An Overview of Labelling-Based Justification Status

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Preliminaries

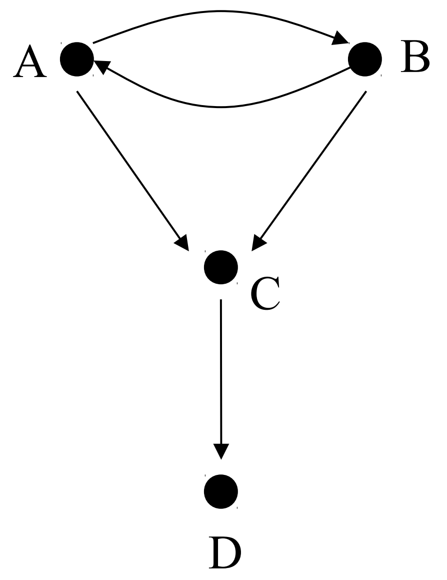
- *Argumentation framework*: graph (Ar, att) in which
  - the nodes (Ar) represent a given set of *arguments,*
  - the arrows (att) represent the *attack* relation.
- A *labelling* is a function *L*ab: Ar → {in, out, undec}.
- A *complete labelling* is a labelling s.t. For each argument A,
  - A is labelled in iff all its attackers are labelling out.
  - A is labelled out iff it has an attacker that is labelled in.

eg. in a gun fight

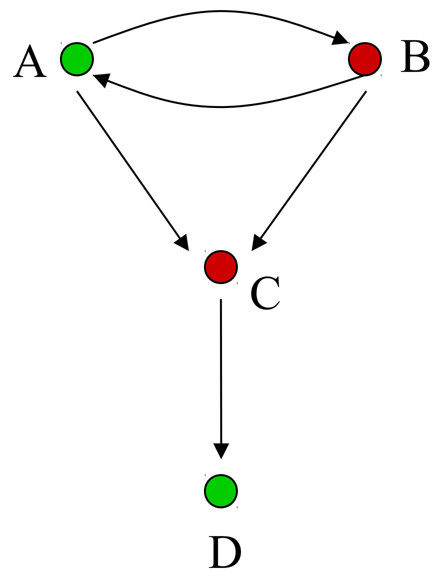
You survive iff al your attackers are killed.

You get killed iff at least one attacker remains alive.

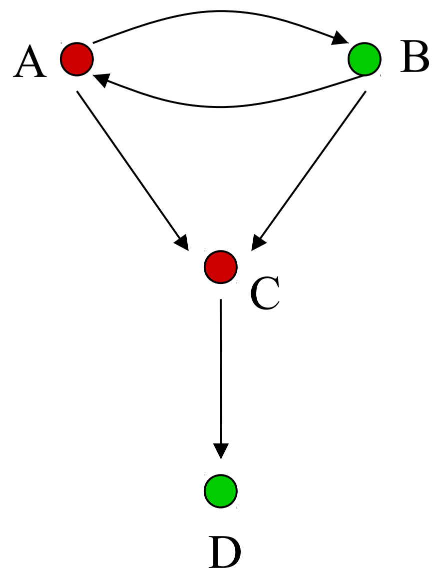
An Example



An Example



An Example



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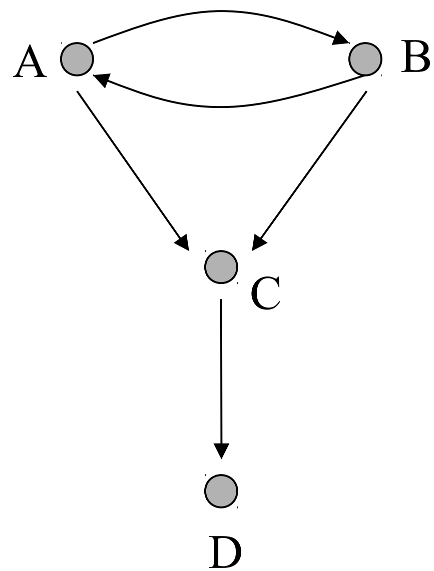
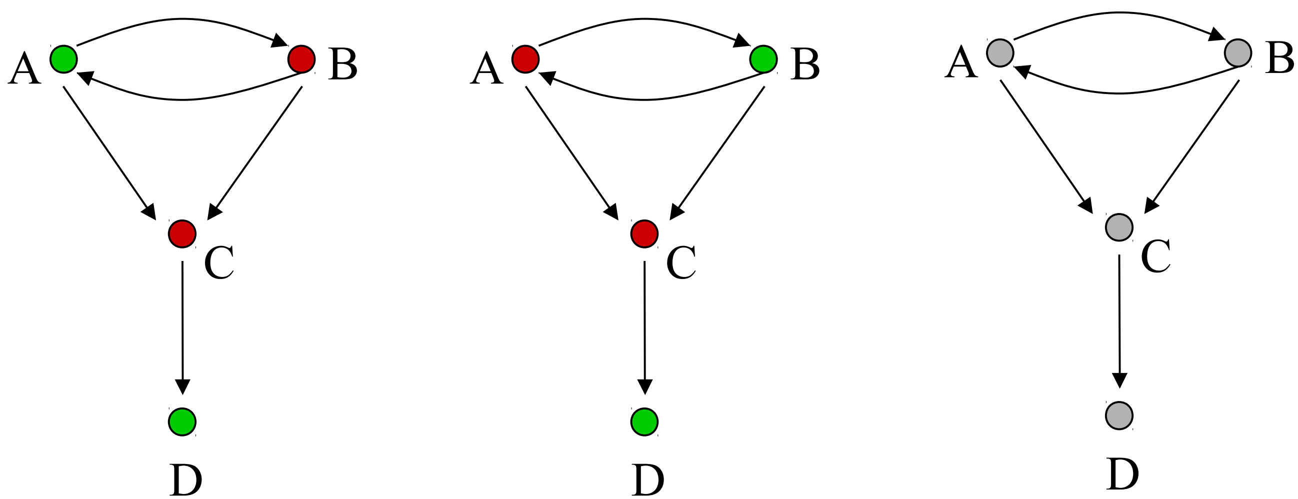


Justification Status

Justification status: the set of labels that can be assigned to an argument by the complete labellings.



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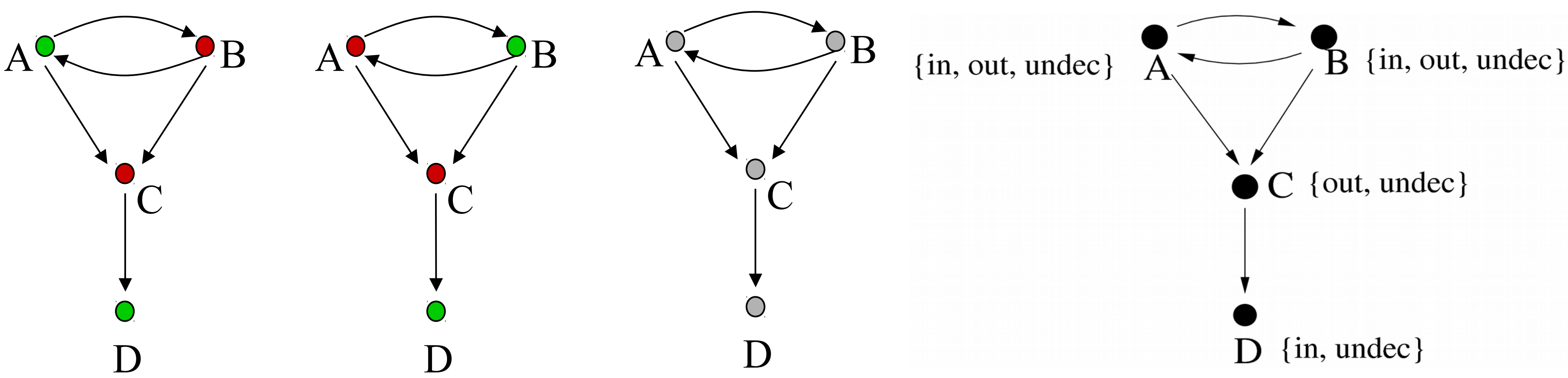


Justification status

$\mathcal{JS}(A) =$

$\{\texttt{in}\}$ iff A is in every complete extension.

$\{\texttt{out}\}$ iff A is attacked by every complete extension.

$\{\texttt{undec}\}$ iff A is not in any complete extension and
A is not attacked by any complete extension.

$\{\texttt{in}, \texttt{undec}\}$ iff A is not in a complete extension and
A is in a complete extension and
no complete extension attacks A.

$\{\texttt{out}, \texttt{undec}\}$ iff A is not in any complete extension and
A is attacked by a complete extension and
there is a complete extension does not attack A.

$\{\texttt{in}, \texttt{out}, \texttt{undec}\}$ iff A is in a complete extension and
A is attacked by a complete extension.

$\{\texttt{in}, \texttt{out}\}$: impossible

$\emptyset$: impossible

Justification status

$\mathcal{JS}(A) =$

$\{\mathtt{in}\}$ iff A is in the grounded extension.

$\{\mathtt{out}\}$ iff A is attacked by the grounded extension.

$\{\mathtt{undec}\}$ iff A is not in any admissible extension and
A is not attacked by any admissible extension.

$\{\mathtt{in}, \mathtt{undec}\}$ iff A is not in the grounded extension and
A is in an admissible extension and
A is not attacked by any admissible extension.

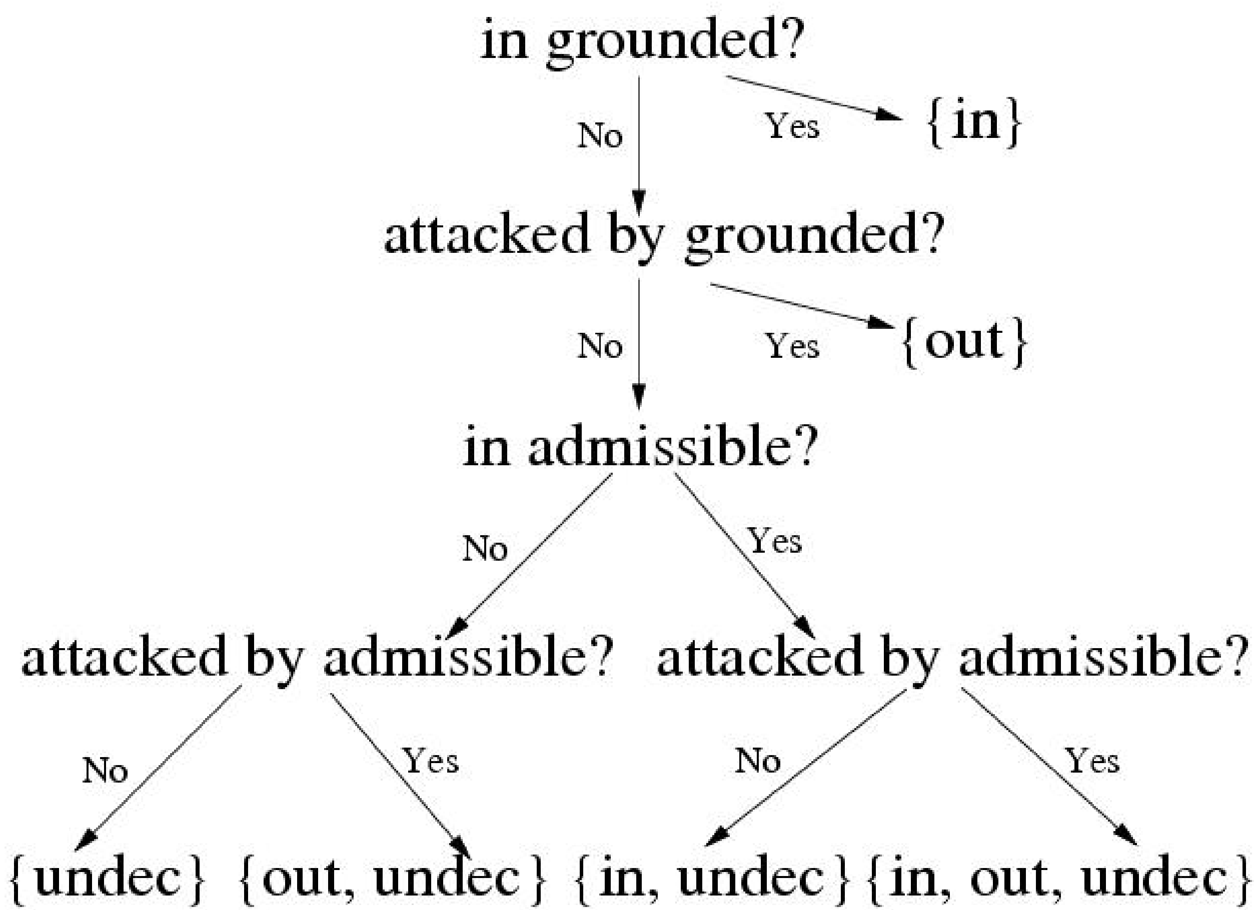
$\{\mathtt{out}, \mathtt{undec}\}$ iff A is not in any admissible extension and
A is attacked by an admissible extension and
A is not attacked by the grounded extension.

$\{\mathtt{in}, \mathtt{out}, \mathtt{undec}\}$ iff A is in an admissible extension and
A is attacked by an admissible extension.

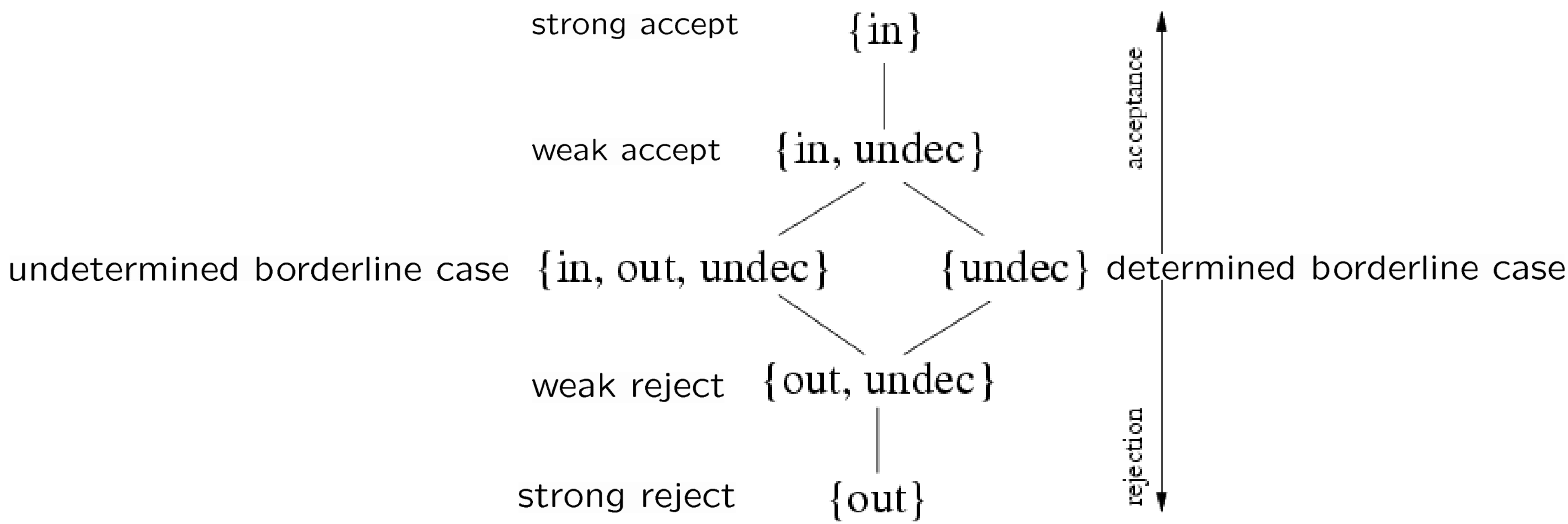
$\{\mathtt{in}, \mathtt{out}\}$: impossible

$\emptyset$: impossible

Justification status



Degrees of Justification status



Justification status

Proposition

- A is in the grounded extension iff it is strongly accepted.
- if A is in every preferred extension then A is strongly or weakly accepted.
- A is in at least one preferred extension iff A is strongly accepted , weakly accepted, or undetermined borderline.
- if A is strongly accepted then A is in every semi-stable extension. if A is weakly accepted then A is in at least one semi-stable extension.
- A is in an ideal set iff A is member of an admissible set consisting only of strongly or weakly accepted arguments.

Justification Status of Conclusions

- each argument A has a conclusion Conc(A) $\in \mathcal{L}$
- a conclusion labelling is a function
  ConcLab: $\mathcal{L} \rightarrow$ {in, out, undec}
- Given an argument labelling ArgLab, we define
  the associated conclusion labelling ConcLab s.t.
  ConcLab(c) is the label of the “best” argument for c
  (or out, if no argument for c exists)

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- each argument A has a conclusion Conc(A) $\in \mathcal{L}$
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  ConcLab: $\mathcal{L} \rightarrow$ {in, out, undec}
- Given a complete argument labelling ArgLab, we define the associated complete conclusion labelling ConcLab s.t.
  ConcLab(c) = max({ArgLab(A) | Conc(A)=c} $\cup$ {out})
- JS(c) = {ConcLab(c) | ConcLab is a complete conclusion labelling}

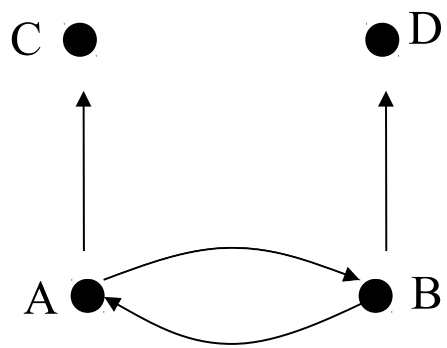
Example:Dealing with Floating Conclusions

- Brygt Rykkje is Dutch because he was born in Holland
- Brygt Rykkje is Norwegian because he has a Norwegian name
- Brygt Rykkje likes ice skating
  because he is Norwegian
- Brygt Rykkje likes ice skating
  because he is Dutch

Example:Dealing with Floating Conclusions

- John says the suspect killed the victim by stabbing him
- Bob says the suspect killed the victim by shooting him
- The suspect killed the victim,
  because Bob says the suspect killed the victim by shooting him
- The suspect killed the victim,
  because John says the suspect killed the victim by stabbing him

Example:Dealing with Floating Conclusions



Conc(A) = a
Conc(B) = b
Conc(C) = e
Conc(D) = e

$ArgLab_1$ = ({A, D}, {B,C}, ∅)
$ConcLab_1$ = ({a, e}, {b}, ∅)

$ArgLab_2$ = ({B,C}, {A,D}, ∅)
$ConcLab_2$ = ({b, e}, {a}, ∅)

$ArgLab_3$ = (∅, ∅, {A,B,C,D})
$ConcLab_3$ = (∅, ∅, {a,b,e})

JS(e) = {in, undec} *(weak accept)*

Labelling-Based JS:

- provides *levels* of justification based on *standard* AFs (so no probabilities or other numerical add-ons)
- provides a more *refined* status
  than the usual extension based approached
  (e.g. grounded or credulous preferred)
- can easily be *computed* (based on existing proof procedures for grounded and preferred)
- can be applied to *arguments* as well as to *conclusions* (floating conclusions become weakly accepted)

Literature

- Yining Wu and Martin Caminada
  A Labelling-Based Justification Status of Arguments
  Studies in Logic 3(4):12-29 (2010)

- Wolfgang Dvořák
  On the Complexity of Computing
  the Justification Status of an Argument
  TAFA post proceedings, pages 32-49 (2012)