

SELF-PRACTICE PROBLEMS

EXERCISE 6.2

1. A firm produces four products. There are four operators who are capable of producing any of these four products. The processing time varies from operator to operator. The firm records 8 hours a day and allows 30 minutes for lunch. The processing time in minutes and the profit for each of the product are given below :

Operator \ Product				
	A	B	C	D
1	60	36	40	24
2	40	24	35	24
3	100	60	60	30
4	60	36	40	40
Profit (₹ per unit)	80	60	50	40

Find the optimal assignment of product to operators.

2. Five lathes are to be allotted to five operators (one for each). The following table gives output figures (in pieces) :

Operator	Hourly output in Lathe				
	L_1	L_2	L_3	L_4	L_5
P	20	22	27	32	36
Q	19	23	29	34	40
R	23	28	35	39	34
S	21	24	31	37	42
T	24	28	31	36	41

Profit per piece is ₹ 250. Find the maximum profit per hour.

3. Four salesmen are to be assigned to four districts. Estimates of the sales revenue in '000 of rupees for each sale as under:

Salesman \ District	A	B	C	D
1	320	350	400	280
2	400	250	300	220
3	420	270	340	300
4	250	390	410	350

Give the assignment pattern that maximizes the sales revenue.

4. A director in a Management Institute has the problem of assigning courses to teachers with a view to maximizing educational quality in his Institute. He has available to him one professor, two associate professors, and one teaching assistant (TA). Four courses must be offered and, after appropriate evaluation, has arrived at the following relative ratings (100 = best rating) regarding the ability of each instructor to teach each of the four courses.

	Course 1	Course 2	Course 3	Course 4
Prof. 1	60	40	60	70
Prof. 2	20	60	50	70
Prof. 3	20	30	40	60
TA	30	10	20	40

How should he assign his staff to the courses to realise his objective ?

5. In a job shop operation, five jobs may be performed on any of four machines. The hours required for each job on each machine are presented in the adjoining table :

Job \ Machine	1	2	3	4
A	13	14	16	10
B	12	13	15	12
C	11	12	12	9
D	16	16	18	14
E	10	12	13	12

The plant foreman would like to assign the jobs so that the total time is minimized. Find the optimal solution. Which job will be left unassigned ?

6. XYZ transport company has a surplus of one truck in each of the cities 1, 2, 3, 4, 5 and a deficit of one truck in each of the cities A, B, C, D, E and F. The distance (in km.) between the cities with a surplus and cities with a deficit are given below:

To \ From	A	B	C	D	E	F
1	80	140	80	100	56	98
2	48	64	94	126	170	100
3	56	80	120	100	70	64
4	99	100	100	104	80	90
5	64	80	90	60	60	70

How should the trucks be dispatched so as to minimize the total distance travelled ? Which city will not receive a truck ?

7. The marketing manager of a company is faced with the problem of assigning 5 regional managers A, B, C, D, E to six zones I, II, III, IV, V, VI. From past experience he knows that the efficiency percentage judged by the sales, market share, operating cost etc. depends a lot on Regional Manager Zone combination given below :

Regional Manager	A	B	C	D	E
Zone					
I	71	79	73		
II	89	83	70	91	88
III	85	67	81	94	89
IV	80	74	82	84	77
V	76	72	76	89	87
VI	78	83	89	81	67
				80	74

Advise the marketing manager which zone should be managed by a junior manager due to non-availability of a regional manager so that overall efficiency is maximized.

8. Average time taken by an operator on a specific machine is tabulated below. The management is considering to replace one of the old machines by a new one and the estimated time for operation by each operator on the new machine is also indicated.

Operator	Machine	1	2	3	4	5	6	New
A		10	12					
B		9	10	8	10	8	12	11
C		8	7	8	7	8	9	10
D		12	13	8	8	8	6	8
E		9	9	14	14	15	14	11
F		7	8	9	8	8	10	9
				9	9	9	8	8

- Find out an allocation of operators to the old machines to achieve a minimum operation time.
- Reset the problem with the new machine and find out the allocation of the operators to each machine and comment on whether it is advantageous to replace an old machine to achieve a reduction in operation time only.
- How will the operators be reallocated to the machines after replacement?

9. A small engineering workshop has five operators A, B, C, D, and E assignable to any one of the five lathes L_1 , L_2 , L_3 , L_4 , and L_5 . The workshop is involved in producing at standard part for which it was obtained a larger order. In view of the varying skills of the operators and the efficiency of the lathes the weekly output in terms of the number of finished parts differ for various possible assignments of the operators to the lathes. The possible weekly outputs are displayed in the matrix given below. The workshop earns a profit of ₹ 1,000 on each standard part produced.

Lathe	L_1	L_2	L_3	L_4	L_5
Operator					
A	18	20	25	30	34
B	17	21	27	32	38
C	21	26	33	37	32
D	19	22	29	35	40
E	22	26	29	34	39

(i) Find the best way to assign the operators to the lathes and assess the maximum weekly profit possible.

(ii) If during a particular week operator C will not be available for work, how does this effect the weekly output and profit? Which Lathes will have to be kept idle during this week?

10. A manufacturer of complex electronic equipment has just received a sizable contract and plans to sub-contract part of the job. He has solicited bids for 6 sub-contracts from 4 firms. Each job is sufficiently large so that any one firm can take on only one job. The table below shows the bids and the cost estimates for doing the jobs internally. Note that no more than two jobs can be performed internally.

Firm	Job	1	2	3	4	5	6
1		48,000	72,000	36,000	52,000	50,000	65,000
2		44,000	67,000	41,000	53,000	48,000	64,000
3		46,000	69,000	40,000	55,000	45,000	68,000
4		43,000	73,000	37,000	51,000	44,000	62,000
Internal		50,000	65,000	35,000	50,000	46,000	63,000