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PATTERN MATCHING IN MATRIX GRAMMARS

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ABSTRACT

In this paper, we present algorithms for four problems on matrix grammars, in the sense of SIROMONEY, SIROMONEY and KRITHIVASAN [6]. The problems are membership testing, vertical strip testing, horizontal strip testing and subimage testing. Inputs to all the four algorithms are a matrix grammar M and a matrix I. The membership testing involves finding whether I is generated by M or not. The vertical strip testing is to test whether I is a vertical strip of some matrix generated by M. Similarly, horizontal strip testing is to find whether I is a horizontal strip of some matrix generated by M. Finally, subimage testing algorithm outputs whether I is a subimage of some image generated by M or not. The first two algorithms are based on an algorithm by COCKE, YOUNGER and KASAMI (CYK algorithm). The last two make use of the so called super equivalent classes. These algorithms may find applications in pattern matching.

Keywords: formal languages, pattern matching, matrix grammars, CYK algorithm.

1. Introduction

Pattern matching is a widely studied subject and finds its application in many places [2]. Matrix grammars were studied in [6], as a generation mechanism to generate rectangular arrays. A different type of matrix grammars has been studied in regulated rewriting [5]. In this paper, we consider the matrix grammars in the sense of SIROMONEY, SIROMONEY and KRITHIVASAN [6]. In this type of grammars, first a horizontal string of intermediates is derived and then vertical columns of the array are derived. In [6], all the four types of Chomsky grammars are considered in the horizontal direction and only type-3 grammars are considered in the vertical direction.

In this paper, we consider a context-free (CF) or regular (REG) grammar in the horizontal direction and a CF or REG grammar in the vertical direction. We denote the matrix grammars as (X:Y)MG, where X, Y can be CF or REG. In this paper, we consider the following four pattern matching problems: membership testing, vertical strip testing, horizontal strip testing and subimage testing. We have solved the first two problems for all the four types of matrix grammars, viz. (REG:REG)MG, (CF:REG)MG, (REG:CF)MG and (CF:CF)MG. The last two have been solved for (REG:REG)MG and (CF:REG)MG. These two problems are open for grammars with a CF in the vertical direction.