Λογική Επιχειρηματολογίας (2)
(Προγραμματισμός Κοινής Λογικής)

- **Κάθε σύνολο κανόνων αποτελεί ένα επιχείρημα για τα (λογικά) συμπεράσματα που στηρίζει.**
- **Επιχειρήματα που στηρίζουν αντίθετα συμπεράσματα αντικρούονται μεταξύ τους – αποτελούν αντι-επιχειρήματα.**
- **Ποιο επιχείρημα υπερισχύει?**

Αποδεκτά Επιχειρήματα (Acceptable Arguments)

- What is a **good/acceptable** argument?
  - An argument that builds a **coherent case** for its position.
    - **Δένει καλά μαζί!**
  - An argument that can **defend** itself against all its counter-arguments
    - An argument that **renders** its counter-arguments **incoherent/invalid**
- An argument that has some kind of a **stable property** in the **space of all available arguments**

Αποδεκτά Επιχειρήματα (Acceptable Arguments)

- What is a **good/acceptable** argument?
  - An argument that can **defend** itself against all its counter-arguments
    - **Admissible arguments**
- Later we will see how we can improve this to get closer to the informal definition

Abstract Argumentation (1)

- An abstract argumentation framework is a pair of a set T of arguments and an attacking relation on arguments
  - AF=<Args, Att>, where Att is a binary relation on Args

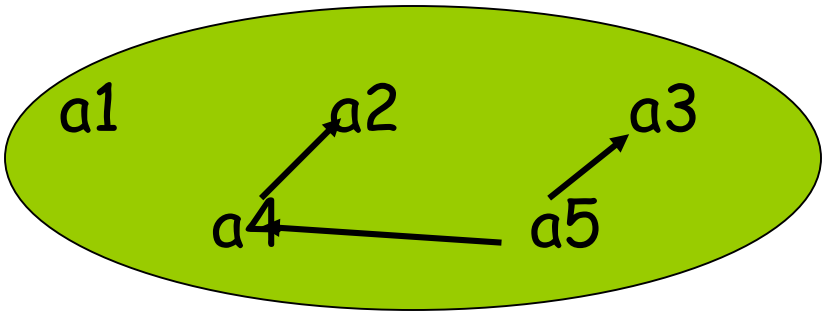
- S⊆T is an Admissible Argument iff
  - S it does not attack itself (i.e. it is conflict free), and
  - S attacks (counter-attacks/defends) all its attacks

- This is a simple but powerful definition.

Abstract Argumentation (2)

- S⊆Args is an Admissible Argument iff
  - S it does not attack itself (i.e. it is conflict free), and
  - S attacks (counter-attacks) all its attacks

- Example

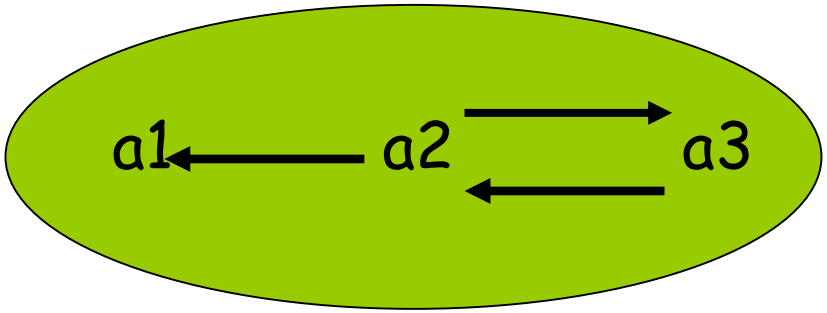


  - {a2} and {a3} are not admissible.
  - But {a2,a5} is admissible.
  - {a1}, {a5} are admissible.
  - {a1,a2,a5} is maximally admissible.

Abstract Argumentation (3)

- $S \subseteq Args$ is an Admissible Argument iff
  - S it does not attack itself (i.e. it is conflict free), and
  - S attacks (counter-attacks) all its attacks

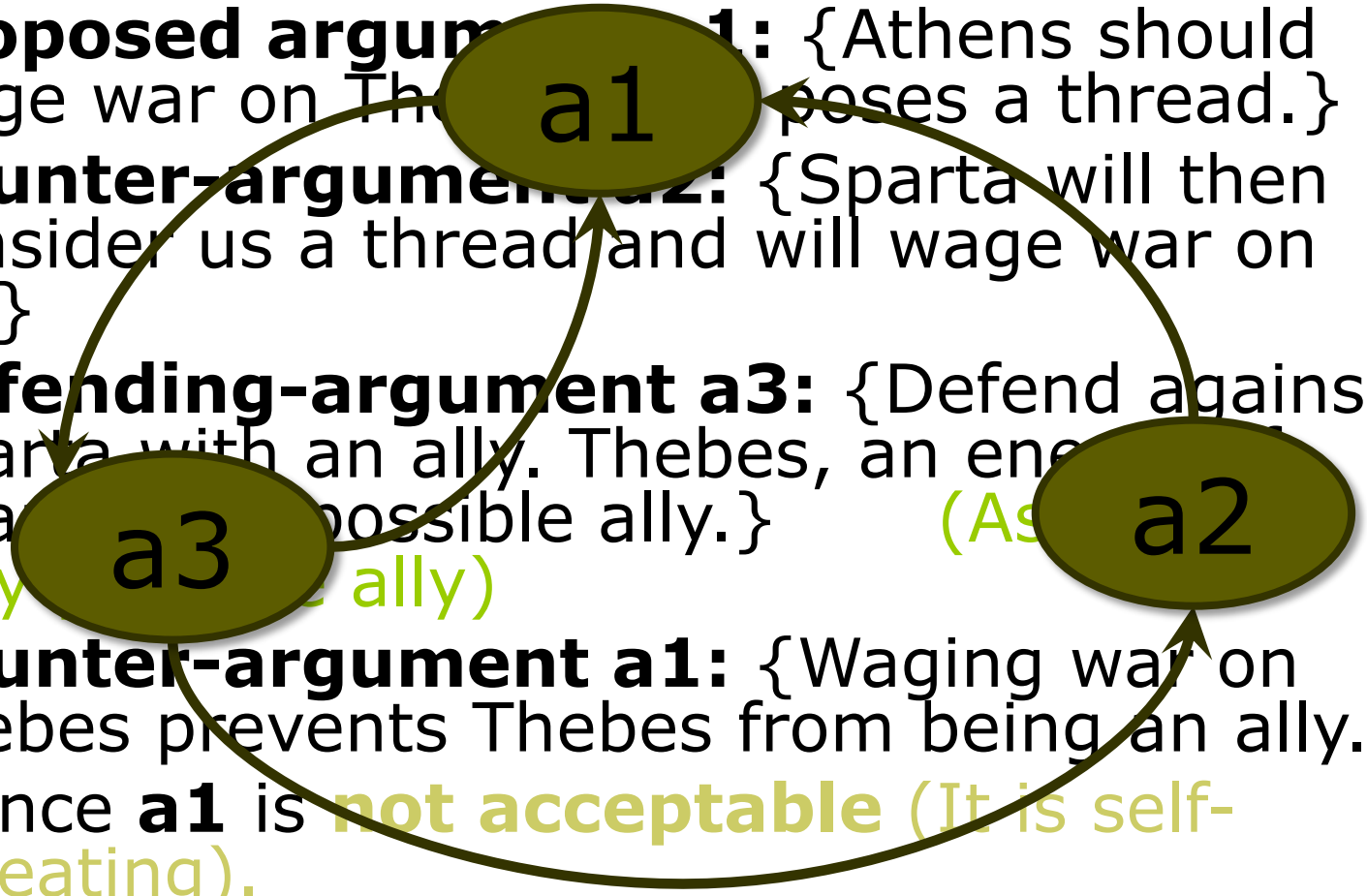
- Example 2



  - {a2} and {a3} are admissible.
  - {a1} is not admissible.
  - {a1, a3} is admissible (maximally).

"Debate" Example of Argumentation

- **Proposed argum[illegible]1:** {Athens should wage war on Th[illegible]poses a thread.}
- **Counter-argumen[illegible]a2:** {Sparta will then consider us a thread and will wage war on us.}
- **Defending-argument a3:** {Defend against Spar[illegible]a with an ally. Thebes, an ene[illegible] Spa[illegible]possible ally.} (As[illegible] only [illegible]e ally)
- **Counter-argument a1:** {Waging war on Thebes prevents Thebes from being an ally.}
- Hence **a1** is **not acceptable** (It is self-defeating).



Banana Example

- **banana(b1)**
  - **a1 supports position yellow(b1)**
  - **{a1, dc} supports position neg(green(b1)).**
  - **It attacks {a2, unripe(b1)} but NOT vice-versa.**
  - **{a1, dc} is the only admissible argument.**
  - **Hence conclude sceptically yellow(b1).**

- **banana(b1), unripe(b1)**
  - **a2 supports position green(b1)**
  - **{a2, dc} supports position neg(yellow(b1)).**
  - **{a2, dc} attacks {a1, dc} and vice-versa.**
  - **Both {a2, dc} and {a2, dc} are admissible.**
  - **Hence conclude credulously yellow(b1) and green(b1)!**
  - **No sceptical conclusion on colour of b1.**
    - **Yet we want to have green(b1) sceptically! HOW?**

Example of Argumentation

- "Sellers who deliver on time are trustworthy"
  - α1={trusted(Seller) :- timely(X)}
- "Sellers who deliver wrong are not trustworthy"
  - α2={¬ trusted(Seller) :- wrong_delivery(X)}
- Suppose we "observe":
  - timely(bob): a1 supports trusted(bob).
  - wrong_delivery(bob): a2 supports ¬trusted(bob).
  - a1 attacks a2 and vice-versa.
- "Sellers who are trusted get large orders"
  - a= {large_orders(X) :- trusted(X)}
  - A={a1, a} supports large_orders(bob)
  - B={a2} attacks A (B undercuts A)

Example of Argumentation

- "Sellers who are trusted get large orders"
  - a= {large_orders(X) :- trusted(X)}
  - A={a1, a} supports large_orders(bob)
  - B={a2} attacks A (B undercuts A)

- Both A and B are admissible.
  - Hence can we be sure about large_orders(bob)?

- Do we have an argument supporting ¬large_orders(bob)?
  - B'={a2,a'} with
    - a'= {¬large_orders(X) :- ¬ trusted(X)}
  - B''={a2,a''} with
    - a''={¬large_orders(bob)} – a'' is a hypothesis.
  - Both B' and B'' are attacked by A.

- Both B' and B'' are admissible, supporting ¬large_orders(bob), because of a2 that defends against A
    - a'' cannot defend against A because a'' is a weaker argument

Building admissible arguments
Dialectics

- Find an argument Δ that supports the position (query) we want.
- Check Δ is not self-attacking.
- Consider attacks, A, against Δ.
- Attack/Defend each A by argument D.
- Add D to Δ to give new Δ′= Δ U D.
- Repeat from 2nd step with Δ′.

Example of Dialectic Argumentation

- **Args** ={a1,a2,a3} **constructed** by:
  - a1={turn_on_switch **causes** light_on, light_on **causes** ¬ darkness} U {turn_on_switch@T}
  - a2={power_cut **causes** ¬ electricity,¬ electricity **implies** ¬ light_on} U {power_cut@T}
  - a3={darkness@T **implies** darkness@T+} U {darkness@T}
- a1 **supports** ¬ darkness@T+ ;
- a3 **supports** darkness@T+
- **Constructed from:** "The power cut had turned the house into darkness. Bob came home and turned on the light switch. …"

Example of Dialectic Argumentation

- a1 **supports** ¬ darkness@T+ ; a3 **supports** darkness@T+
- **Attacks** between arguments = {(a1,a3), (a2,a1)}
  - a1 **attacks** a3 but **not** vice-versa
    - "Bob expects the house to come out of darkness"
  - a2 **attacks** a1 (on light_on) but **not** vice-versa
    - a2 **defends** a3 against the attack of a1
- {a3,a2} **acceptable** argument for darkness@T+
  - Also {a2} **acceptable** but {a1} is not acceptable.

Example of Dialectic Argumentation

- Suppose now that we **also** have an **argument** that the power cut had ended at T, e.g.:
  - **a4** ={short_power_cut@T$^-$ **implies**$_\neg$ power_cut@T} U {short_power_cut@T$^-$}

- ***Atts*** = {(a1,a3), (a2,a1), (a4,a2), (a2,a4)}
  - Args a4 and a2 are **equally strong** on **"power_cut"**
    - No **preference** between them
    - They **defend** against each other.

- {a3,a2} **acceptable** argument for darkness@T$^+$

- {a1,a4} **acceptable** argument for $\neg$ darkness@T$^+$

Another Example - Dialectics

- What is a good argument? - EXAMPLE
  - Position: Attend this talk
  - Arg: This is the reason we came to the conference
  - C-Arg1: The speaker is known to be boring
    - But the title of the talk is interesting – **Separate Defence**
  - C-Arg2: A friend wants to meet (for coffee I think)
    - But my sense of professional responsibility is generally stronger than that of self satisfaction - **Arg is Stronger than C-Arg2**
  - C-Arg2': The friend is not well and wants help
    - My sense of social responsibility is generally stronger than professional responsibility - **Arg is Weaker than C-Arg2'**
    - I have been assigned to write up a report on this afternoons talk

      --Argument for social resp. is weaker than that of professional resp.

      -- Hence, Arg is Stronger than C-Arg2