimal sequence is

2	4	3	5	1

Job	A tin	A tout	B tin	B tout	Idle time
2	0	0+1=1	1	1+6=7	1
4	1	4	7	15	-
3	4	13	15	22	-
5	13	23	23	27	1
1	23	28	28	30	1

The total minimum elapsed time = 30

Idle time for machine A = 30-28 = 2

Idle time for machine B = 3

=

% utilization of machin A =

$$\frac{(\text{Total elapsed} - \text{idle})}{\text{Total elapsed}}$$

$$= \frac{(30 - 2)}{30} \times 100$$

$$= 93.33\ \%$$

% utilization of machine B

$$= \frac{(30 - 3)}{30} \times 100$$

$$= 90\ \%$$