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METHOD OF THE CONSECUTIVE ANALYSIS OF OPTIONS IN A PROBLEM OF DRAWING UP THE SCHEDULE

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On the basis of the theory of consecutive decisions and dynamic programming the general scheme of the consecutive analysis of options was developed. The technique of consecutive development, analysis and elimination of options consists of development of options and creation of analysis operators which allow eliminating unpromising initial parts of options before their full construction. On the basis of the general scheme a number of algorithms of the consecutive analysis of options were developed. They received broad application in practice.

The branch of science, which received the name of the «theory of schedules», originated from Henry Gantt's well-known work of 1903 [1] which introduced what today we call Gantt's charts referred to in many works on the theory of schedules [2, 3].

The first works in the field of automated scheduling appeared in the 50s-60s of the XXth century when of automated control production systems were introduced [4].

At the turn of XXth and XXIst centuries the creation of automated education systems management [5] became an actual problem. The reasons were the following: to strengthen quality requirements of training, to develop new forms of education including distance learning, to increase economic efficiency of training, etc.

There is a set of methods aiming at drawing up the study schedule: a local and evolutionary method, a multiagent approach, a method of replacements, a method of the consecutive analysis of options, a genetic algorithm, a method of coloring the vertices of a graph, an intellectual method, etc.

In this article we consider how a method of the consecutive analysis of options can be applied to drawing up the study schedule.

On the basis of the theory of consecutive decisions and dynamic programming the general scheme of the consecutive analysis of options was developed. From the point of view of formal logic, the scheme of the consecutive analysis of options is consolidated to the following sequence of repeated procedures:

1. to split a set of versions of the task solution into some subsets, each of which possesses specific properties;
2. to use these properties to search for logical contradictions in the description of separate subsets;
3. to except further consideration of the subsets of versions which have logical contradictions.

Thus the technique of consecutive development, analysis and elimination of options consists of the development of options and creation of analysis operators which eliminate unpromising initial parts of options before their full construction. This technique also reduces computing expenses.

On the basis of this general scheme a number of algorithms of the consecutive analysis of options were developed. Many of them received broad application in practice

Approximate methods can be divided into the following groups: methods of local optimization, modification of exact methods, heuristic methods, methods of casual search, and methods combining local optimization with casual search.

We will note that many approximate algorithms allow solving problems of discrete optimization in a dialogue mode. Depending on allocated resources (time, memories of the computer, etc.) these algorithms optimize the task solution by changing of all or some of the basic data.

The considerable part of approximate algorithms of discrete optimization is based on computing schemes of exact methods, such as a method of branches and borders, the consecutive analysis of options and others.

One of the most developed approximate methods is the method of the local optimization, searching for locally optimum decisions. At certain stages of the task solution these methods are often combined with methods of casual search and heuristic methods which reduce a set of options and consider the specifics of a task.

It should be noted that algorithms in which various ideas are combined appear to be the most effective. By means of these methods numerous challenges object classification, placements, planning and design were

solved. The main advantage of these methods is the simplicity of realization, and the main shortcoming is that they can't adapt to conditions of a task. Much more flexible are methods in which the probabilistic law depends on outcomes of the previous tests and changes from iteration to iteration. These are methods of casual search.

Methods of casual search are used for the approximate solution of multidimensional tasks on a rank, and problems of linear Boolean programming of big dimension.

The specification of the scheme of the consecutive analysis of options is in several directions. In connection with the solution of tasks of linear or treelike structure the generalized principle of optimality for monotonously recursive functionalities on the basis of which it is possible to build the scheme of decisions, free from some restrictions inherent in initial procedures of dynamic programming was created.

For treelike structures, the questions connected with order of viewing of branches were investigated, and ways of minimization of the number of information arrays necessary for the realization of procedures of the consecutive analysis of options were found.

The method of the consecutive analysis of options was used for planning and design (calculation of transport networks, problems of placement on a treelike network, design of distributive electric networks, a choice of optimum parameters of the main gas pipelines, etc.).

Further on the basis of the algorithmic scheme of the consecutive analysis of options, effective methods of designing, analysis and elimination of options were developed to solve scheduling problems. Based on the theory of scheduling the exact methods of the solution of different classes of problems of small dimension were proved, necessary and sufficient conditions of a pre-solution for problems of scheduling with the same equipment were proved, effective ways which use rules of domination were developed.

Decomposition algorithms based on schemes of the consecutive analysis and elimination of options were developed to solve problems of big dimension of discrete separable and linear integer programming.

Thus the narrowing of an initial set of options was carried out by eliminating components that gave the chance to consolidate the solution of an initial problem of big dimension to the solution of set of subtasks of small dimension.

The method of the consecutive analysis of options is based on the elimination of unpromising elements, both on restrictions, and on criterion function.

The method of the consecutive analysis of options which can be used to draw up the study schedule is considered. The method is effective for problems of small dimension as at big dimension of the solution task time significantly increases. Decomposition algorithms which are based on the schemes of the consecutive analysis and elimination of options were developed to solve the problems of big dimension of discrete separable and linear integer programming.

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