1 Basic concepts of operations research (OR) and the classification of problems

Operational research is a complex mathematical discipline dealing with the construction, analysis and application of mathematical models of optimal decision making when conducting operations.

Operation is a system of controlled actions united by a common idea and aimed at achieving a particular goal.

Example 1. The company produces several types of products and uses various types of limited resources during manufacturing. It is required to make a plan to manufacture products for a month, ie indicate the number of each product, so as to maximize the profitability considering restrictions on resources consumed.

Example 2. It is required to create a temporary network of retail outlets so as to ensure maximum efficiency of sales. This involves determining

    number of points,
    their placement,
    number of employees and their salaries,
    commodity prices.

Example 3. It is required to organize the construction of the store. In this case, you must specify the order of execution of the works in time and resources required to distribute between the works in such a way to complete the construction on time and minimize the cost. A set of control parameters (variables) for the operation is called a solution. The solution is called admissible if it satisfies a set of specific conditions. The solution is called optimal if it admissible and according to certain characteristics more preferable or at least not worse. A sign of preference called optimality criterion.

Optimality criterion includes the objective function and the direction of optimization or a set of objective functions and related directions of optimization.

The objective function is is a quantitative measure of preferability or efficiency of the solutions.

The direction of optimization is the maximum (minimum), if the most preferred is the largest (smallest) value of the objective function. For example, the criterion may be to maximize profits or minimize costs. A mathematical model of the OR

problem includes:

1. description of the variables that need to be found,

2. description of optimality criteria,

3. description of the set of feasible solutions (constraints imposed on the variables).

The purpose of OR is quantitative and qualitative decision-support. Final decision is taken the responsible person (or group of individuals), called the decision maker (DM).