Solving economic issues in MATHCAD

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Anatation. ***This article provides information about the MATHCAD program, which provides methods, methods and formulas for solving economic problems using this program.***
Keywords. ***MATHCAD, linear programming, mathematical modeling, maximization, minimization, given.***

The problem of linear programming is one of the problems of optimization, and the form of its generalized mathematical model is as follows.

$$\sum_{j=1}^{n} a_{ij} x_j \le b_i, \quad (i = \overline{1, m})$$

$$x_j \ge 0 \qquad (j = \overline{1, n})$$

$$Z = \sum_{j=1}^{n} c_i x_i \to \max(\min)$$

The first formula of the mathematical model represents the constraints on the quantities sought in the economic sense, which arise from the amount of resources, the need to meet certain requirements, technological conditions and other economic and technical factors. The second condition is that the variables, ie the quantities sought, are not negative. The third is called the objective function and represents a relation of the quantity sought. Consider the following problem related to linear programming. The factory produces two types of A and B sewing products. It uses three different types of materials N1, N2, N3 in the production of products. 15 m from N1 material, 16 m from N2 material, 18 m from N3 material. there is.

2 m from N1, 1 m from N2, 3 m from N3 for the production of M1-product. uses.

M2- 3 m from N1, 4 m from N2, 0 m from N3 to produce the product. uses.

M1 - profit per unit of product is 10 soums, M2 - profit per unit of product is 5 soums.

It is necessary to make a production plan so that the factory gets the maximum benefit.

Let's create a mathematical model of the problem: $2x_1+3x_2 \le 15$

$x_1+4x_2 \le 16$ $3x_1 \le 18$ $x_1 \ge 0$, $x_2 \ge 0$

$Z=10x_1+5x_2 \to$ max

In MATHCAD, maximize and minimize functions can be used to solve a linear programming problem. These functions are generally written as follows:

Maximize (F, <list of variables>)

Minimize (F, <list of variables>)

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The solution of the linear programming problem in MATHCAD is as follows (Figure 1):

1. After starting MATHCAD, write the objective function, for example, f (x, y) = <function view> and enter the initial value of the variable.

2. The keyword Hiven is written.

3. A system of inequalities and constraints is introduced.

4. The function maximize or inimize is sent to a variable.

5. Write this variable and enter the equation. The result is in the form of a vector.

6. To calculate the value of the objective function, write an example (p0, p1) and enter the sign of equality

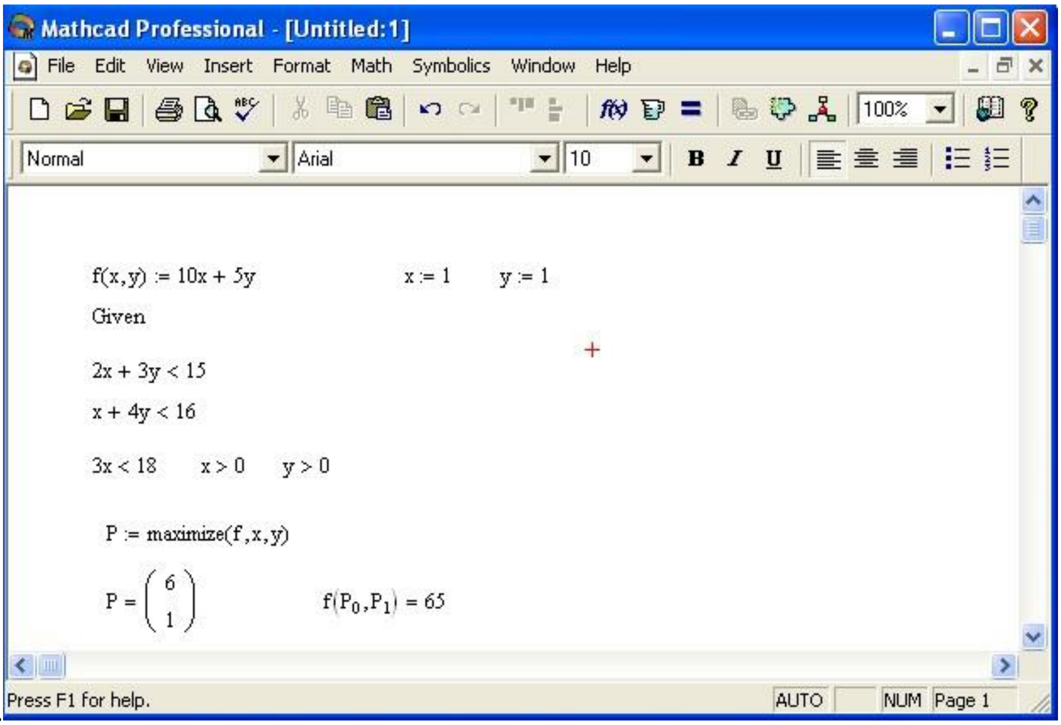

Figure 1. Solve the linear programming problem.

1) To make an item, you need 80 sticks with a length of 120 cm, 120 sticks with a length of 100 cm, and 102 sticks with a length of 70 cm. How much does a 220cm long metal rod need to cut them?

Solution. There are 5 rational ways to make the necessary pieces from the given material:

Cutting method	Number of parts			The amount of waste, cm
	120sm	100sm	70 sm	
1	1	1	0	0

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2	1	0	1	30
3	0	2	0	20
4	0	1	1	50
5	0	0	3	10

We construct a mathematical model. To do this, we use the following table

The length of the rod	1-method	2-method	3-method	4-method	5-method	Total required sterjen issui
120sm	1	1	0	0	0	80
100sm	1	0	2	1	0	120
70sm	0	1	0	1	3	102
Number of materials	x1	x2	x3	x4	x5	

Mathematical model.

1) Target function (minimum material consumption):
$x1+x2+x3+x4+x5 \rightarrow min$

1) Boundary conditions (cut the required number of sternum pieces):
$x1+x2 \geq 80$ $x1+2x3+x4 \geq 120$ $x2+x4+3x5 \geq 102$

1) Non-negative conditions of unknowns $x1 \geq 0$ $x2 \geq 0$ $x3 \geq 0$ $x4 \geq 0$ $x5 \geq 0$

Write the model in the MathCAD window as follows:

x1:=1 x2:=0 x3:=0 x4:=0 x5:=0

F(x1,x2,x3,x4,x5):= x1+x2+x3+x4+x5

Given

$x1+x2 \geq 80$

$x1+2x3+x4 \geq 120$

$x2+x4+3x5 \geq 102$

$x1 \geq 0$ $x2 \geq 0$ $x3 \geq 0$ $x4 \geq 0$ $x5 \geq 0$

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P:=Minimize(F, x1,x2,x3,x4,x5)

$$P = \begin{pmatrix} 80 \\ 0 \\ 20 \\ 0 \\ 34 \end{pmatrix}$$

$$F(P_0, P_1, P_2, P_3, P_4) = 134$$

This result shows that for the minimum consumption of material with a length of 220 cm, it is necessary to cut 80 in method 1, 20 in method 3, 34 in method 5. A total of 134 materials will be used.

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