OPERATIONS RESEARCH

ASSIGNMENT-2-

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(1) A company operates in four territories, and four salesmen available for an assignment. The territories are not equally rich in potential. It is estimated that a typical salesmen operating in each territory would bring the following annual sales:

TERRITORY	I	II	III	IV
ANNUAL SALES (₹)	126000	105000	84000	63000

The four salesmen also differ in their ability. It is estimated that, working under the same condition, their yearly sales would be proportional as follows:

SALESMEN	A	B	C	D
PROPORTION	7	5	5	4

If the criterion is MAXIMUM expected total sales, find the correct assignment of territories to salesmen.

SOLUTION:

TERRITORIES

SALESMEN	1	2	3	4	SALES PROPORTION
A	42	35	28	21	7
B	30	25	20	15	5
C	30	25	20	15	5
D	24	20	16	12	4
SALES ('000)	6	5	4	3	

converting into a minimization problem

	1	2	3	4	ROW MINIMUM
A	0	7	14	21	0
B	12	17	22	27	12
C	12	17	22	27	12
D	18	22	26	30	18

	1	2	3	4
A	0	7	14	21
B	0	5	10	15
C	0	5	10	15
D	0	4	8	12
COLUMN MINIMUM	0	4	8	12

	1	2	3	4
A	0	3	6	9
B	0	1	2	3
C	0	1	2	3
D	0	0	0	0

	1	2	3	4
A	0	2	5	8
B	0	0	1	2
C	0	0	1	2
D	1	0	0	0

	1	2	3	4
A	0	2	4	7
B	0	0	0	1
C	0	0	0	1
D	2	1	0	0

OPTIMAL ASSIGNMENT :

SALESMEN	TERRITORY	SALES ('000)
A	1	42
B	2	25
C	3	20
D	4	12
		99

(2)

	R_1	R_2	R_3	R_4	R_5	ROW MINIMUM
C_1	9	14	19	15	0	0
C_2	7	17	20	19	0	0
C_3	9	18	21	18	0	0
C_4	10	12	18	19	0	0
C_5	10	15	21	15	0	0
COLUMN MINIMUM	7	12	18	15	0	

	R_1	R_2	R_3	R_4	R_5
C_1	2	2	1	0	0
C_2	0	5	2	4	0
C_3	2	6	3	3	0
C_4	3	0	0	4	0
C_5	3	3	3	1	0

	R_1	R_2	R_3	R_4	R_5
C_1	2	2	1	0	1
C_2	0	5	2	4	1
C_3	1	5	2	2	0
C_4	3	0	0	4	1
C_5	2	2	2	0	0

	R_1	R_2	R_3	R_4	R_5
C_1	2	1	0	0	1
C_2	0	4	1	4	1
C_3	1	4	1	2	0
C_4	4	0	0	5	2
C_5	2	1	1	0	0

Since the number of squares marked cells = no. of rows = 5, the solution is OPTIMAL

OPTIMUM ALLOCATION:

CONTRACTOR	ROAD	COST
C_1	R_3	19
C_2	R_1	7
C_3	–	0
C_4	R_2	12
C_5	R_4	16
		54 LAKHS

(a) The optimum cost is ₹ 54 lakhs.

(b) Yes, it is necessary to seek a supplementary grant of ₹ 4 lakhs

(c) The third contractor, C_3 will be unsuccessful in his bid.

(3) COST MATRIX IS GIVEN BELOW:

	P	Q	R	S	T	ROW MINIMUM
A	85	75	65	125	75	65
B	90	78	66	132	78	66
C	75	66	57	114	68	57
D	80	72	60	120	72	60
E	76	64	56	112	68	56

	P	Q	R	S	T
A	20	10	0	60	10
B	24	12	0	66	12
C	18	9	0	57	12
D	20	12	0	60	12
E	20	18	6	56	12
COLUMN MINIMUM	18	8	0	56	10

	P	Q	R	S	T
A	2	2	0	4	0
B	6	4	0	10	2
C	0	1	0	1	2
D	2	4	0	4	2
E	2	0	0	0	2

	P	Q	R	S	T
A	2	2	2	4	0
B	4	2	0	8	0
C	0	1	2	1	2
D	0	2	0	2	0
E	2	0	2	0	2

	P	Q	R	S	T
A	2	1	2	3	0
B	4	1	0	7	0
C	0	0	2	0	2
D	0	1	0	1	0
E	3	0	3	0	3

Since the number of square marked cells = no. of rows = 5, the obtained solution is OPTIMAL

OPTIMUM ASSIGNMENT:

TYPIST	JOB	COST
A	T	75
B	R	66
C	Q	66
D	P	80
E	S	112
		399

(4) Consider a problem of assigning four clerks to four tasks. The time (in hours) required to complete the tasks is given below:

		TASK			
		A	B	C	D
CLERK	1	4	7	5	6
	2	–	8	7	4
	3	3	–	5	3
	4	6	6	4	–

clerk 2 cannot be assigned to task A, clerk 3 cannot be assigned to task B and clerk 4 cannot be assigned to task D. Find the optial assignment schedule:

SOLUTION:

	A	B	C	D	ROW MINIMUM
1	4	7	5	6	4
2	M	8	7	4	4
3	3	M	5	3	3
4	6	6	4	M	4

	A	B	C	D
1	0	3	1	2
2	M	4	3	0
3	0	M	2	0
4	2	2	0	M
COLUMN MINIMUM	0	2	0	0

	A	B	C	D
1	0	1	1	2
2	M	2	3	0
3	0	M	2	0
4	2	0	0	M

	A	B	C	D
1	0	0	0	2
2	M	1	2	0
3	0	M	1	0
4	3	0	0	M

Since the number of square marked cells = no. of rows = 4, the solution is optimal

OPTIMUM ASSIGNMENT:

CLERK	TASK	TIME
1	B	7
2	D	4
3	A	3
4	C	4
		18

(15) Six salesmen are to be allocated to six sales regions. The earnings of each salesman at each region is given below. How can you find an allocation that earnings will be maximum.

		REGION					
		1	2	3	4	5	6
SALESMEN	A	15	35	0	25	10	45
	B	40	5	45	20	15	20
	C	25	60	10	65	25	10
	D	25	20	35	10	25	60
	E	30	70	40	5	40	50
	F	10	25	30	40	50	15

SOLUTION

Converting into a minimization problem

	1	2	3	4	5	6	ROW MINIMUM
A	55	35	70	45	60	25	25
B	30	65	25	50	55	50	25
C	44	10	60	5	45	60	5
D	45	50	35	60	45	10	10
E	40	0	30	65	30	20	0
F	60	45	40	30	20	55	20

	1	2	3	4	5	6
A	30	10	45	20	35	0
B	5	40	0	25	30	25
C	39	5	55	0	40	55
D	35	40	25	50	35	0
E	40	0	30	65	80	20
F	40	25	20	10	0	35
COLUMN MINIMUM	5	0	0	0	0	0

	1	2	3	4	5	6
A	25	10	45	20	35	(0)
B	(0)	40	0	25	30	25
C	34	5	55	(0)	40	55
D	30	40	25	50	35	0
E	35	(0)	30	65	30	20
F	35	25	20	10	(0)	35

	1	2	3	4	5	6
A	5	10	25	20	35	(0)
B	(0)	60	0	45	50	45
C	14	5	35	(0)	40	55
D	10	40	5	50	35	0
E	15	(0)	10	65	30	20
F	15	25	(0)	10	0	35

	1	2	3	4	5	6
A	(0)	10	20	20	30	0
B	0	65	(0)	50	50	50
C	9	5	30	(0)	35	55
D	5	40	0	50	30	(0)
E	10	(0)	5	65	25	20
F	15	30	0	15	(0)	40

Since the number of squares marked cells = no. of rows = 6, the solution is OPTIMAL

OPTIMUM ALLOCATION!

SALESMEN	REGIONS	EARNINGS
A	1	15
B	3	45
C	4	65
D	6	60
E	2	70
F	5	50
		305