

Tutorial N°1 (Modeling and graphical resolution of PLs)

Exercise 1. A company manufactures two products, A and B, using two raw materials, M_1 and M_2 . It has 50 units of M_1 and 60 units of M_2 . To produce one unit of A, 10 units of M_1 and 12 units of M_2 are used; to produce one unit of B, 20 units of M_1 and 16 units of M_2 are used. The profit from the sale of one unit of A is estimated at 4 000 DA, and that of B is estimated at 4 500 DA. We are interested in the production schedule for this company that will yield the maximum profit. We are asked to express this problem as a LP.

Exercise 2. A device can be manufactured using three technical production processes: T_1 , T_2 and T_3 . Each of these processes consumes four resources: E (energy), RM (raw materials), L (labor), and K (machinery). The consumption per process, the available resources, and the cost price of the parts are given in the following table. The device will be sold for 2800DA. Find the quantity of devices to be produced by each process in order to maximize profit.

	E	RM	L	K	cost price
T₁	3	2	3	5	1700 DA
T₂	2	3	6	4	1600 DA
T₃	4	1	4	5	1900 DA
capacity	86	64	156	138	

Exercise 3. A company manufactures three products, P_1 , P_2 and P_3 , which are sold for 140 DA, 150 DA and 220 DA per unit, respectively. Four raw materials are used to manufacture these products. The prices and units of raw materials required for each type of product, as well as the corresponding available quantities, are given in the following table.

Raw materials	Unit price	P_1	P_2	P_3	Quantity of available raw materials
M_1	30	0	2	3	50
M_2	20	3	2	1	200
M_3	5	4	4	6	200
M_4	10	0	0	2	100

The objective of the company is to determine the optimal production quantities for each product in order to maximize profit. Define the decision variables, the objective function, and all relevant constraints for the problem.

Exercise 4 (Transportation problem).

A company has two factories, F_1 and F_2 . Factory F_1 has 500 units of a certain product, and factory F_2 has 300 units of the same product.

The company has three customers: E_1 , E_2 , and E_3 , whose demand for this product is as follows: 100 units for customer E_1 , 200 units for customer E_2 , and 300 units for customer E_3 . The unit transportation costs (in thousands of DA) are summarized in the following table:

	E_1	E_2	E_3
F_1	20	10	30
F_2	30	20	20

Provide the mathematical formulation in the form of a linear program for this situation.