1. A merchant wants to obtain an amount not exceeding 5 tons of a certain product that can be ordered from two factories A and B. Factory A guarantees a profit of 4 contos per ton, but cannot supply more than 3 tons. Factory B guarantees a profit of 3.5 contos per ton, and can supply any quantity. Assuming that the merchant wants to obtain the maximum profit, formulate his problem in mathematical programming.

2. A video manufacturing company produces two types of devices: with two heads and with four reading heads. The assembly of the two-head devices is carried out on production line 1, and requires 5 components. The four-head devices are assembled on line 2, requiring 6 components. The components are supplied by another manufacturer, in a quantity limited to 600 components per day. The company has 160 employees, with 1 man required for one day to assemble a two-head video and 2 men for one day to assemble a four-head video. Taking into account the costs of labor and materials, the revenue obtained is a function of the number of videos of each type produced:

$$f(x, y) = 32x + 8y + xy - \frac{x^2}{2} - y^2$$

   where x and y are the numbers of two-head and four-head videos produced daily, respectively. Taking into account that this company wants to find a daily video production plan that maximizes revenue, translate this problem mathematically.

3. A seed export company wants to fulfill its order book. In some cases, it is convenient to ship orders by mail. The Portuguese Post Office (CTT) requires that the boxes used have the shape of a rectangular parallelepiped, obeying the following rules:

   - The length cannot exceed 42 cm, and the sum of the length and width cannot exceed 72 cm.
   - The height must be less than or equal to the width, and the width cannot exceed the length.

   What is the largest volume of seeds that can be shipped in a single mail order that complies with these regulations?

4. A factory produces two types of fabric using 3 different colors of wool. The following amounts of wool (in grams) are required for each meter of fabric:

Wool	Fabric A	Fabric B
yellow	400	500
green	500	200
black	300	800

   The factory only has 100 kg of yellow wool, 100 kg of green wool, and 120 kg of black wool. The manager of this factory wants to determine how to establish production, assuming that he profits $5.00/monfabricAand2.00/$m on fabric B. Formulate your problem.

5. A steel factory has to decide how to use the time of the following week in a mill. The mill uses steel scrap, and can produce strips or coils. The strips can be produced at a rate of 200 tons per hour, and the coils at a rate of 140 tons per hour. The profits obtained are 25 contos per ton with the strips and 30 contos per ton with the coils. Considering the order book, the maximum production in the following week is 6000 tons for strips and 4000 tons for coils.

   If 40 hours of production are available that week, how many tons of each product should be produced in order to maximize profit? Formulate the problem.

6. Consider the problem of choosing food to meet certain nutritional requirements. The available dishes are the following, with prices indicated in escudos:

	Dish	Price
1	Steak	319
2	Chicken	259
3	Fish	229
4	Hamburger	289
5	Pasta	189
6	Empanada	199
7	Spaghetti	199
8	Turkey	249

These dishes provide the following percentages (per dish) of the daily minimums required in vitamins A, C, B1, and B2:

	A	C	B1	B2
Steak	60	20	10	15
Chicken	8	0	20	20
Fish	8	10	15	10
Hamburger	40	40	35	10
Pasta	15	35	15	15
Empanada	70	30	15	15
Spaghetti	25	50	25	15
Turkey	60	20	15	10

The problem is to find the combination of dishes that meets the dietary requirements of a week (700

7. There are three factories located along the Leça River (1, 2, and 3), each of which emits two types of pollutants (1 and 2) into the river. If the waste emitted is processed, pollution in the river can be reduced. The processing of waste from factory 1 costs 15 euros per ton, and each ton processed reduces the amount of pollutant 1 by 0.1 tons, and the amount of pollutant 2 by 0.45 tons. The cost of processing waste from factory 2 is 10 euros per ton, and each ton processed reduces the amount of pollutant 1 by 0.2 tons, and the amount of pollutant 2 by 0.25 tons. For factory 3, the cost of processing waste is 20 euros per ton, and each ton processed reduces the amount of pollutant 1 by 0.4 tons, and the amount of pollutant 2 by 0.3 tons. The state intends to reduce the amount of pollutant 1 in the river by at least 30 tons, and the amount of pollutant 2 by at least 40 tons. Formulate the linear program that minimizes the cost of reducing pollution to the desired amounts. Indicate whether the hypotheses of linear programming are verified in this case.