The use of restrictions in Logic Programming: Puzzle Akkoy

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Abstract. The present report serves the purpose of explaning the process of finding a solution for akkoy puzzles using programming with restrictions. It also refers the implementation of restrictions in order to generate random puzzles. The main objective is to deepen the knowledge of *PROLOG*, specially the clpfd library. The project was developed for the curricular unit of Logic Programming. The results will be evaluated in order to realize the efficiency of the found solution.

Keywords: restrictions programming logic prolog efficiency

1 Introduction

This project was developed for the curricular unit of Logic Programming in order to deepen the knowledge of the clpfd prolog library. Between the many objectives accounted for this project, the following can be highlighted: examining the results of the use of restrictions whilst programming, understanding the logic of rule-based languages, realizing the advantages of logic in programming. The analized puzzle has many restrictions which made it hard to find a solution which incorporated all the restrictions. Besides this, the efficiency of the solution can not be hightened as well as in other puzzles since the difficulty level is very high. The implemented solution uses the following approach: count the number of black squares in columns and white squares in lines and compare it with the numbers on the restrictions list. The returned board is a list of variables. Each number one represents a black square and each number two represents a white square. The article is structured in order to make it easier to understand the solution. Firstly, the problem is described. Secondly, the solution and its visualization is explained. Finally, the results are analized and the conclusions are made.

2 Problem Description

The presented problem consists in solving an akkoy puzzle. This puzzle has a blank board with numbers on the top and on the right. Figure 1 represents a puzzle with size seven.

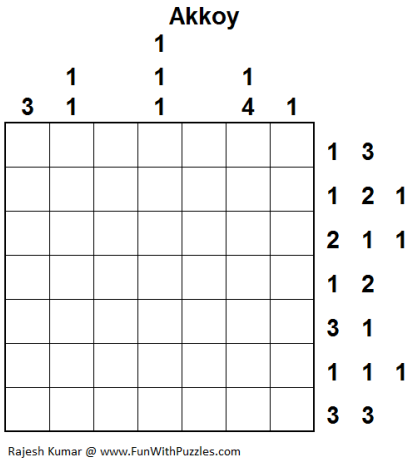

Fig. 1. Example Puzzle.

The numbers on the top represent the number of black squares in each column. For example, in the fourth column there must be three black squares separated. The numbers on the right represent the number of white squares in each line. If these requirements are met, the solution will be a drawing composed of black and white areas (such as Figure 2).

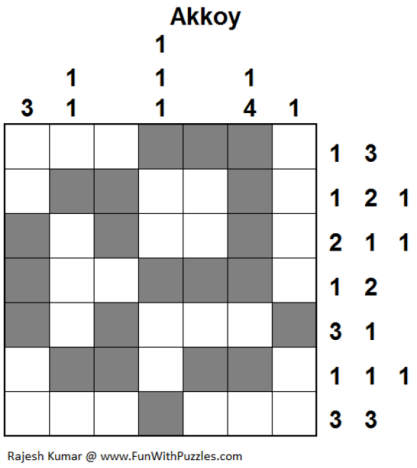

Fig. 2. Solution of the example puzzle.

If there are no numbers in a certain line or column it means that there are no restrictions on the respective line or column.

3 Approach

3.1 Decision Variables

3.2 Constraints

3.3 Search Strategy

4 Solution Presentation

5 Results

6 Conclusions and Future Work

7 References

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8 Annex

$$\psi(u) = \int_o^T \left[\frac{1}{2}\left(\Lambda_o^{-1}u, u\right) + N^*(-u)\right] dt \; . \tag{1}$$