A Principle-Based Analysis of Weakly Admissible Semantics

Computational Models of Argument,
Perugia, 2020

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Motivations

- Increasing number of abstract argumentation semantics.
- Principles-based approach for a high level analysis of the semantics.

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- Principles-based approach for a high level analysis of the semantics.
- Three classes: admissibility-based, naive-based and the new weakly admissible-based.
- Introduce new semantics in the weakly admissible class.

Preliminaries

Abstract Argumentation Framework

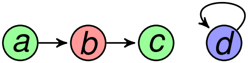
A pair $(A, \rightarrow)$:

- A: a set of *abstract* arguments;
- $\rightarrow \subseteq A \times A$: a relation of *attack* between arguments.

Labeling semantics

An argument is in if it is accepted (in the extension), out if it is fully rejected (attacked by the extension) and undec otherwise.

Example:



Labeling color code: in out undec

Classes of semantics

All based on being conflict-free. Additionally:

Admissibility-based

An admissible set is a set of arguments that also defends itself.
A *preferred* extension is a $\subseteq$-maximal admissible set.

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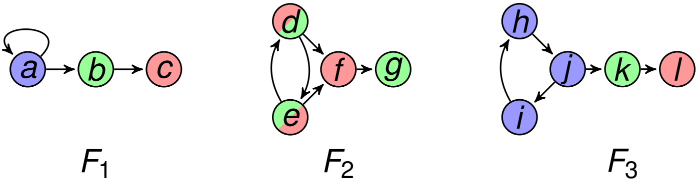
Weak Admissibility (Baumann, Brewka and Ulbricht, AAAI 2020)

A weakly admissible set is a set of arguments that also is not attacked by any weakly admissible arguments in its reduct.

Example behavior



Semantics	F_1	F_2	F_3
Preferred	$\{\emptyset\}$	$\{\{d,g\},\{e,g\}\}$	$\{\emptyset\}$
CF2	$\{\{b\}\}$	$\{\{d,g\},\{e,g\}\}$	$\{\{h,k\},\{i,k\},\{j,l\}\}$
Weakly preferred	$\{\{b\}\}$	$\{\{d,g\},\{e,g\}\}$	$\{\{k\}\}$

Semi-qualified admissibility

Semi-qualified admissibility

We say that a semantics σ satisfies *semi-qualified admissibility* iff for every argumentation framework $F = (A, \rightarrow)$ and every extension $E \in \sigma(F)$ we have that $\forall a \in E$, if $b \rightarrow a$ and $b \in \bigcup \sigma(F)$ then $\exists c \in E$ s.t. $c \rightarrow b$.

Defense is necessary only against acceptable arguments!

Semi-qualified admissibility of weakly complete

Proposition

co^w, gr^w and pr^w don't satisfy semi-qualified admissibility.

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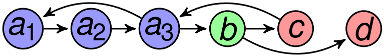
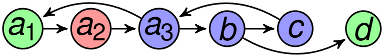
Counter-example:



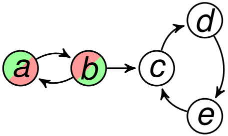


SCC-recursion

SCC

$E \subseteq A$ is a *Strongly Connected Component* (SCC) iff it is a $\subseteq$-maximal subset of A such that every argument $a \in E$ has a $\to$-path to every other argument $b \in E$.

An SCC-recursive semantics decomposes an AF into SCCs and recursively applies a local function to each of them.
For example, CF2 semantics applies the naive local function recursively (here, b is the input for the 3-cycle):



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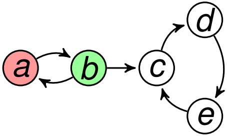

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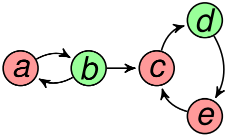

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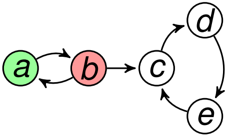

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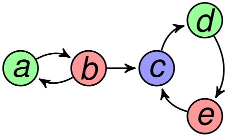

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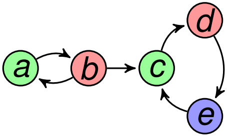

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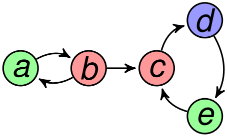
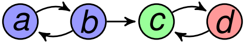


Qualified semantics

Qualified complete:

- Recursively apply complete semantics locally;
- treat undec input as out.

Example:



Semi-qualified semantics

Semi-qualified complete:

- recursively apply complete semantics locally;
- treat undec input as out only if it is <u>never</u> in.

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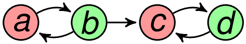

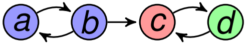

Principles table

	co	pr	CF2	st2	co^w	gr^w	pr^w	q-**co**	q-**gr**	q-**pr**	sq-**co**	sq-**pr**
Admissibility	✓	✓	×	×	×	×	×	×	×	×	×	×
Naivety	×	×	✓	✓	×	×	×	×	×	×	×	×
Reinst.	✓	✓	×	×	✓	✓	✓	✓	✓	✓	✓	✓
I-Max.	×	✓	✓	✓	×	✓	✓	×	✓	✓	×	✓
Allow. abs.	✓	×	×	×	×	×	×	×	✓	×	✓	×
Directionality	✓	✓	✓	✓	×	×	?	✓	✓	✓	✓	✓
Semi-qual. adm.	✓	✓	×	×	×	×	×	×	✓	×	✓	✓
Reduct adm.	✓	✓	×	×	✓	✓	✓	×	?	?	?	?
SCC Decomp.	✓	✓	✓	✓	×	×	?	✓	✓	✓	×	×
W-SCC Decomp.	✓	✓	✓	✓	?	?	?	✓	✓	✓	✓	✓

Conclusions and future work

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- Introduced two new principles.
- Introduced new semantics inspired by those principles.
- Analyse existing semantics w.r.t. these principles.
- Analyse weak admissibility-based semantics w.r.t. new principles and existing ones.

Future work:

- Fill in question marks in the table.
- Develop labeling-based semantics for weak admissibility-based semantics and the new semantics we introduced.
- Closer comparison to recent work from Baumann, Brewka and Ulbricht[1].

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Thank you!

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