

## BASIC PUZZLE GRAMMARS AND GENERATION OF POLYGONS<sup>1</sup>

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### ABSTRACT

In this paper, we examine the generation of right triangles and squares by an equivalent form of Basic Puzzle Grammars with a view to reducing the number of rules in the grammars generating these geometric figures. The generation of lines and polygons by Basic Puzzle Grammars are also considered here. We show that it is not possible to construct lines with irrational slope using Basic Puzzle Grammars. Furthermore, any polygon which can be rotated such that it has at least one side with irrational slope and at least one side with rational (or undefined) slope cannot be generated by a Basic Puzzle Grammar. We also note that hexagons cannot be generated.

*Keywords:* picture grammars, picture languages, generation of polygons.

### 1. Introduction

Syntactic methods such as two-dimensional grammars for the description of digitized pictures have been of great interest and study. The digitized pictures are connected finite arrays of unit cells. Various array grammars and picture grammars have been proposed for describing interesting classes of pictures (see references [8, 9, 4]). One of the earliest array models, called isometric array grammars [8] and their subclasses [1] context-free and regular array grammars have been investigated both for theoretical properties and applications [3].

Motivated by problems in tiling, NIVAT et al. [7] introduced a new class of two-dimensional grammars, called Puzzle grammars. It is interesting to note that the

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