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The Concept of an Algorithm. Types of Algorithms

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Annotation

This article gives the concept and types of algorithms in different points of view, starting from the origin of this concept, ending with today's concepts.

Keywords and phrases

Algorithm, set of rules, number system, mathematical symbolism, prescription, recipe, deterministic algorithm, stochastic algorithm, heuristic algorithm, procedure

Among the various rules that one has to face daily and hourly, a special role is played by rules that prescribe a sequence of actions leading to the achievement of some desired result. They are often referred to as algorithms.

The word "algorithm" comes from the name of the outstanding mathematician of the medieval East, Muhammad bin Musa al-Khwarizmi. In one of his works, he described the decimal number system and for the first time formulated the rules for performing arithmetic operations on integers and ordinary fractions.

Al-Khwarizmi sought to ensure that the rules he formulated were understandable. It was difficult to achieve this in the 9th century, when mathematical symbols (signs of operations, brackets, letter designations, etc.) had not yet been developed. However, he managed to develop a clear style of strict verbal prescription, which did not give the reader the opportunity to deviate from the prescribed or skip any actions.

The rules in the books of Al - Khorezmi in Latin translation began with the words "Algorizmi said." In other Latin translations, the author was referred to as Adgoritmus. Over time, it was forgotten that Algorism (Algorithm) is the author of the rules, and these rules began to be called algorithms [Stoilova, 2007].

There is no single "true" definition of the concept of "algorithm". The scientific definition of the concept of algorithm was given by Alonzo Church in 1930. An algorithm means an exact description of some process, an instruction for its implementation. [Knut, 1976].

According to another definition given by V.P. Bepalko, an algorithm is understood as an exact, generally understandable description of a certain sequence of intellectual operations that are necessary and sufficient for solving any of the problems belonging to a certain class [Bepalko, 1997].

According to A.A. Markov in mathematical everyday life understands an algorithm as "an exact prescription that defines a computational process leading from variable input data to the desired result" [Markov, 1984].

L.N. Landa defines an algorithm, which, as a rule, prescribes a sequence of elementary actions (operations), which, due to their simplicity, are unambiguously understood and performed by everyone. An algorithm is a system of instructions (prescriptions) about these actions, about which of them should be performed and how [Landa, 1996].

The definition that N.A. Krinitsky gives in his book sounds like this: an algorithm is a rule formulated in a certain language that determines the process of processing valid input data into the desired results. [Krinitsky, 1984].

An algorithm is a finite set of rules that determines the sequence of operations for solving a specific set of problems and has five important features: finiteness, certainty, input, output, efficiency [Knuth, 1976].



An algorithm is any system of calculations performed according to strictly defined rules, which, after a certain number of steps, leads to the solution of the problem [Kolmogorov, 1987].

An algorithm is a rule of action, a sequence of computational operations, a way to find the desired result [Raizberg, 2007].

An algorithm is a set of prescriptions for the sequential execution of a system of various operations (calculations) necessary to solve a specific problem [Paffengolts, 1978].

An algorithm is a mathematical system of operations (for example, calculations) applied according to strictly defined rules, which, after their sequential execution, leads to the solution of the problem [Komlev, 2006].

The algorithm [algorithm] is an exact prescription regarding the sequence of actions (steps) that transform the initial data into the desired result [Delo, Lopatnikov, 2003].

An algorithm is a set of actions, rules for solving a given problem [Ozhegov, 2008].

The Great Soviet Encyclopedia interprets the concept of "algorithm" as an exact prescription that specifies a computational process starting from an arbitrary initial data and to the determination of a result completely determined by this initial data [Prokhorov, 2003].

In our work, we will rely on the definition given by L.P. Stoilova, according to which the algorithm is considered as a program of actions for solving problems of a certain type [Stoilova, 2007].

Algorithms, depending on the goal, initial conditions of the task, ways to solve it, determine the actions of the performer, are divided as follows:

- Mechanical algorithms, or otherwise deterministic, rigid (for example, the algorithm of the machine, engine, etc.);
- Flexible algorithms, such as stochastic, ie. probabilistic and heuristic. The mechanical algorithm sets certain actions, denoting them in a unique and reliable sequence, thereby providing an unambiguous required or desired result if the process conditions and tasks for which the algorithm is developed are met.
- A probabilistic (stochastic) algorithm gives a program for solving a problem in several ways or ways that lead to the probable achievement of a result.
- A heuristic algorithm is an algorithm in which the achievement of the final result of the action program is not uniquely predetermined, just as the entire sequence of actions is not indicated, all the actions of the performer are not identified.
- Linear algorithm - a set of commands that are executed sequentially in time one after another.
- Branching algorithm - an algorithm that contains at least one condition, as a result of which the computer provides a transition to one of two possible steps.
- Cyclic algorithm - an algorithm that involves multiple repetition of the same action (same operations) on new source data. Most of the calculation methods and enumeration of options are reduced to cyclic algorithms.
- Auxiliary algorithm (procedure) - an algorithm previously developed and fully used in the algorithmization of a particular problem. In some cases, if there are identical sequences of indications (commands) for different data, in order to reduce the record, an auxiliary algorithm is also allocated [Internet resource].

Professor of Stanford University D. Knuth (California, USA) in the book "The Art of Computer Programming" notes that the modern meaning of the word "algorithm" is very similar to the meaning of the words "recipe", "process", "method", "method", "program", but has its own additional semantic connotation. This clarification of the meaning can be formulated as a list of some properties that any algorithm should have.



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