COMP4418, 2019 – Exercises

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1 Answer Set Programming

1.1 Modelling

Let $S = \{s_1, \ldots, s_n\}$ be a set of sets. A *set cover* of S is a set $C \subseteq S$ such that $\bigcup_{s \in S} s = \bigcup_{s \in C} s$. A *$k$-set cover* is a set cover of size k, that is, $|C| = k$.

For instance, for an input $S = \{\{1,2\},\{2,3\},\{4,5\},\{1,2,3\}\}$, there is a 2-set cover $C = \{\{1,2,3\},\{4,5\}\}$ since $\bigcup_{s \in S} s = \{1,2\} \cup \{2,3\} \cup \{4,5\} \cup \{1,2,3\} = \{1,2,3\} \cup \{4,5\} = \bigcup_{s \in C} s$.

Write an ASP program that decides the k-Set-Cover problem:

> Input: a set of sets and a natural number $k \geq 0$.
>
> Problem: decide if there is a k-set cover.

Assume the input parameter $S = \{s_1, \ldots, s_n\}$ is encoded by a binary predicate `s` in the way that $x \in s_i$ iff `s(`i`,`x`)`. The input parameter k is given as constant symbol `k`. Use a unary predicate `c` to represent the output C in the way that $s_i \in C$ iff `c(`i`)`.

1.2 Semantics

Consider the following program P.

$$
\begin{aligned}
&a.\\
&c \leftarrow \text{not } b, \text{not } d.\\
&d \leftarrow a, \text{not } c.
\end{aligned}
$$

Determine the stable models of S.

S	Reduct P^S	Stable model?
$\{a, b, c, d\}$	$a.$	✗
$\{a, b, c\}$		
$\{a, b, d\}$		
$\{a, c, d\}$		
$\{b, c, d\}$		
$\{a, b\}$		
$\{a, c\}$		
$\{a, d\}$		
$\{b, c\}$		
$\{b, d\}$		
$\{c, d\}$		
$\{a\}$		
$\{b\}$		
$\{c\}$		
$\{d\}$		
$\{\}$		