School of Mathematics, Thapar University
Operations Research (UMA-019)
Tutorial Sheet 6

1. Iron ore is to be transported from three mines to four steel mills situated in different cities. Find the minimum cost transportation schedule given the following cost matrix:

	Steel Mills A	B	C	D	Ore Available
I	14	56	48	27	13
Mines II	82	35	21	81	19
III	99	31	71	63	16
Ore required	7	14	21	6	

2. In a flood relief operation, there are four bases of operations B_i $(i=1,2,3,4)$ from where air crafts can take relief materials to three targets T_j $(j=1,2,3)$. Because of the difference in air crafts, range to target and flying altitudes, the relief material (in tons) per aircraft from any base that can be delivered to any target differs according to following table:

	T_1	T_2	T_3
B_1	8	6	5
B_2	6	6	6
B_3	10	8	4
B_4	8	6	4

The daily sortie capacity of each of the four bases is 150 sorties per day and the daily requirement of sorties on each target is 200. Find the allocation of sorties that maximizes the total tonnage over all the targets. If the problem has alternative solutions, find one.

3. A steel company has three open hearth furnaces and five rolling mills. Shipping cost of steel from furnaces to rolling mills are shown in the following table. Find the optimal shipping schedule.

Mills / Furnaces	M_1	M_2	M_3	M_4	M_5	Capacities (in quintal)
F_1	4	2	3	2	6	8
F_2	5	4	5	2	1	12
F_3	6	5	4	7	3	14
Requirement (in quintal)	4	4	6	8	8	

4. Solve the following transportation problem for minimum transportation cost.

	D_1	D_2	D_3	D_4	D_5	Availability
O_1	20	19	14	21	16	40
O_2	15	20	13	19	16	60
O_3	18	15	18	20	–	70
Requirement	30	40	50	40	60	

where – indicates that it is not possible to transport goods from origin O_3 to destination D_5.

5. Solve the following transportation problem for minimum cost starting with the degenerate basis $x_{12} = 30$, $x_{21} = 40$, $x_{32} = 20$, $x_{43} = 60$

	D_1	D_2	D_3	Availability
O_1	4	5	2	30
O_2	4	1	3	40
O_3	3	6	2	20
O_4	2	3	7	60
Demand	40	50	60	

6 A company has four plants producing the same product. The production cost differs from one plant to another as do the cost of raw materials. There are five regional warehouses. Sales price at each is different. The maximum sales, capacity, unit transportation costs etc. are given in the following table. Determine the transportation schedule which maximizes the over all profit.

		Plants					
		1	2	3	4	Sales	
		Maximum					
Production cost (Rs.)		15	18	14	13	Price	Sales
Raw material cost (Rs.)		10	9	12	8	(Rs.)	
	Warehouse						
	1	3	9	5	4	34	80
	2	1	7	4	5	32	110
Transportation cost	3	5	8	3	6	31	150
(Rs.)	4	7	3	8	2	31	100
	5	4	5	6	7	31	150
Capacity		150	200	175	100		