

Principles of Knowledge Representation and Reasoning

B. Nebel, S. Wöfl, F. Lindner
Winter Semester 2015/2016

University of Freiburg
Department of Computer Science

Exercise Sheet 13 Due: February 3th, 2016

Exercise 13.1 (SOLVING TRAVELLING SALESMAN PROBLEM USING ASP, 4)

The *travelling salesman problem (TSP)* is specified as follows: Given a set of cities and the (Euclidean) distances between each pair of them, what is the shortest possible route that visits each city exactly once and returns to the first city in the route? A solution to a TSP instance is constituted by a subset of the given roads such that each city is visited exactly once (except the origin city which is also the end city). One instance of the TSP is depicted in the Figure below.

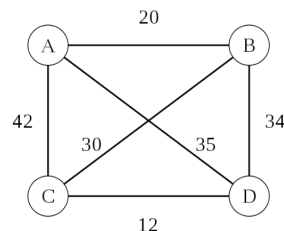
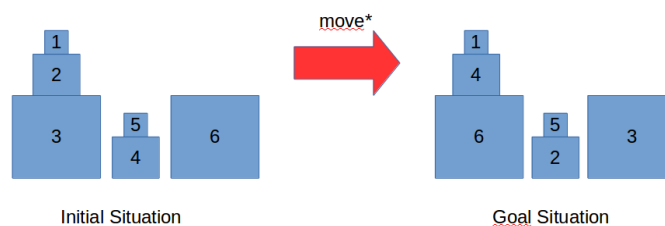


Figure 1: Example of the Travelling salesman problem

Write a program using the ASP paradigm which can solve arbitrary instances of the Traveling Salesman Problem. *Hint:* Check the `#minimize` command in the ASP manual.¹

Exercise 13.2 (PLANNING IN THE BLOCKSWORLD USING ASP, 4)

Blocks world is a famous planning domain in AI. The initial situation is given by a set of blocks. A block can either be located directly on the table or it can be stacked on another block. The planning problem then consists of finding the shortest sequence of actions that turns the initial situation into a specified goal situation. The only type of action allowed is to move one block either on another block or on the table. However, a move action is only possible if there is no other block located on the moved block and no other block is already on the destination block. *Note:* Additionally, we assume that blocks can be of different size and it is not possible to stack blocks on smaller blocks. One instance of the blockworld problem is depicted below.



Your task is to write an ASP program that can solve arbitrary instances of blocks world.

¹<http://sourceforge.net/projects/potassco/files/guide/>

Exercise 13.3 (SOLVING SUDOKU USING ASP, 4)

Sudoku is yet another well-known combinatorial problem. Sudoku is played on $n^2 \times n^2$ grids that consist of blocks of size $n \times n$. The variant $n = 3$ is the most popular one, and one of its problem instances is depicted below.

?	?	6	?	?	?	?	9	?
?	?	?	5	?	1	7	?	?
2	?	?	9	?	?	3	?	?
?	7	?	?	3	?	?	5	?
?	2	?	?	9	?	?	6	?
?	4	?	?	8	?	?	2	?
?	?	1	?	?	3	?	?	4
?	?	5	2	?	7	?	?	?
?	3	?	?	?	?	8	?	?

Initially, some of the grid's cells are filled with numbers ranging from 1 to n^2 . The goal of the player is to fill all the remaining cells with numbers from 1 to n^2 such that each column, each row, and each of the $n \times n$ blocks contain all of the numbers 1 to n^2 .

Write a program using ASP that can solve arbitrary instances of Sudoku.

Submit your source code and documentation(!) to: `lindner@informatik.uni-freiburg.de`.