Dragan's live session 2

Dragan Doder

Methods in AI Research

Before we start...

- Next week: Wrap up session on Thursday
  - A mock exam ($\approx$ twice shorter than the final exam) – available on Monday on BB
  - A quiz on BB

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  - Exercises from the slides
  - Your questions regarding Lecture 14
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  - Your question regarding exercises - no tome for all, please contact me for One to One questions (or later via Teams)

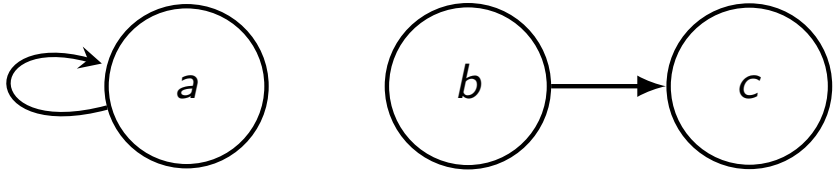
Quiz Questions

Before we start...

- S is a complete extension if it is an admissible set and every argument defended by S belongs to S
- S is a preferred extension if it a is maximal (for $\subseteq$) complete extension
- S is a stable extension if it is a complete set and attacks all the arguments that do not belong to S
- S is a grounded extension if it is the minimal (for $\subseteq$) complete extension (can be calculated as follows: (1) non-attacked are accepted, those attacked by accepted are rejected (2) ignore arguments that are already accepted/rejected and repeat the process)

Question 1

Consider the graph depicted above (note that *a* is a self-attacking argument). Find all grounded, preferred and stable extensions.



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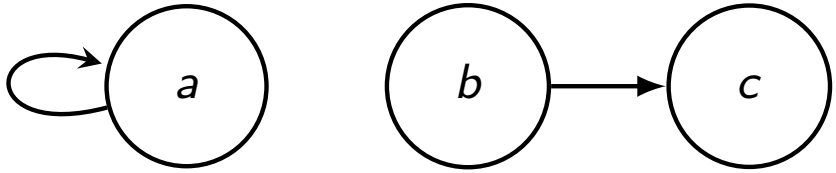

Grounded & preferred: $\{b\}$; Stable: none

Typical mistakes:

1. Grounded is $\emptyset$ – False!
   - Non-attacked arguments are in every extension
   - Check the procedure from the slides

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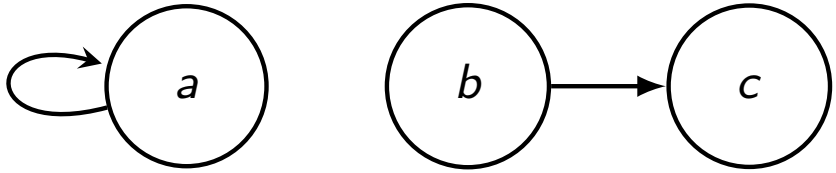

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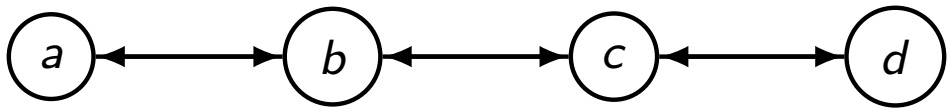
Typical mistakes:

1. Grounded is $\emptyset$ – False!
   - Non-attacked arguments are in every extension
   - Check the procedure from the slides
2. Stable is $\emptyset$ – False?
   - $\emptyset$ is a set of arguments (with 0 elements), which does not satisfy the definition of stable semantics
   - $\emptyset \neq \{\emptyset\}$

Question 2

Consider the graph depicted above. Which of the following sentences is true?

1. there are 4 complete extensions, and 2 of them are preferred
2. there are 6 complete extensions, and 3 of them are preferred
3. there are 5 complete extensions, and they are all preferred
4. there are 3 complete extensions, and they are all preferred



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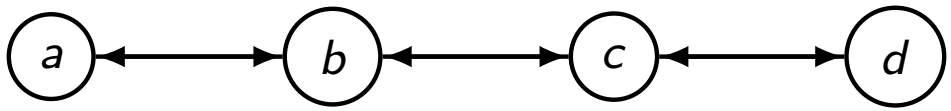

- Complete = conflict free + defends its elements + contains everything it defends
- Preferred = maximal complete (wrt $\subseteq$, which means no proper superset is also complete)
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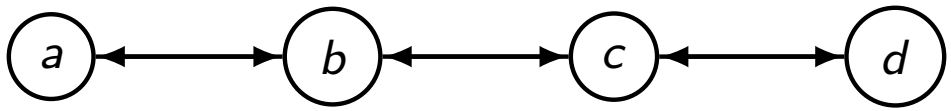

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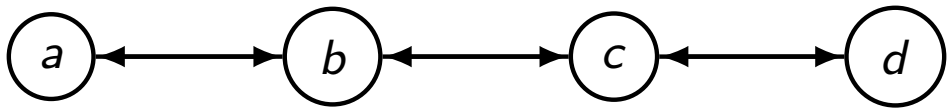

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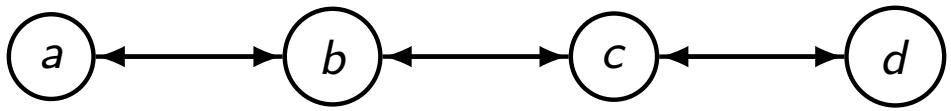

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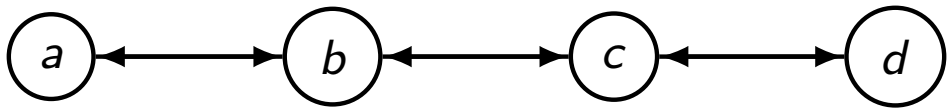

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Consider the graph depicted above. Under Preferred semantics, which of the following sentences is true:

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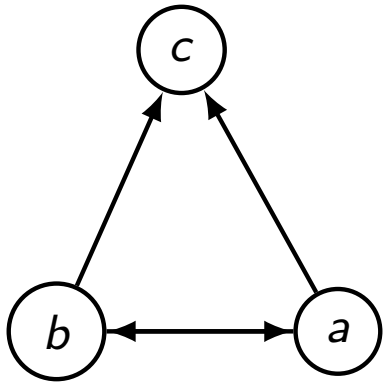

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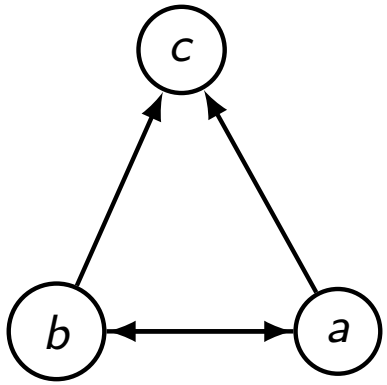

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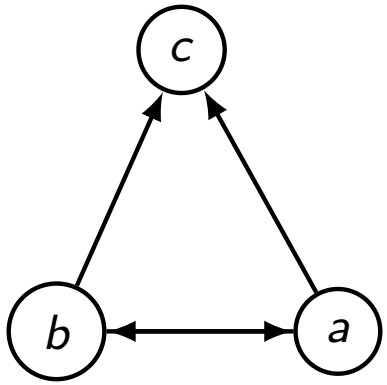

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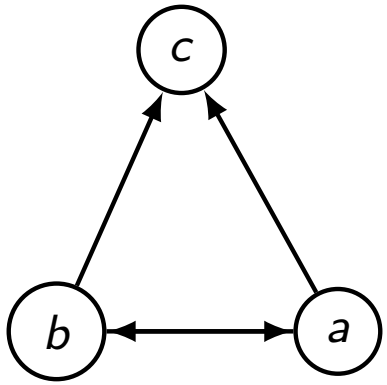

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- Thus, both a and b are credulously justified

Question 4

Given the knowledge base $\mathcal{K} = \{p, q, r\}$ and the rule base $\mathcal{R} = \{r_1 : p \Rightarrow a;\ r_2 : q \Rightarrow b;\ r_3 : r \Rightarrow c;\ r_4 : \neg b \Rightarrow \neg c;\ r_5 : c \Rightarrow \neg a\}$, it is **not** possible to construct an argument whose conclusion is:

1. a
2. $\neg a$
3. c
4. $\neg c$

Each possible conclusion must be inferred by a rule (if it is not in $\mathcal{K}$).
In order to infer $\neg c$, we would need to apply r_4. But we cannot infer $\neg b$.

Question 5

Given the knowledge base $\mathcal{K} = \{p, q, t\}$ and the rule base $\mathcal{R} = \{r_1 : p \Rightarrow s;\ r_2 : q \Rightarrow \neg s;\ r_3 : q, t \Rightarrow \neg n(r_1)\}$, we can construct the arguments:

$A_1 : p$

$A_2 : A_1 \Rightarrow s$

$B_1 : q$

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$C : t$

$D : B_1, C \Rightarrow \neg n(r_1)$

Find all the attacks between those arguments. For each attack determine its type (rebut/undercut/undermine).

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- B_2 and A_2 attack each other– rebut
- D attacks A_2 – undercut

Question 6

Consider a FO language that contains the constant symbol UU (that stands for Utrecht University), the unary relation symbol Tea and binary relation symbols $StudiesAt$ ($At(x, y)$ means that x studies at y) and $Drinks$ ($Drinks(x, y)$ stands for x drinks y). Select the correct translation or the sentence
There is a student of Utrecht University which does not drink any tea.
to FOL.

$$\exists x(StudiesAt(x, UU) \wedge \neg\exists y(Tea(y) \wedge Drinks(x, y)))$$

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- $\forall x\ At(x, UU) \rightarrow Smart(x)$
  "Everyone at UU is smart"
- $\exists x\ At(x, UU) \wedge Tall(x)$
  "Someone at UU is Tall"

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Is it following DL statement valid?

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Answer: Not true!

- $\exists r.C$ – individuals that are in relation r with some element in C
- $\forall r.C$ – individuals that are in relation r only with elements in C

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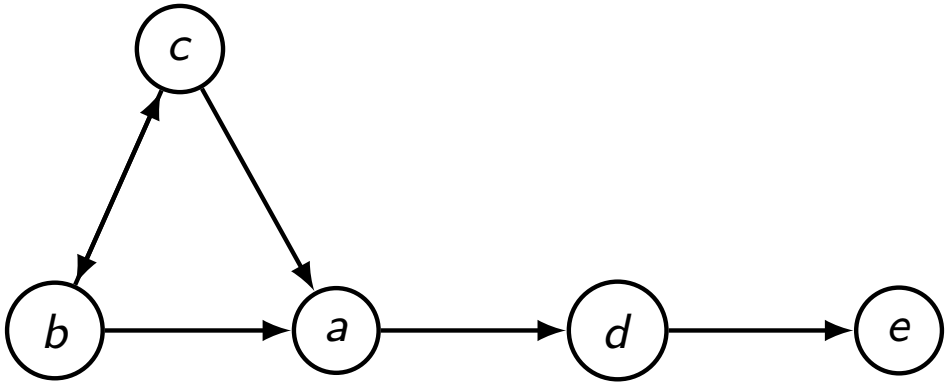
Answer: It is not!

If I do not have any brother, then

- I belong to the class given by $\forall brother.Criminal$
- but I do not belong to the class given by $\exists brother.Criminal$

Exercises from the slides

Exercise 1



1. Calculate stable, preferred, complete and grounded extensions
2. For each semantics, determine which arguments are sceptically justified, and which are credulously justified.

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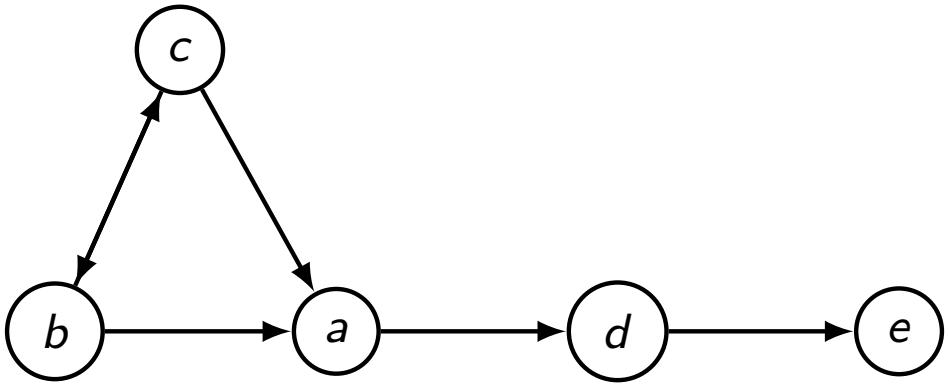

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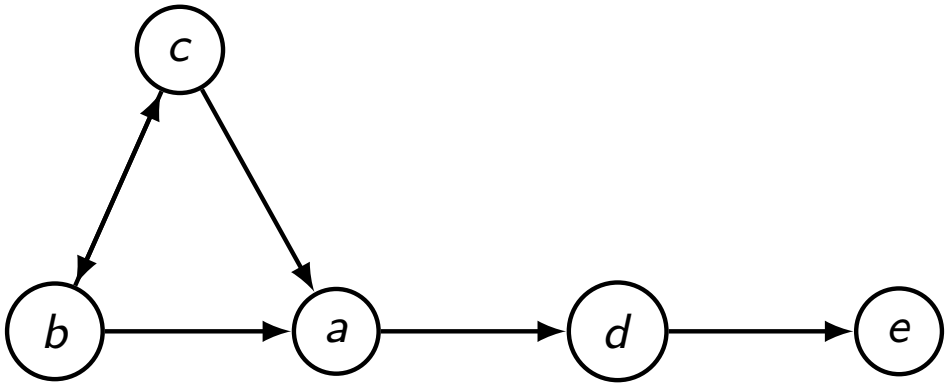

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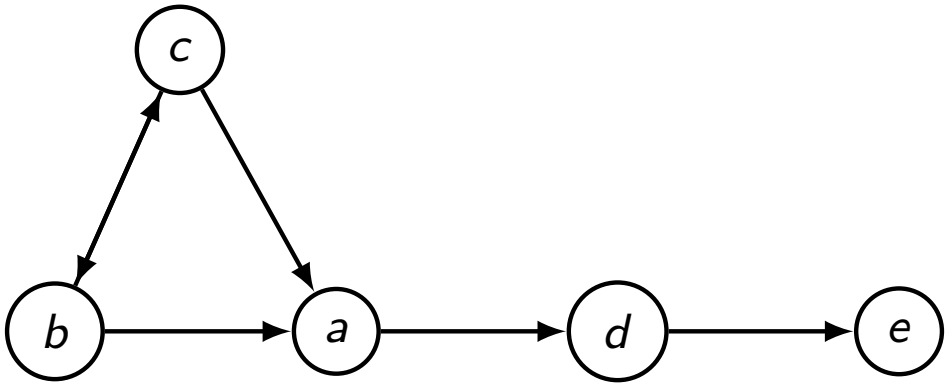

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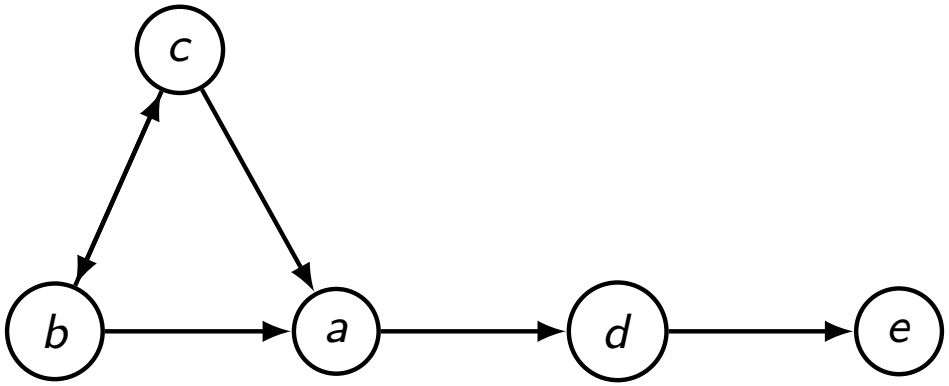

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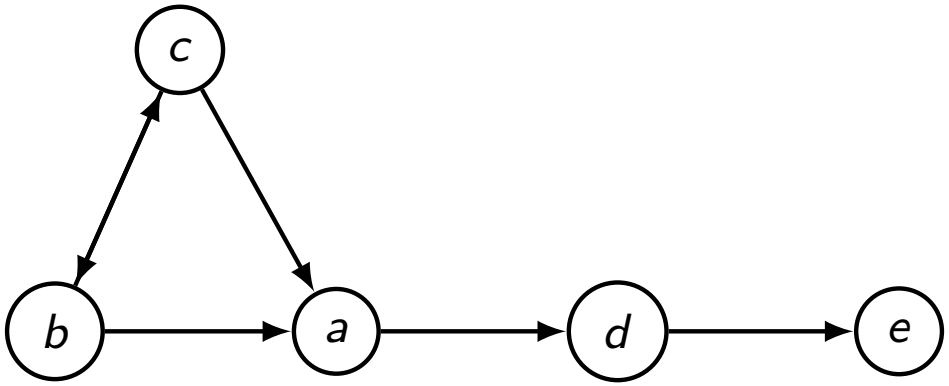

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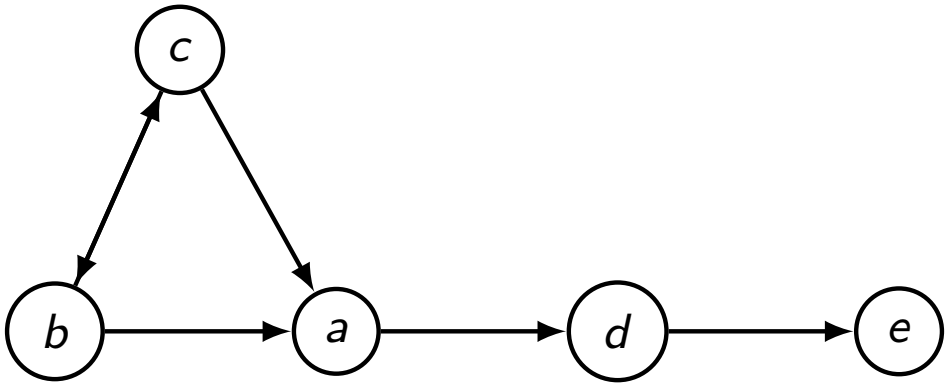

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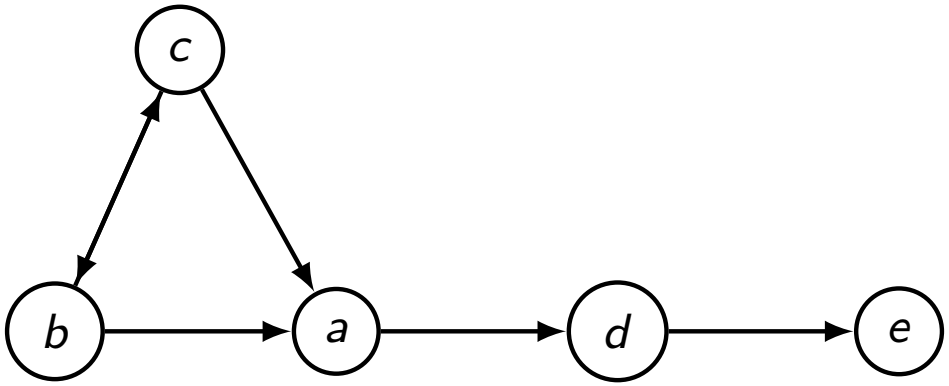

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   Correction: all sceptically accepted are already credulously accepted.

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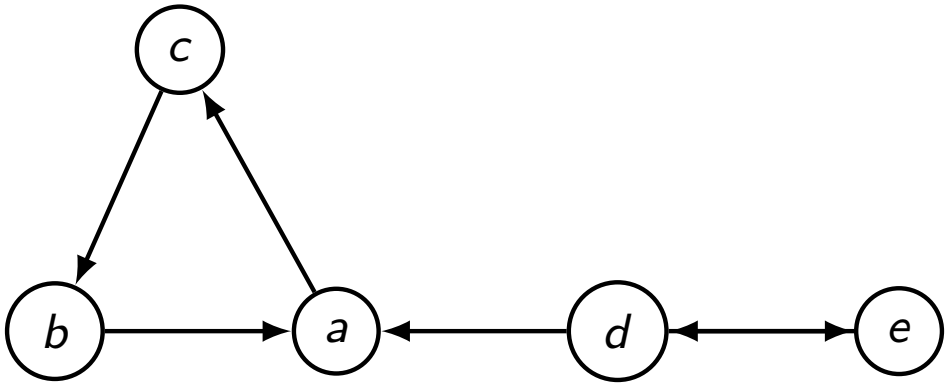

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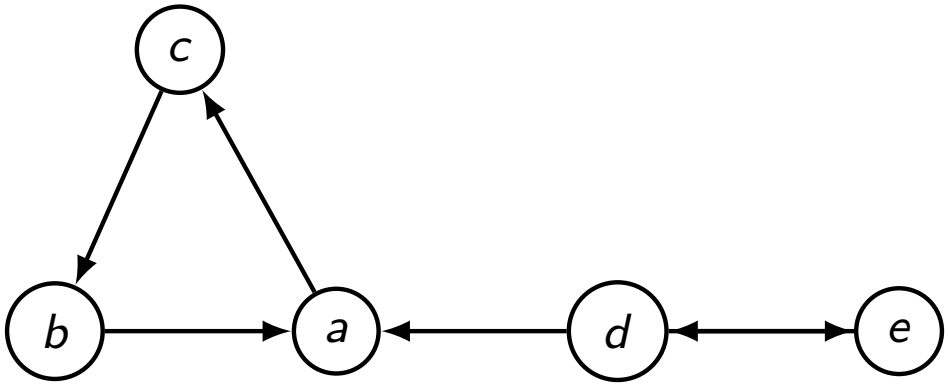

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Structured argumentation Exercise 1

$\mathcal{K} = \{Bird, Penguin\}$

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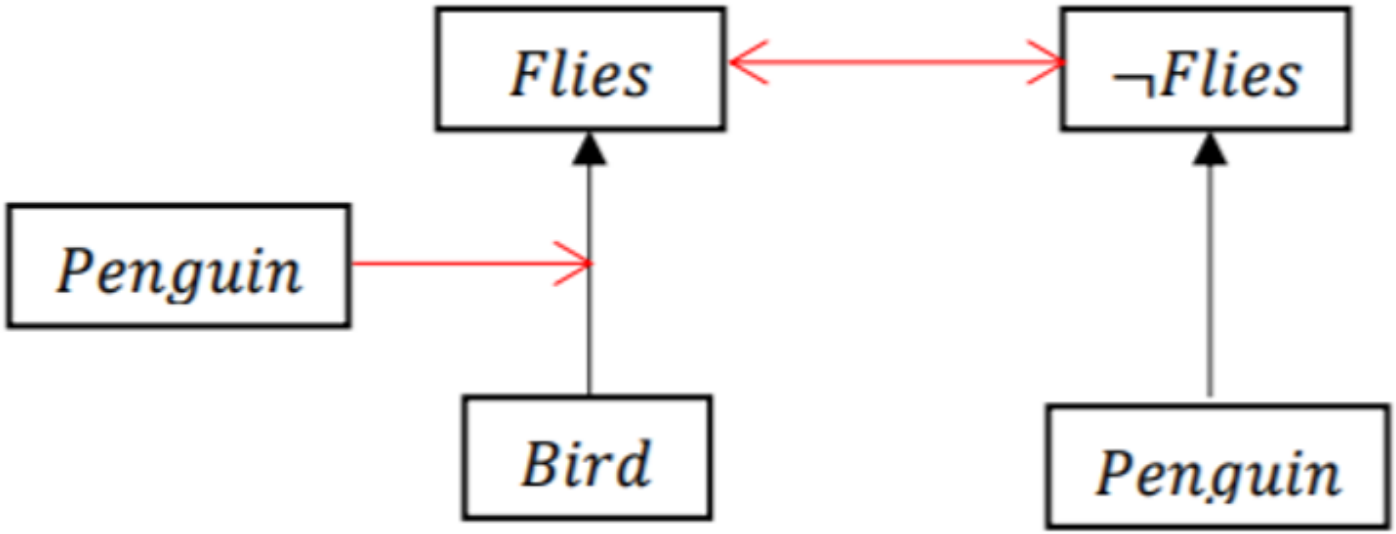

Structured argumentation Exercise 2

Take the knowledge base

$\mathcal{K} = \{Bat, Baby\}$

and the rule-base

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A. Construct all the arguments which can be built using this knowledge and rule base.

B. Indicate which of these arguments attack each other, and what the type of each attack is (rebut/undercut/undermine).

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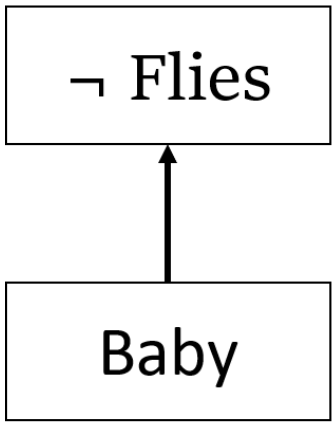

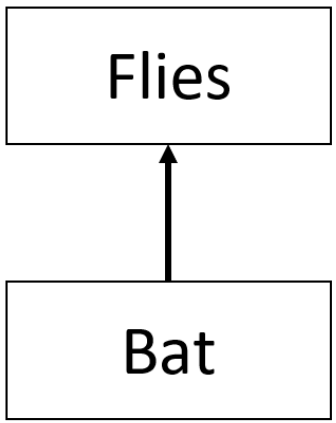

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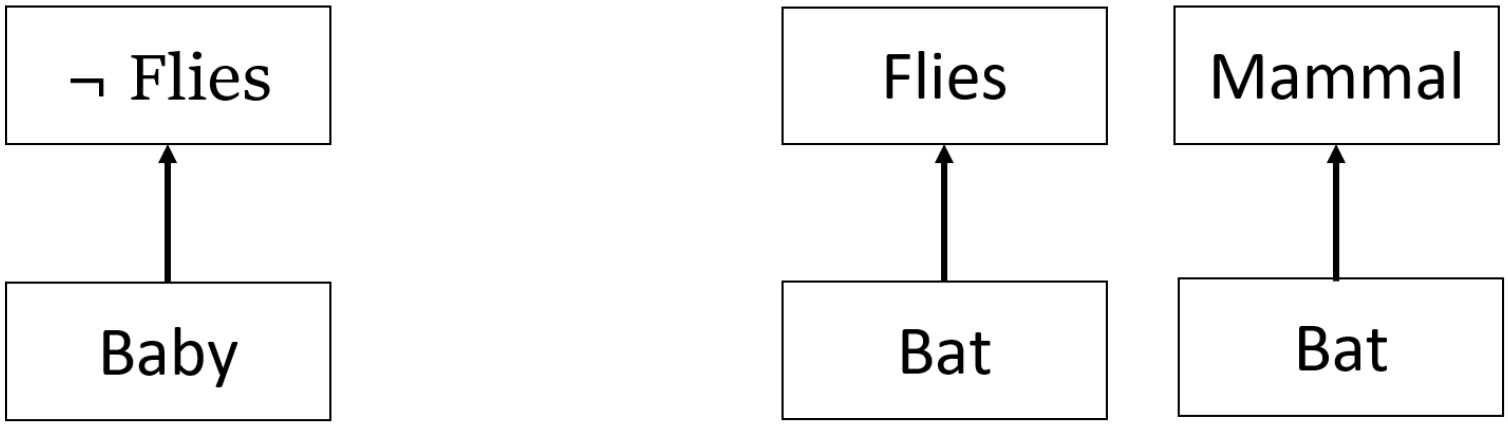
$\mathcal{R}_d = \{r_1: Bat \Rightarrow Flies, r_2: Baby \Rightarrow \neg Flies, r_3: Bat \rightarrow Mammal,\ r_4: Mammal \Rightarrow \neg Flies, r_5: Baby \Rightarrow \neg r_1, r_6: Bat \Rightarrow \neg r_4\}$



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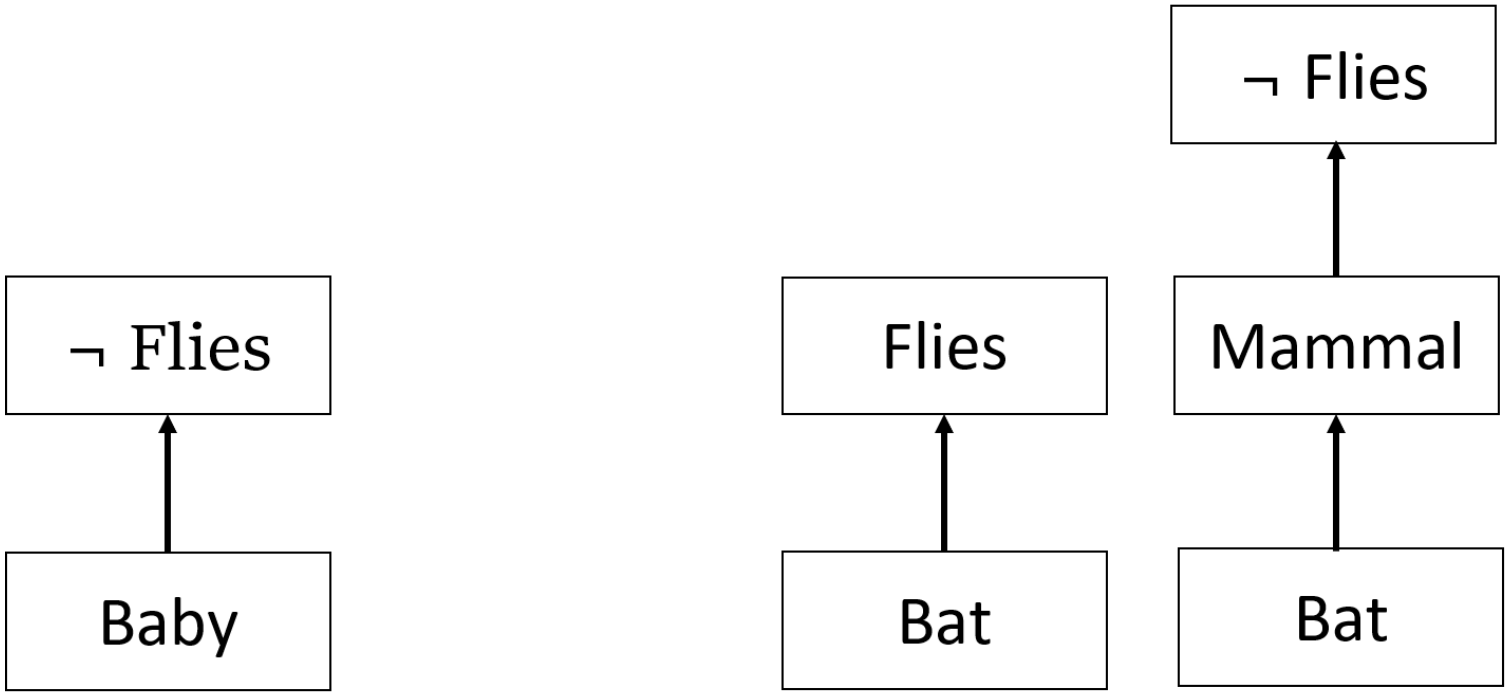

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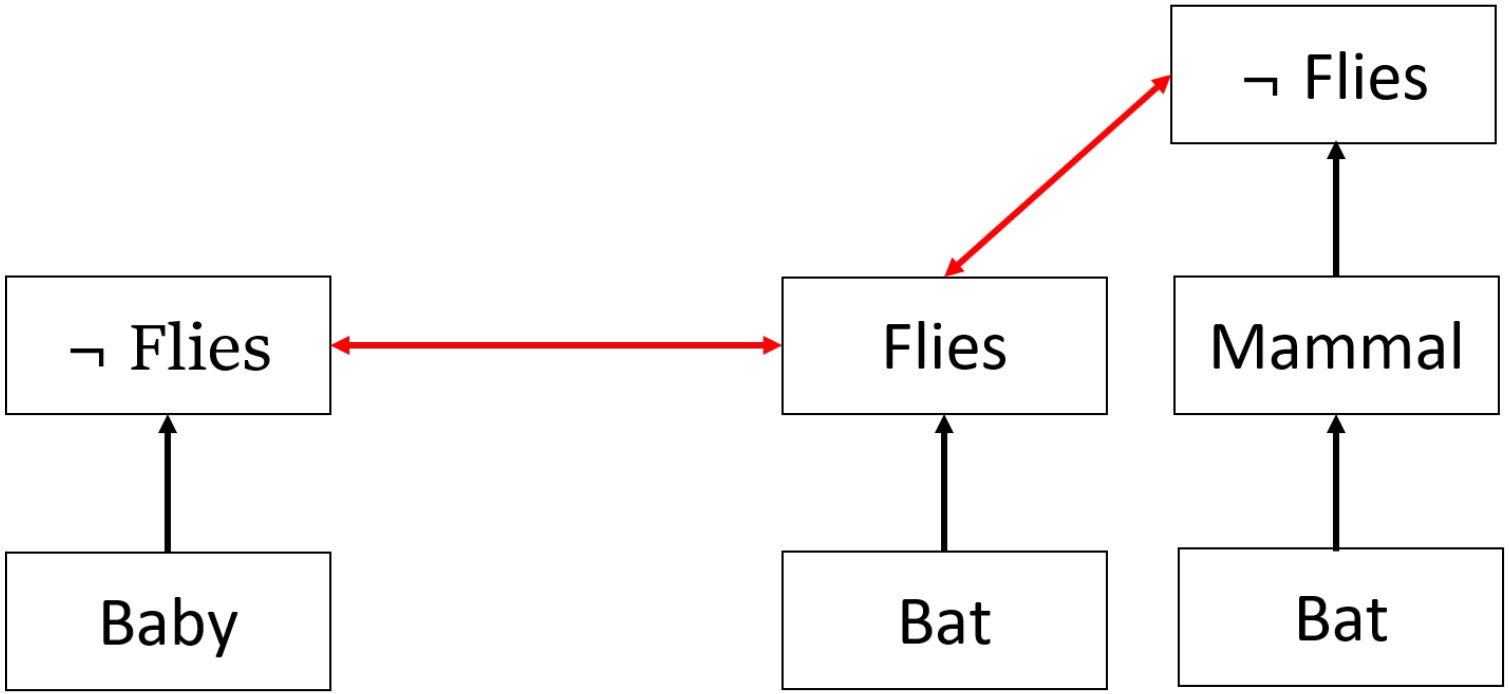

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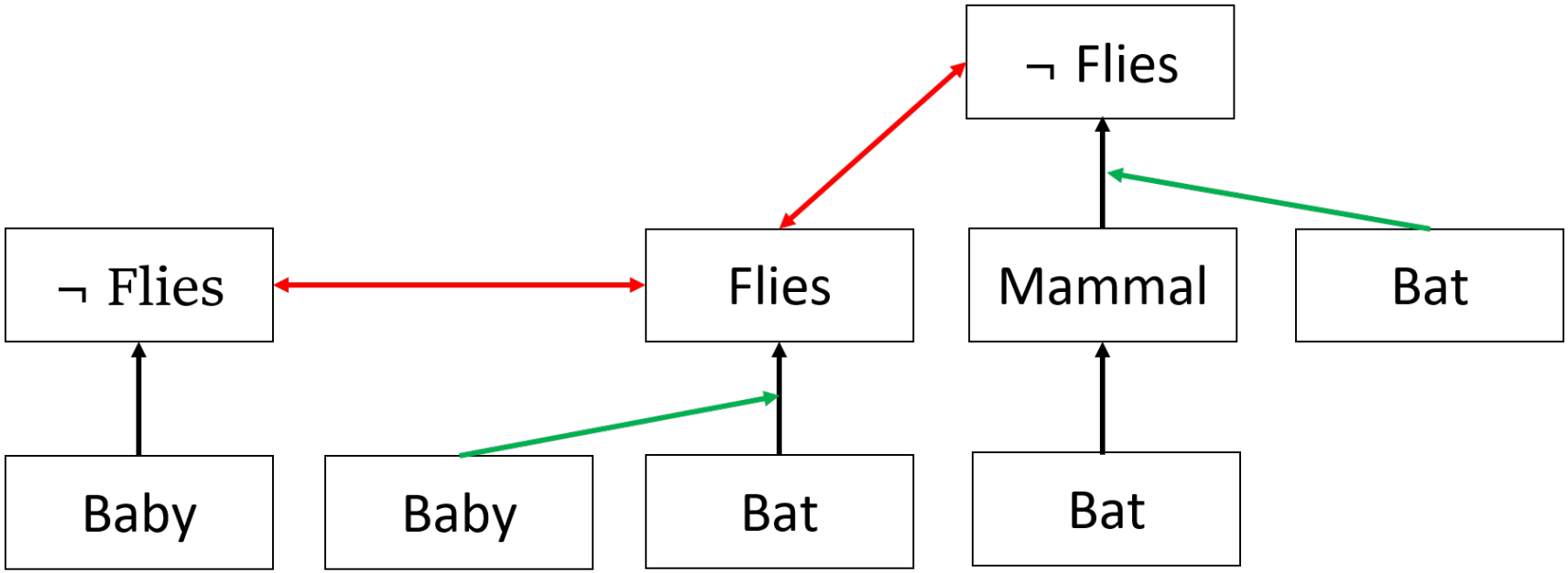

Your questions

Your questions 1

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1) Maximal means maximal wrt $\subseteq$. For example, if we have 3 complete extensions: $\{a, b, c, d, e, f\}$, $\{a, g\}$ and $\{a, b, c, e, f\}$, the first two will be preferred.

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1) Maximal means maximal wrt $\subseteq$. For example, if we have 3 complete extensions: $\{a, b, c, d, e, f\}$, $\{a, g\}$ and $\{a, b, c, e, f\}$, the first two will be preferred. Minimal is again minimal wrt $\subseteq$.
2) Yes! Sorry to all, I omitted sceptically accepted from the set of credulously accepted in the exercises, but they also belong there!

Your questions 2

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However, I would like some more explanations or examples of the construction of arguments from a knowledge base with the following rules. I feel that part is discussed briefly, but it is a little complicated. Especially question 4 in the quiz; I do not feel I have the knowledge to answer this. I would like to practice a bit more with this. The bat-example in the lecture was really hard.
Can you also maybe explain the rebuttal, undermine and undercut with respect to the knowledge base and construction of arguments. In a graph I can see which attack is performed, but this is hard for me in a simple line of arguments.

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General comment: if this lecture didn't answer your question completely, please ask me later via Teams.

Your questions 3

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2. Why justifications have are named sceptical and credulous? Both names seem to suggest that a the justification is not very strong or certain.
3. Is spelling sceptical as skeptical correct? Or is it a different word?

A. Could you explain the intuitive meaning of labelling arguments as "sceptically" and "credulously" justified? Why were these words chosen?

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If we have a rule that is r1: $q \Rightarrow a$, is $\neg a \Rightarrow \neg q$ also a rule in formal argumentation? (because in propositional logic : $q \Rightarrow a \Leftrightarrow \neg a \Rightarrow \neg q$)

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$\Rightarrow$ is an inference rule (can be also $p, q, r \Rightarrow s$), converse does not hold in general
It does not hold for defeasible rules: In the presence of LLE and RW (from Lecture 13, the last video), Contraposition implies Monotonicity (Monotonicity $\approx$ not defeasible)

Your questions 4

Question

slides: Lecture 14: Formal argumentation
I have a question, exercise 1 answers on slide 15/25
part 2 of the question 1
I dont understand why you include 'd' in the sceptically justified arguments for 3 and 4, but you don't include it in the credulously justified arguments.
For example, prefered semantic (number 3 of the question answers) consists of: E2 = c, d E3 = b, d So I understand that 'c' and 'b' are credulously justified, since they are not in all preferred extensions but in at least one. I understand that 'd' is sceptically justified, because it is in all prefered extensions
However, why is 'd' not also credulously justified, because it is also in at least one extension?

Question

It's very difficult for me to understand the first video about formal argumentation. I watched it a few times and I still don't know what do the relations (complete, preffered) mean.
in Lec13,slide P10, why e also defends b?
More examples would be nice ^_^

Your questions 5

Question

The completeness, preferability, stability, etc. are quite hard to remember. Some examples of them would also be fantastic please.
Semantics from the previous two lectures are also difficult and very unclear for me still.
I find it quite hard to find the complete, preferred, and stable extensions. Is there some sort of algorithm for finding these, like there is with the grounded?

Question

I'm not sure if i understand undercutting correctly.
During the lecture you talked about attacking the inference in "prof B says .." -> "lower taxes increase productivity" with the statement "prof B is not objective"
Does that mean undercutting plays out like "A -> B" and then we attack the inference with something like "(A$\rightarrow$ C $\wedge\neg$ C)$\rightarrow$???? "
How do you represent the attack of an inference in such a scenario?
Can you give more examples how check preferred, stable and grounded? Does it need to be complete before preferred, stable or grounded is possible?
If i understood correctly: so undercutting is attacking the relation, undermining is attacking the argument and rebuttal is attacking the conclussion?
Difference between preferred extensions and complete extensions?

Your questions 6

Question

Could you go into the knowledge bases and arguments a bit more (questions 4 and 5 from this quiz)
I also noticed that in your answers for the exercises of part 1 that a sceptically justified argument is not also credulously justified, this seems strange to me since a sceptically justified argument belongs to all extensions, therefore it must also belong to at least one extension and thus be credulously justified. Is this a mistake or is credulous actually defined as belonging to at least one, but not all extensions? The semantics from the abstract argumentation are kind of difficult, could you maybe go over it again and explain in more detail how to get to the answers? (for example, the steps on how to find the grounded/preferred/etc extensions of a certain figure)

Question

Are all L13 bonus on microsoft Teams?

Yes! NMR - not at the exam