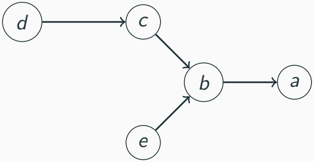
Extension-based approach [Dung, 1995]

Let an argumentation system $\langle \mathcal{A}, \mathcal{R} \rangle$, where: $\mathcal{A}$ is a set of arguments and $\mathcal{R} \subset \mathcal{A} \times \mathcal{A}$: an attack relation among arguments.

Definitions

Let $\mathcal{B} \subset \mathcal{A}$

- $\mathcal{B}$ is conflict-free iff $\nexists a, b \in \mathcal{B}$ such that $(a, b) \in \mathcal{R}$;
- $\mathcal{B}$ defends an argument a iff $\forall b \in \mathcal{A}$, if $(b, a) \in \mathcal{R}$, then $\exists c \in \mathcal{B}$ such that $(c, b) \in \mathcal{R}$



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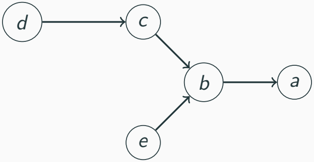


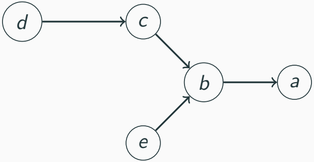
$\{a, e\}$ is conflict-free.

Extension-based approach [Dung, 1995]

Admissible extensions

Let $\mathcal{B} \subset \mathcal{A}$, $\mathcal{B}$ is an admissible extension iff:

- $\mathcal{B}$ is conflict-free;
- $\mathcal{B}$ defends all its elements.
- It is a minimal notion of a reasonable position (internally consistent and defends itslef, and it is coherent, defendable position).



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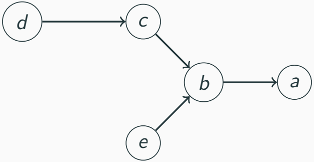


$\{\}$,$\{d\}$,$\{e, a\}$, $\{d, e\}$,$\{d, e, a\}$

Extension-based approach [Dung, 1995]

Stable extensions

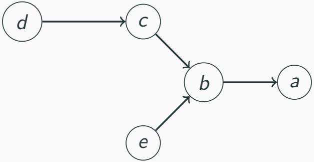
Let $\mathcal{B} \subset \mathcal{A}$, $\mathcal{B}$ is a stable extension iff:

- $\mathcal{B}$ is conflict-free;
- $\mathcal{B}$ attacks any argument in $\mathcal{A} \setminus \mathcal{B}$

Notes

- intuition: un argument is not accepted because it is attacked by at least one accepted argument;
- it does not exist necessarily a stable extension, however we might have several stable extensions;

Extension-based approach [Dung, 1995]



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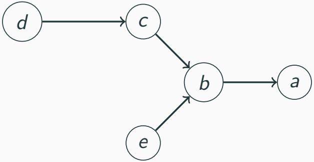
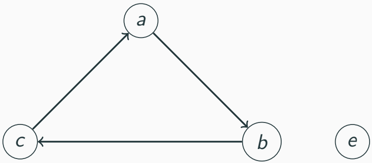


Stable: $\{d, e, a\}$

Extension-based approach [Dung, 1995]



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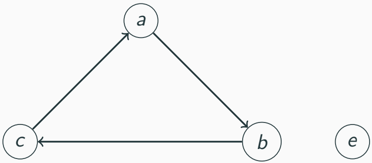
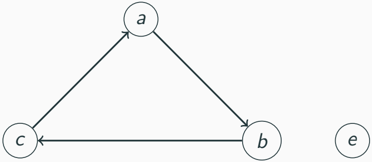


- No stable extension → no accepted argument

Extension-based approach [Dung, 1995]



- No stable extension $\rightarrow$ no accepted argument
- But we would like to accept the argument e since it is not attacked !

Extension-based approach[Dung, 1995]

Preferred extensions

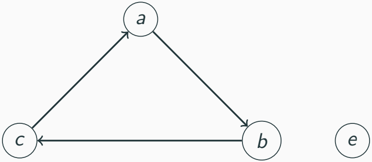
Let $\mathcal{B} \subset \mathcal{A}$, $\mathcal{B}$ is a preferred extension iff:

- $\mathcal{B}$ is an admissible extension;
- $\mathcal{B}$ is maximal for set inclusion among admissible extensions.

Notes

- intuition: it represents maximal coherent positions, able to defend themselves against all attackers.
- it necessarily exists a preferred extension (we can have several ones also)
- every stable extension is a preferred extension (the inverse is not true).

Extension-based approach [Dung, 1995]



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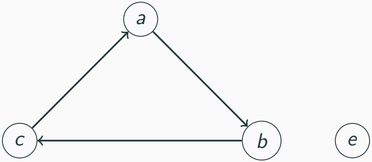
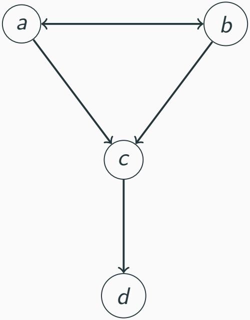
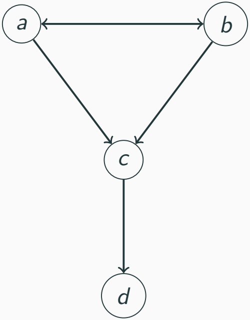


- One preferred extension $\rightarrow \{\text{e}\}$
- e is accepted

Extension-based approach [Dung, 1995]



Extension-based approach [Dung, 1995]



Preferred extensions $\rightsquigarrow \{a, d\}, \{b, d\}$

Acceptability semantics [Dung, 1995]

Complete extensions

Let $\mathcal{B} \subset \mathcal{A}$, $\mathcal{B}$ is a complete extension iff:

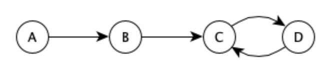
- $\mathcal{B}$ is an admissible extension;
- each argument which is defended by $\mathcal{B}$ is in $\mathcal{B}$.

Grounded extension

The least (wrt set inclusion) complete extension is the grounded extension.

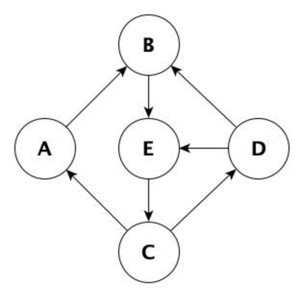
- The least questionable set
- Accept only the argument that one cannot avoid to accept
- Reject only argument that one cannot avoid to reject
- Abstain as much as possible (one should have insufficient grounds to accept the argument and insufficient grounds to reject the argument (meaning that it does not have an attacker that is accepted).)

Acceptability semantics [Dung, 1995]



- Complete extensions: $\{A\}, \{A, C\}, \{A, D\}$
- Grounded extensions: $\{A\}$

Exercice I



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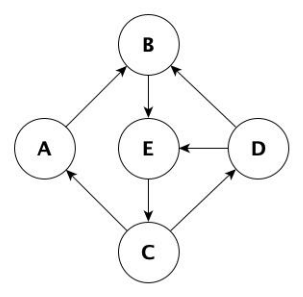
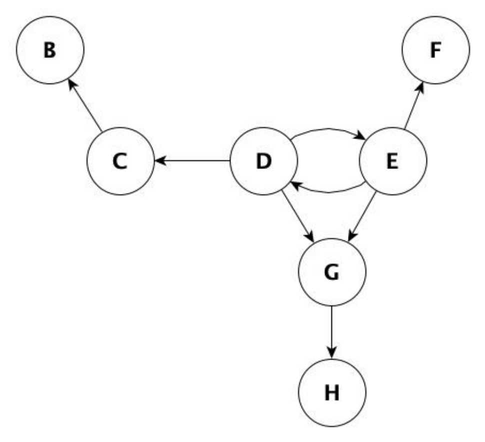


- Conflict free: $\emptyset, \{A, D\}, \{A, E\}, \{B, C\}$ (no attacker relations)
- Admissible: $\emptyset, \{B, C\}$ (conflict free and mutually defensive)
- Preferred extensions : $\{B, C\}$
- Grounded extension: $\emptyset$ (every argument is attacked by at least one other argument, so it is not possible to determine any argument that are *in* (and consequently other arguments that are out)

Exercice II (At home)



Abstract argumentation system

$\rightsquigarrow$What is the status of an argument a in $\mathcal{A}$?

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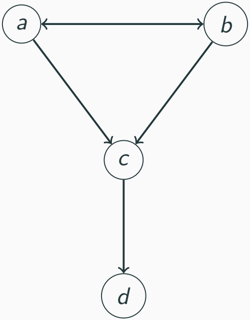
Let $\mathcal{E}_1, \ldots, \mathcal{E}_k$: the extensions (under a given semantics) of $\langle \mathcal{A}, \mathcal{R} \rangle$

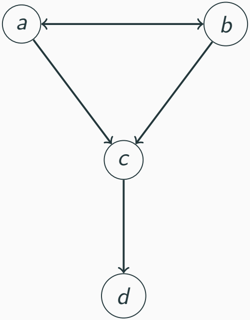
- a is justified iff $\forall \mathcal{E}_{i=1,\ldots,k}, a \in \mathcal{E}_i$
- a is defensible iff $\exists \mathcal{E}_i$ such that $a \in \mathcal{E}_i$
- a is rejected (overruled) $\nexists \mathcal{E}_i$ such that $a \in \mathcal{E}_i$

Abstract argumentation system



Preferred extensions $\rightsquigarrow \{a, d\}, \{b, d\}$. We can say:

Abstract argumentation system



Preferred extensions $\leadsto \{a, d\}, \{b, d\}$. We can say:

- d is justified
- c is overruled (rejected)
- a and b are defensible (undecided)