Using Information Technology in the Modern Educational System – Computer Science - Advanced Programming Techniques - Backtracking

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Abstract. *When creating the two lessons, which have been made by us, the following requirements have been our criteria:*

Pedagogical, social and psychological criteria:

The learning process focuses on the subject – the student.
The informatic system (the lesson on the computer) is "personalized".

The lessons are attractive and captivating.

The text, the graphical, the animated, audio-video achievement of the lesson motivate the student to acquire the information and abilities.

Technical and informatic criteria:

The IT products we have created are flexible stable and a friendly interface;

Modularity – allowing selective and economical utilization, adaptability to the subject's training level.

Keywords. education process, innovation, interactivity, IT.

This multimedia product offers students the opportunity to know, use and implement backtracking programming techniques.

The following have been pointed out to this purpose:

Defining the backtracking technique and the presentation of some problems/ exercises which can be solved by using this method;

The presentation of the main procedures (subprograms and functions) specific to backtracking and the applying of these procedures in solving exercises which can be solved by using this technique;

The forming of the abilities to build up algorithms based on backtracking, by using active-participating methods.

The lesson is modular and allows the teacher to adapt both to the student's training level and to the psychological features of every individual. The student has various tools at his/ her disposal, tools by means of which he/ she can learn in his/ her own rhythm: return buttons, theory buttons, go back buttons, dialogue windows, specific mechanisms which help to modify the running speed of the explanations, can require the automatic running of experiments, or can , on its own, conduct the experiment. The lesson also includes assessment steps that allow a permanent correctional feedback that should point out the progress the student is making. The main steps in the lessons are:

"Game" steps (Fig. 1) - these urge the student to search, investigate and discover. This is the case of the queen problem and the generating of arrangement. They generate a permanent interaction between the student and the computer leading to

discovering and understanding the backtracking mechanism.
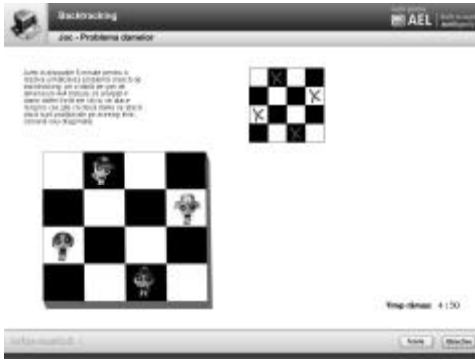
Figure 1. Queen's Problem Game

Figure 2. Stack structure

Steps of the type "explaining, problematisation - questioning, modeling and simulation"- these present interactively and attractively the method of backtracking.
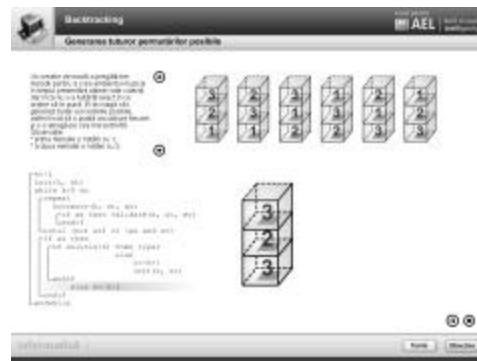
The attractive and captivating animation, carefully observed and explained in the right rhythm, lay the theoretical and practical bases of this programming technique.

Two steps of this lesson are devoted to explaining the *stack* structure (LIFO - Last In First Out). The attractive and suggesting animation (a stack of plates) makes the student understand the stack mechanism better: to extract a plate we have we have to take out everything that is on top of it, and to add a plate, it has to be placed on top of the others. (Fig. 2)

Steps of the type "explaining, problematisation - questioning, modeling and simulation" - they are quite motivating when the students solves the problem. His/Her task is to order

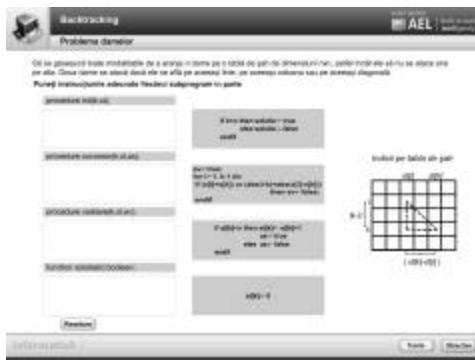
Figure 4. Queen's Problem Test

The second step in explaining the *stack* structure teaches the student how to manage such a structure. By means of tri-dimensional animation, the student learns how to take an element out of the stack, how to add a new element to the stack or how to modify an element. (Fig. 3)

Figure 3. Queen's Problem Test

operations specific to every procedure or function. The solving of the problem is followed by an animation stage whose role is to exemplify the execution mode of the built algorithm. (Fig. 4)

Assessment steps - the student has to deal with multiple choice exercises (only one answer possible). The implemented tests deal with the previously taught notions and aim at informing the teacher about the level of comprehension and acquiring of the taught data.

The informatic system has lots of advantages compared to the traditional classical lesson, using the computer interactively, as a modern and efficient educational tool.

Among these advantages we mention:

Every student's active participation in the lesson, taking into account the fact that most of the lesson modules are interactive , require the student's effort , urge an guide him/ her;

Each module is to be approached in a personal manner: the running rhythm is set by the student, he/ she can ask the rerunning of some unclear notions and can establish the solving method according to his/her own individual psychological features ;

The students acquire the new notions more rapidly due to the fact that visual memory *greatly* brings its contribution to the learning process (suggesting illustrations, captivating animation, quality graphics and text suitable for a virtual lesson).