Interactive Parse-Tree Generator

Graduate Project Final Report

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ABSTRACT

This project is the design and implementation of an Interactive Parse-Tree Generator to be used as a teaching tool in selected computer science courses at Texas A&M University – Corpus Christi. The generator is available to both students and instructors via the Internet so as to provide maximal access. The data source for the generator is a C++ statement provided by the user through the keyboard. If the statement is syntactically correct, the output is a graphic display of the corresponding parse tree. If the statement is syntactically incorrect, the generator displays an error message.
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BACKGROUND AND RATIONALE

An important aspect of any computer science curriculum is learning and understanding parse trees. This is especially true in courses such as Compiler Construction, Programming Languages, and System Software. A thorough comprehension of parse trees, their structure, and their purpose allows the student to more easily fathom such mysteries as language development and language interpretation. At present, most of the teaching of parse trees at Texas A&M University – Corpus Christi is the draw-it-on-the-whiteboard-during-lecture approach. While this method works well, there are some drawbacks. For example, if students wish to practice with additional parse trees after lecture, they have no immediate way of knowing if their answers are correct. This project will offer an interactive approach that provides students with immediate feedback. It also provides the faculty with an additional teaching tool that may be used to enhance the presentation of the subject.

A considerable amount of educational research has been done which shows how the use of multimedia in teaching improves retention and understanding of the material being taught. Several of these studies generally attribute the improvement to Paivio’s Dual Coding Theory (Becker and Dwyer 1998; Najjar 1995; Najjar 1996; Najjar 1998). According to this theory, people tend to process information by one of two relatively independent methods. One method tends to process information more readily if the information is in a verbal form, such as text or audio. The other method tends to process information more readily if the information is in a non-verbal form, such as pictures. Even though the two methods are generally independent, studies have shown that when information is presented in both forms, learning is enhanced (Najjar 1995).
Additional research has shown that, when used for a suitable learning task, multimedia presentations of the material to be learned have a strong influence on how well the information is assimilated (Najjar 1998). If the information to be learned is spatial in nature, pictures appear to communicate the information more effectively. When pictures are used in conjunction with textual presentations, students can more easily establish conceptual connections between the verbal and graphical information.

Since a parse tree is so easily represented as a two-dimensional structure, it lends itself to a spatial display. Showing the graphical representation of a parse tree with its corresponding C++ statement in a multimedia setting should enhance the student’s ability to understand the concept of parse trees.

The type of student involved in learning a specific task has an effect on the efficacy of educational multimedia (Najjar 1998). Students with limited prior knowledge of a subject tend to benefit from a multimedia presentation of the material to be learned. Adults tend to benefit more from the use of educational multimedia than do children.

This project is targeted for adult students in a university environment. Many of these students will have little or no prior exposure to the concept of parse trees.

Other parse-tree generators, both commercial and non-commercial, have been produced. The obvious disadvantage of the commercially available generators is the expense, particularly if it is to be made available to a large number of people. For example, SandStone Technology, Inc. in La Jolla, California, offers their Visual Parse ++ program for a minimum of $495 per copy. The one non-commercial generator found on the World Wide Web (Umrigar 1997) offers several parsing methods, although the author admits there are several “bugs” in the program. The author also states the parser may not
perform as expected on all platforms. The parse-tree generator component of this
graduate project was built “in-house” and tailored to meet the needs of the Computing
and Math Sciences Department at Texas A&M University – Corpus Christi.