Formulation of linear programming problems:

Question 1:

A factory manufactures two articles A and B. To manufacture one unit of article A, a certain machine has to be worked for 1.5 hours and in addition a craftsman has to work for 2 hours. To manufacture one unit of article B, the machine has to be worked for 2.5 hours and in addition a craftsman has to work for 1.5 hours. In a week the factory can avail of 80 hours of machine time and 70 hours of craftsman's time. The profit for a unit of article A is 5 SAR and that on each unit of article B is 4 SAR. If all the produced articles can be sold away, find how many of each kind should be produced to earn the maximum profit per week. Formulate the problem as L.P. problem.

Question 2:

A company produces 3 products P, Q, and R from 3 raw materials A, B, and C. One unit of product P requires 2 units of A and 3 units of B. One unit of product Q requires 2 units of B and 5 units of C. One unit of product R requires 3 units of A, 2 units of B and 4 units of C. The company has 8 units of material A, 10 units of material B and 15 units of material C available to it. Profits per unit of products P, Q and R are 3 SAR, 5 SAR and 4 SAR respectively.

Question 3: (Diet Problem):

Vitamins V and W are found in two different foods F1 and F2. One unit of food F1 contains 2 units of vitamin V and 3 units of vitamin W. One unit of food F2 contains 4 units of vitamin V and 2 units of vitamin W. One unit of food F1 and F2 costs 3 SAR and 2.5 SAR respectively. The minimum daily requirements (for a person) of vitamins V and W are 40 and 50 units respectively. Assuming that excess amount is not harmful, find out the optimal mixture of foods A and B at the minimum cost that meets the minimum daily requirement of vitamins V and W. Formulate the problem as L.P. problem.

Question 4: Blending problem:

The manager of an oil refinery must decide on the optimal mix of two possible blending processes of which the inputs and outputs per production run are as follows:

Process	Input		Output	
	crude A	crude B	gasoline X	gasoline Y
1	6	4	6	9
2	5	6	5	5

The maximum amounts available of crudes A and B are 500 units and 400 units respectively. Market demand shows that at least 300 units of gasoline X and 260 units of gasoline Y must be produced. The profits per production run of process1 and process2 are 40 SAR and 50 SAR respectively. Formulate the problem for maximizing the profit.

Question 5: Staff Management problem:

A city hospital has the following minimal daily requirements for nurses:

Period	Clock time	Min. number of nurses required
1	6 a.m. – 10 a.m.	2
2	10 a.m. – 2 p.m.	7
3	2 p.m. – 6 p.m.	15
4	6 p.m. – 10 p.m.	8
5	10 p.m. – 2 a.m.	20
6	2 a.m. – 6 a.m.	6

Nurses report to the hospital at the beginning of each period and work for 8 consecutive hours. The hospital wants to determine the minimum number of nurses to be employed so that there will be sufficient number of nurses available for each period. Formulate the problem as L.P. problem.

Question 6: Advertising Media Selection:

The owner of Metro sports wants to determine how many advertisements to place in the selected 3 monthly magazines A, B and C. His objective is to advertise in such a way that the total exposure to principal buyers of expensive of sports goods is maximized. Percentages of readers for each magazine are known. Exposure in any particular magazine is the number of advertisements placed multiplied by the number of principal buyers. The following data can be used:

	Magazines		
	A	B	C
Readers	100,000	60,000	40,000
Principal buyers	10%	15%	7%
Cost per advertisement SAR	5000	4500	4250

The budgeted amount is at most 100,000 SAR for advertisements. The owner has already decide that magazine A should have no more 6 advertisements, and that B and C each have at least 2 advertisements. Formulate a L.P. model for the problem.