SOFTWARE FOR SOLVING THE ONE-STEP STOCHASTIC PROBLEM OF PRODUCTION CONTROL

Mambetov Atamurat Baymuratovich,
Gubenova Galya Turganbaevna,
Teachers of the Department "Information Technologies, Mathematics, Physics and Chemistry" of Karakalpakstan Institute of Agriculture and Agrotechnologies

Allamuratova Venera Jumamuratovna
Teacher of Karakalpak State University

Abstract
In an article considered software development for algorithm of the decision by one step stochastic problem(task) of production management on language C#.

Keywords: Software development, object-orientation software languages, algorithm, stochastic.

Introduction
Setting up a single-stage production management task. Let's consider the problem of producing *x*. We do not know the demand for this product, that is, it is a random variable that we denote by θ. Let's denote the cost of producing a product in *x* by $g(x)$. If the demand is $x \geq \theta$, i.e. the product is processed and exceeds the demand, then expenses $f^1(x,\theta)$ (i.e. expenses for excess products) arise, and conversely, if $x<\theta$, then unsatisfied expenses $f^2(x,\theta)$ arise.
In general, we have the following function:

$$f(x,\theta) = \begin{cases} f^1(x,\theta), & x \geq \theta \\ f^2(x,\theta), & x < \theta \end{cases}$$

Let the function $f^l(x,\theta), l=1,2$ be a curved and continuously differentiable function with respect to the variable *x* at every θ. Then we have the following function minimization problem:

$$F(x) = g(x) + Mf(x,\theta) \to min \quad (1)$$
$$x \in X \quad (2)$$

Here, *X* is the *n*-dimensional space arising from the limitations associated with the enterprise's capacity.
Let's say. Let the objective function *F (x)* be convex in the problem *(1) - (2)* and let $f(x,\theta)$ be differentiable in all θ, where $X= E^n$

The necessary and sufficient condition for x^* to be the solution of this problem is as follows:

$$F_x(x^*) = g_x(x^*) + Mf_x(x^*, \theta) = 0 \quad (3)$$

where $g_x(x^*)$ is the gradient $g(x)$ at the point x^*, $f\_x(x^*,\theta)$ is the longitudinal gradient $f(x,\theta)$ at the point x^*. $F_x(x^*)$ is the gradient of the function $F(x)$.

Algorithm for solving a single-stage production management problem. Among the correct methods of stochastic optimization, the stochastic quasi-gradient method is the most common. When solving the problem (1) - (2), this method has the following algorithm:

Let the convergence x^s, $s=0,1,...$, be obtained on step s. (x^0 *initial approximation).*

1^0. Select a random variable θ^s as a result of observation. For this purpose, a simulation model can be used.

2^0. Let's construct a stochastic quasi-gradient vector:

$$\xi^s = g_x(x^s) + \hat{f}_x(x^s, \theta^s)$$

Where, $g_x(x^s) - g_x(x)$ is the gradient at the point x^s,

$\hat{f}_x(x^s, \theta^s) - f(x, \theta)$ is the total gradient at the point (x^s, θ^s)

3^0. Let's calculate the following approximation using the following recursive formula:

a) Stochastic quasi-gradient method

$$x^{s+1} = \pi_x(x^s - \rho_s \xi^s), \quad s = 0, 1, \dots, \quad (4)$$

where $\pi_x(y^s)$ is the design operator

$$\pi_x(y^s) = argmin\{\|x - y^s\|^2 | x \epsilon X \subset E^N\} \quad (5)$$

b) Stochastic linearization method

$$x^{s+1} = x^s + \rho_s(\bar{x}^s - x^s), \quad 0 \le \rho_s \le 1 \quad (6)$$

$$z^{s+1} = z^s + \gamma_s(\xi^s - z^s) \quad (7)$$

$$\bar{x}^s = argmin\{(z^s, x) | \, x \epsilon X\}, \quad s = 0, 1, \dots, \quad (8)$$

Here, ρ_s - is the step multiplier, s is the step multiplier, γ is the sample coefficient.

$$x^0 = 0, z^0 = 0$$

Setting a specific stochastic task for an enterprise producing homogeneous products and an algorithm for its solution. A company with a capacity of x must produce a homogeneous product of x. The demand for this product is given by a random value θ in the period *[0,T]*.

A company with a capacity of x must produce a homogeneous product of x. The demand for this product is given by a random value θ in the period [0,T].

Since the demand for the output is random, for any x there can be either a surplus or a shortage of output. Let's introduce a designation: the cost of producing a product is denominated in monetary units c, the losses arising from the increase in demand for the product are denominated in monetary units a, and vice versa, the losses arising from the decrease are denominated in monetary units β.

In this case, the stochastic programming problem is written as follows:

$$f(x,\theta) = cx + \begin{cases} \alpha(x-\theta), & eger\ x \geq \theta \\ \beta(\theta - x), & eger\ x < \theta \end{cases}$$

or

$$F(x) = cx + M\, max\{\alpha(x-\theta);\ \beta(\theta - x)\} \rightarrow min \quad (9)$$

$$x \in X = \{x: 0 \leq \underline{x} \leq x \leq \bar{x}\} \quad (10)$$

Let's solve this stochastic problem using the algorithm presented above. The next step is determined by the following recurrence relation

$$x^{s+1} = max\{\underline{x},\ \min(\overline{x},\ x^s - \rho_s \xi^s)\}, \qquad (11)$$

$$s = 0, 1, \dots,$$

The stochastic quasi-gradient of the given statedaf *(x,θ)* is calculated as follows:

$$\xi^s = \widehat{f_x}(x^s, \theta) = c + \begin{cases} \alpha, & eger\ x^s \geq \theta^s \\ -\beta, & eger\ x^s < \theta^s \end{cases} \qquad (12)$$

Here, the demand θs is a random variable.

A program developed in the object-oriented C# programming language for a single-stage production management task solution algorithm. The software consists of several dialog windows. For example, task type selection, learning, storage, etc. When the software is launched, the main window of the program opens (Fig. 1).

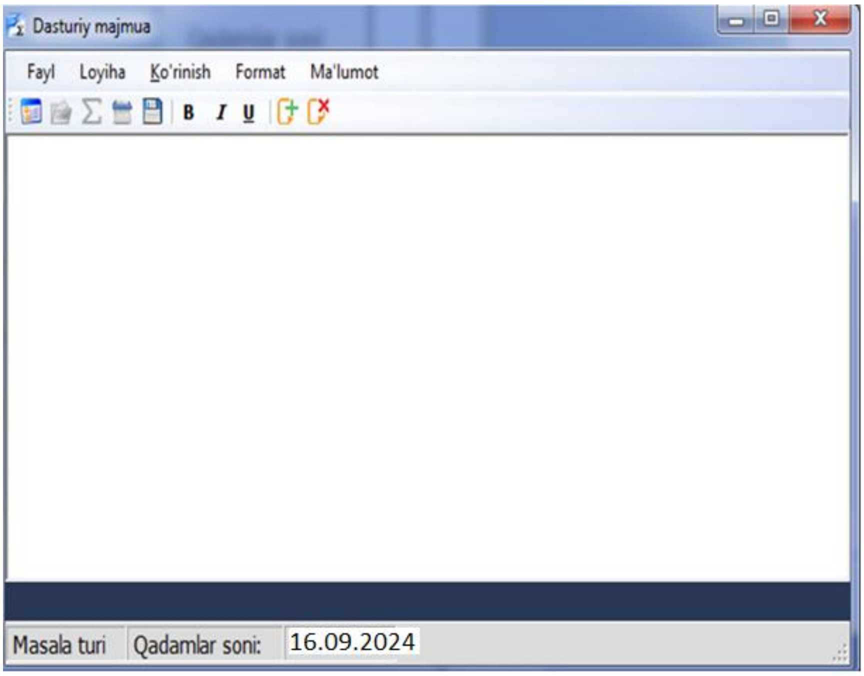

Figure 1.

Web of Teachers: Inderscience Research
webofjournals.com/index.php/1

Web of Teachers: Inderscience Research
webofjournals.com/index.php/1

When solving a one-step stochastic programming problem using software, we first choose the type of problem. To do this, in the "Project" menu, we select "One-Step SDM." Then the next window will open (Fig. 2).

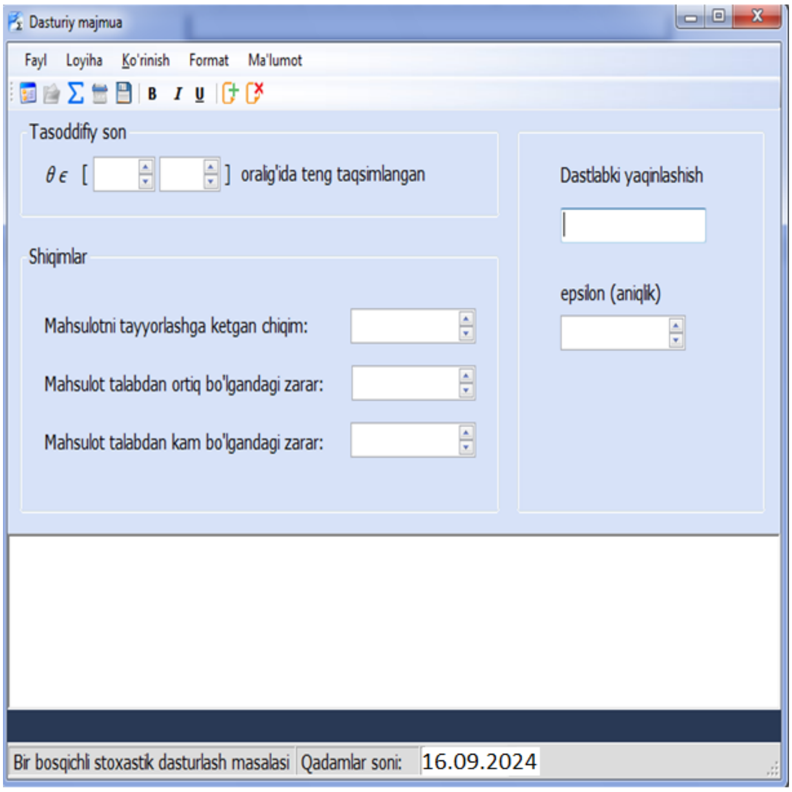

Figure 2.

When we enter the necessary data and click the pictogram, we can see the result of solving the one-step stochastic problem.
Therefore, a software package for one-stage stochastic programming of production management has been developed, and a numerical experiment has been conducted using this software package for one-stage stochastic programming and an optimal solution has been found.

REFERENCES

1. Ермольев Ю.М., Ястремский А.И. Стохастические модели и методы в экономическом планировании.-М.: 1979.-139с.
2. Мирзоахмедов Ф., Некоторые численные решения двухэтапных задач стохастического программирование кибернетика. – 1984. – С.71–73.