

# Artificial Intelligence

## Assignment 7

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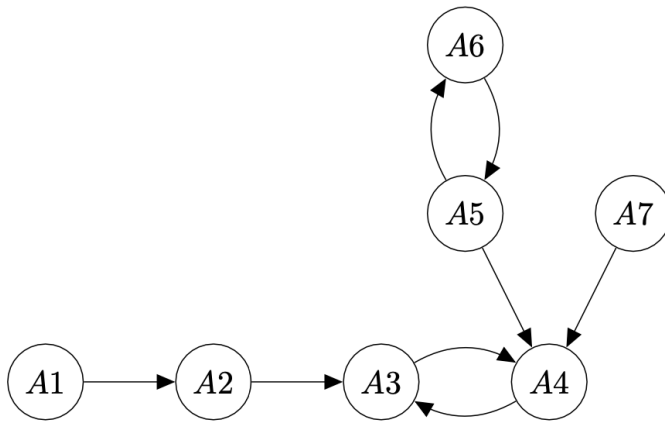
Tutorial on: 28.06.2023

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## 1 Argumentation

(8 Points)

Assume the following abstract argumentation framework  $AF_1$ :



For each of the following sets, decide whether they are (1) conflict-free and (2) admissible, and whether they are (3) preferred, and/or (4) grounded extensions of  $AF_1$ . If they are not, give a short reason why not.

### Solution

a)  $E = \{A_1, A_3, A_7\}$

Conflict free.

Admissible.

Not preferred extensions.  $\{A_1, A_3, A_5, A_7\}$  is preferred.

Not grounded.

b)  $E = \{A_1, A_4, A_5, A_7\}$

Not conflict free.

Not admissible.

Not preferred.

Not grounded.

This is because  $A_5$  attacks  $A_4$ .

c)  $E = \{A_1, A_3, A_6\}$

Conflict free.

Admissible.

Not preferred.

Grounded extensions

d)  $E = \{A_1, A_3, A_5, A_7\}$

Conflict free.

Admissible.

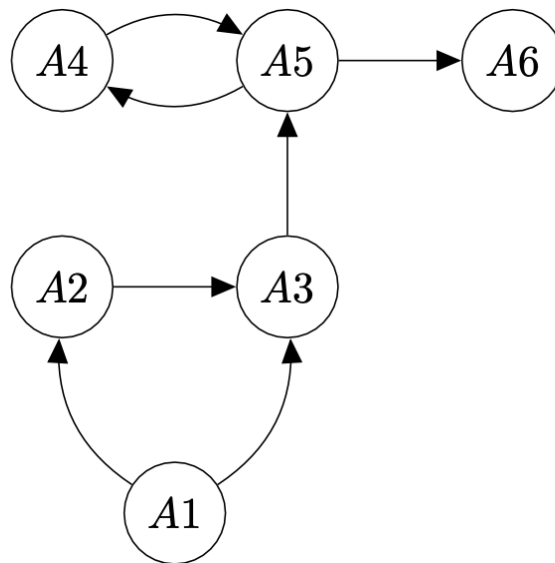
Preferred.

Grounded extensions.

## 2 Argumentation

(5 Points)

Assume the following abstract argumentation framework  $AF_2$ :



Find all complete and all stable extensions of  $AF_2$ .

### Solution

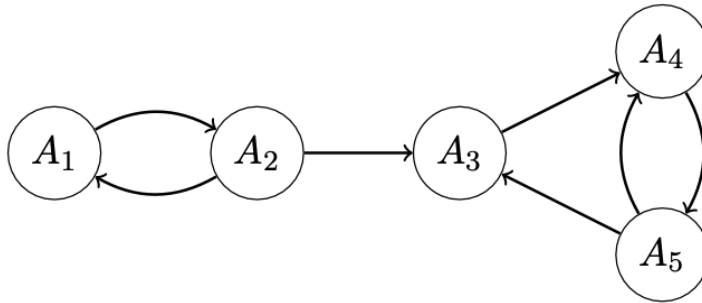
Complete extensions:  $\{\Phi\}, \{A_1\}, \{A_4\}, \{A_1, A_4\}, \{A_1, A_5\}, \{A_4, A_6\}, \{A_1, A_4, A_6\}$

Stable extensions:  $\{A_1, A_5\}, \{A_1, A_4, A_6\}$

### 3 Encoding Argumentation Semantics using Potassco

(35 points)

In this assignment, we compute extensions of an argumentation framework in Potassco, using the example from the lecture:



Your tasks are:

1. Write a Potassco program encoding the complete semantics of the argumentation framework.
2. Write a Potassco program encoding the stable semantics of the argumentation framework.

Use the following steps to create your programs:

- Encode the graph above using two predicates: `argument/1` to indicate that something is an argument and `attacks/2` to indicate that one argument attacks another one.
- In order to generate one model per possible subset  $S \subseteq \text{Arg}$ , we encode such a set with a predicate `s/1`. The following clauses can be used to make sure that all possible sets are generated:

```
s(A) :- not -s(A), argument(A).  
-s(A) :- not s(A), argument(A).
```

- Use a predicate `defeated/1` to denote that a predicate is defeated by  $S$ , i.e. that it is attacked by an argument in  $S$ .
- Use a predicate `undefended/1` to denote that a predicate is not defended by  $S$ . An argument  $A' \in \text{Arg}$  is undefended by  $S$  if it is attacked by an argument  $A \in \text{Arg}$  that is undefeated.
- All extensions must be conflict-free and admissible, i.e. you need constraints stating that no two arguments in  $S$  attack each other and that no argument in  $S$  is undefended by  $S$ .
- Finally, you need constraints that restrict  $S$  to complete or stable extensions, respectively. An extension is complete if it contains all arguments that are not undefended. An extension is stable if all arguments that are not in  $S$  are defeated.
- Submit both your programs (in individual files) and the output of each program. To limit the output of the ASP solver, use `#show s/1.` to only show the arguments that are contained in  $S$ .
- As always, make sure to submit a source code files that Potassco can actually interpret. If your programs produce errors, you may not receive any points for the whole exercise. If you ask Potassco to enumerate all models, you can check your programs' output against the lecture slides 107 and 111.

