

Problem Solving and Search in AI Tutorial 1 (on May 6th - SS 2019)

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First download MiniZinc from <https://www.minizinc.org/> and have a look at the handbook including a tutorial <https://www.minizinc.org/doc-latest/en/index.html>. We will discuss the MiniZinc Solver briefly in the tutorial, also the solutions of the exercises will be available as source files later on. You can also use MiniZinc to test whether your encodings actually work :)

Exercise 1.1:

Consider the following *crossword puzzle*, where a given list of words can be used to fill the empty spaces.

1		2		3
#	#		#	
#	4		5	
6	#	7		
8				
	#	#		#

AFT	LASER
ALE	LEE
EEL	LINE
HEEL	SAILS
HIKE	SHEET
HOSES	STEER
KEEL	TIE
KNOT	

- a) Formalize the problem as a CSP and draw the *constraint graph*.
- b) Reduce the domains of the variables by applying the constraint propagation method *arc consistency*.
- c) Use a search algorithm with forward checking and the degree heuristic to obtain all solutions of the CSP.

Exercise 1.2 (old exam question):

Given a graph $G = (V, E)$, a matching is a set of edges $M \subseteq E$, such that every node is the endpoint of exactly one edge. Formulate the graph matching problem as CSP.

Exercise 1.3 (Subsetsum problem):

given a set (or multiset) of integers, is there a non-empty subset whose sum is zero? For example, given the set $\{-7, -3, -2, 5, 8\}$, the answer is yes because the subset $\{-3, -2, 5\}$ sums to zero. Formulate the problem as CSP.

Exercise 1.4 (Rucksack problem):

Given a set of n items numbered $1 \dots n$, each with a weight w_i and a value v_i ,

determine whether or not to include an item in a collection so that the total weight W is less than or equal to a given limit W_{\max} and the total value V is as large as possible. Formulate the problem as COP.