The American Journal of Applied sciences
(ISSN – 2689-0992)
Published: October 28, 2021 | **Pages:** 9-14
Doi: https://doi.org/10.37547/tajas/Volume03Issue10-03

IMPACT FACTOR
2021: 5. 634

OCLC - 1121105553

Methodology Of Application Of The Simplex Method In The Optimal Development Of Industrial Enterprises

Javohir Sobirovich Eshonkulov
Researcher, Karshi Engineering-Economical Institute, Uzbekistan

Journal Website: https://theamericanjournals.com/index.php/tajas

ABSTRACT

Methods of solving mathematical models of industrial enterprises using the simplex method, which is one of the most important methods of constructing mathematical models, are shown in finding optimal solutions to economic problems.

KEYWORDS

Industrial enterprise, mathematical programming, linear programming, simplex method, objective function, minimum (maximum) value, base plan (solution), optimal solution.

INTRODUCTION

Rational organization of the economy of the Republic of Uzbekistan is one of the important directions of economic policy. Effective use of natural, economic and labor potential of the regions is one of the main conditions for achieving economic independence and economic growth, improving the living standards of the country's population.

As the President of the Republic of Uzbekistan Sh.M.Mirziyoev noted, “As a result of structural changes in the economy, the share of industry in GDP is expected to increase from 35% to 37% this year. However, in some cities and districts, this very important issue is not given enough attention. As a result, the share of industry in 27 districts of the country is less than 1% of the regional average. Therefore, it is necessary to develop medium and long-term programs for the development of industry in each district and city. First of all, the leaders of the Republic of Karakalpakstan and the regions should take this issue under special control” [1].

Rapid and sustainable development of industrial enterprises, increase their export potential, technical and technological re-equipment of production enterprises, supply the domestic market with products of domestic enterprises, selection of optimal options for high profitability using available limited resources, implementation of active investment policy on the basis of which it is possible to further increase the efficiency and competitiveness of the industrial enterprise.

THE MAIN FINDINGS AND RESULTS

Today, the resource problem is one of the most pressing issues in the world. Therefore, it is advisable to choose the optimal options for high profits, making efficient use of limited resources.

Any industrial enterprise has a production plan, that is, target functions in economic terms. Alternatively, there are limited resources, i.e., boundary conditions. It is advisable to solve such processes by applying linear programming problems.

The simplex method was first proposed by the American scientist D. Dansig in 1949 and later fully developed in 1956 by Dansig, Ford, Fulkeran and others [2].

It is well known that linear programming is an integral part of mathematical programming. Let's look at the problem of linear programming in general.

$$F = c_1x_1 + c_2x_2 + \dots + c_nx_n \quad (1)$$

linear function

$$\begin{cases} a_{11}x_1 + a_{12}x_2 + \dots + a_{1n}x_n \le b_1 \\ a_{21}x_1 + a_{22}x_2 + \dots + a_{2n}x_n \le b_2 \\ \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \\ a_{m1}x_1 + a_{m2}x_2 + \dots + a_{mn}x_n \le b_m \end{cases} \quad (2)$$

$$x_j \ge 0, \ j = 1,2,..,n \quad (3)$$

find the minimum (maximum) value that satisfies the constraint conditions. It is known that the general problem of linear programming is represented by a system of equations. We therefore express (2) in the form of an equation by introducing new variables.

$$\begin{cases} a_{11}x_1 + a_{12}x_2 + \dots + a_{1n}x_n + y_1 = b_1 \\ a_{21}x_1 + a_{22}x_2 + \dots + a_{2n}x_n + y_2 = b_2 \\ \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \\ a_{m1}x_1 + a_{m2}x_2 + \dots + a_{mn}x_n + y_m = b_m \end{cases} \quad (4)$$

$$x_i \ge 0 \quad i = 1,2,\dots,n \quad y_j \ge 0 \quad j = 1,2,m$$

The target function takes the following form.

$$F(x_1, x_2, \dots, x_n, y_1, y_2, \dots, y_m) = c_1x_1 + c_2x_2 + \dots + c_nx_n + 0y_1 + 0y_2 + \dots + 0y_m \quad (5)$$

(4) if we write the system in vector form:

$$A_1x_1 + A_2x_2 + \ldots + A_nx_n + A_{n+1}y_1 + \ldots + A_{n+m}y_m = A_0 \qquad (6)$$

proliferation is formed, in this case

$$A_0 = \begin{pmatrix} b_1 \\ b_2 \\ \ldots \\ b_m \end{pmatrix}, A_1 = \begin{pmatrix} a_{11} \\ a_{21} \\ \ldots \\ a_{m1} \end{pmatrix}, \ldots, A_m = \begin{pmatrix} a_{1n} \\ a_{2n} \\ \ldots \\ a_{mn} \end{pmatrix}, A_{n+1} = \begin{pmatrix} 1 \\ 0 \\ \ldots \\ 0 \end{pmatrix}, A_{n+2} = \begin{pmatrix} 0 \\ 1 \\ \ldots \\ 0 \end{pmatrix}, \ldots, A_{n+m} = \begin{pmatrix} 0 \\ 0 \\ \ldots \\ 1 \end{pmatrix}$$

$A_{n+1}, A_{n+2}, \ldots, A_{n+m}$ the vectors are linearly unrelated unit vectors of m-dimensional space that form the basis of this space. Therefore, taking the s for the base variables in the distribution (6), $y_1, y_2, .., y_m$ assuming that the free variables $x_1, x_2, .., x_m$ are equal to $b_j \geq 0$ o, and $(j = 1,2,\ldots,m)$ that the unit vectors are $A_{n+1}, A_{n+2}, \ldots, A_{n+m}$

$$X_0 = (x_1 = 0, x_2 = 0, \ldots x_n = 0, y_1 = b_1, y_2 = b_2 \ldots, y_m = b_m) \qquad (7)$$

we create the initial solution. (6) solution $A_{n+1}y_1 + A_{n+2}y_2 + \ldots + A_{n+m}y_m = A_0$ according to the spread, $A_{n+1}, A_{n+2}, \ldots, A_{n+m}$ the vectors are not linearly connected, so the initial solution is also the base solution. We calculate the value of the linear function corresponding to this initial solution.

$$F = 0y_1 + 0y_2 + \ldots 0y_m = 0 \qquad (8)$$

Any A_{n+j} vector $A_{n+1}, A_{n+2}, \ldots, A_{n+m}$ to a single distribution through the base vectors: $A_{n+1}y_1 + A_{n+2}y_2 + \ldots + A_{n+m}y_m = A_0$ 9) has, so the vector distribution A_j is the only of the linear function on this basis

$$c_{n+1}y_1 + c_{n+2}y_2 + \ldots + c_{n+j}y_j = F \ (j = 1, 2, ..\mathrm{m}) \qquad (10)$$

value corresponds to. $C_j - A_j$ let be the coefficients in the linear function corresponding to the vector. We prove the following theorem without proof:

Theorem. For any A_j vector $F_j - A_j > 0 (F_j - A_j < 0)$ If the evaluation is done, the solution X_0 will not be optimal, and the solution X_1can be found as $F(X_1) < F(X_0)$or

The American Journal of Applied sciences
(ISSN – 2689-0992)
Published: October 28, 2021 | Pages: 9-14
Doi: https://doi.org/10.37547/tajas/Volume03Issue10-03

IMPACT FACTOR
2021: 5. 634
OCLC - 1121105553

The inequality $F(X_1) > F(X_0)$ is satisfied.

RESULT

Any X_0 solution and all the $A_j\,(j=1,2,..,n)$ $F_j - A_j \leq 0\,(F_j - A_j \geq 0)$ If the evaluation is done, the solution X_0 will not be optimal, and the solution X1 can be found as $F_j - A_j \leq 0\ (F_j - A_j \geq 0)$. We now give a simplex table in general.

Table 1.

Simplex table

I	Basics	Basics coeff	A_0	A_1	A_2	...	A_n	A_{n+1}	A_{n+2}	...	A_{n+m}
1	A_{n+1}	c_{n+1}	b_1	a_{11}	a_{12}	...	a_{1n}	1	0	...	0
2	A_{n+2}	c_{n+2}	b_2	a_{21}	a_{22}	...	a_{2n}	0	1	...	0
...	...	...	..	...		...	...	...	...	...	
m	A_{n+m}	c_{n+m}	b_m	a_{m1}	a_{m2}		a_{mn}	0	0		1
m+1	$F_j - C_j$		F_0	$F_1 - C_1$	$F_2 - C_2$		$F_n - C_n$	$F_{n+1} - C_{n+1}$	$F_{n+2} - C_{n+2}$		$F_{n+m} - C_{n+m}$

Based on this table, a 1-simplex table is created. When analyzing an index bar, attention is paid to whether the row elements are positive or negative. If all the elements of the index bar are positive, then the possible solution cannot be changed, and this solution will be the optimal solution.

Description 1. The vector that satisfies the conditions (2) and (3) is called $X = (x_1, x_2, ..x_n)$ a possible solution or a brief plan of the linear programming problem.

Description 2. (4) If the positive boundary vectors of the X_i inputs are not linearly connected, the plan is called $A_i\,(i=1,2,..,m)$ a base plan (solution) $X = (x_1, x_2, ..x_n)$.

$A_i\,(i=1,2,..,m)$ since the **m** vectors are dimensional, it is clear from the definition of the base plan that its positive limit coefficients do not exceed m.

Description 3. If the base plan (solution) has m positive components, it is called special plan, otherwise it is called special plan.

Description 4. A plan (solution) in which a linear function has a minimum (maximum) value is called an optimal plan (solution) of a linear programming problem.

Let's look at some features of the linear programming problem solution:

1) The set of plans (possible solutions) of the system of constraint conditions of the problem of linear programming consists of an empty set or R^n a convex set of space;
2) If the set of plans of a linear programming problem is not an empty set and the target function is limited from above (below) in this set, the problem will have a maximum (minimum) optimal solution.

Solving using the geometric method of basic problems of linear programming becomes more complicated as the system of equations and the number of variables included in the objective function. Special methods have been developed to address such issues.

Using this method, optimal solutions can be found in limited steps. Solving the problem of linear programming by the simplex method is often referred to as the method of sequential improvement of a plan (solution). The main idea of the method in such a term is the following sequence of steps:

Step 1, the initial possible solution is found;

Step 2, the optimality of the solution found is checked;

Step 3 If the solution is not optimal, in Step 2 move on to another possible solution that is closer to the optimal solution. Then, continue to step 2 again and so on until the optimal solution is found. If the problem does not have a solution or if the objective function is not limited to a solution polygon, it is possible to determine it in the process of solving it with the simplex method.

CONCLUSION

Nowadays, as the production process becomes more complex and market relations expand, there is a great need for scientific theories that can be used to analyze each issue and draw the right conclusions from them. In this context, a scientific approach to the management of the economy, the widespread use of mathematical methods, especially the use of specific methods of mathematical programming has become necessary. With the widespread use of modern computer technology, the application of mathematical programming and optimization methods in economic research and planning has become important. The subject of mathematical programming and optimization methods is the creation and application of mathematical models describing economic processes in enterprises, firms, construction, agriculture, markets, production associations, national industries, and the economy as a whole. Mathematical models have been used in economics for a long time. For example, the 1st model used in economics is the reproduction model created by F.Kene. "Mathematical model of economic problems" means the expression of the basic conditions and purpose of the problem using mathematical formulas. The solution of extreme economic problems using optimization methods can be divided into four stages:

- To study the problem in depth and choose the methods that can be applied to it, to create a mathematical model based on the conditions of the problem;
- To find the optimal solution using the appropriate mathematical method, if the

conditions of the problem meet the purpose;

- Economic analysis of the solution and its implementation in practice "as much as possible";
- To give an idea about the use of mathematical programming and approximate methods of optimization in practice.

Mathematical programming is a branch of mathematics that helps to find the best, most expedient, i.e. optimal solution of economic problems that have basically multiple options.

In order to apply mathematical programming methods to find the optimal solution, it is necessary to write the characteristics of the objects of modeling an economic problem and the relationships between them in the form of functions, equations, inequalities, numbers, etc., ie to create a mathematical model of the problem.

The most studied branch of mathematical programming is linear programming. A number of effective methods, algorithms and programs have been developed to solve linear programming problems.

Solving linear programming problems using the geometric method is made easier by the smaller the number of variables included in the system of equations and the objective function; the greater the number of variables, the more complex it is. One of the special ways to solve such problems is the simplex method, which is widely used.

REFERENCES

1. Address of the President of the Republic of Uzbekistan Shavkat Mirziyoyev to the Oliy Majlis. People's Word newspaper. 29.12.2018, №271-272 (7229-7230).
2. Q.Safayeva "Mathematic programming" T., 2004.
3. M.Adhamov, T.Otaboev "Application of mathematical methods in planning", T., 1982.
4. I.L.Akulich "Mathematical programming in samples and tasks" M., 1986.
5. S.A.Ashmanov "Linear programming" M., 1981.
6. A.G.Kurosh "Course of supreme math" M., 1971.
7. Sh.R.Muminov "Mathematical models and methods" T., 2006.
8. M.Raisov "Mathematical programming" T., 2013.
9. Safayeva K., Beknazarova N. Mathematical methods of checking operations. Part 1, - Tashkent, Teacher, 1984.
10. M.Raisov. "Mathematical programming" Tashkent-2009.
11. A.I. Karasev. "Course of Higher Mathematics for Economic Universities". 1982.
12. A.V. Kuznetsov "Mathematical programming" Textbook 1980.
13. A.N.Rakhimov, G.X Makhmatkulov A.M.Rakhimov. "Construction Of Econometric Models Of Development Of Services For The Population In The Region And Forecasting Them" The American Journal of Applied sciences February 20, 2021 |Pages:21-48.
14. https://usajournalshub.com/index.php/tajas/article/view/2119.