Foundations of Knowledge Representation
Argumentation - Problems

Problem 1. *Consider the following formal description of two argumentation frameworks:*

Let $F_1 = (A, R)$ *be an AF with*

$$A = \{a, b, c, d\}$$
$$R = \{(a, b), (b, c), (b, d), (d, a)\}$$

Let $F_2 = (A, R)$ *be an AF with*

$$A = \{a, b, c, d, e\}$$
$$R = \{(a, b), (b, c), (b, d), (d, e), (e, a)\}$$

Do the following:

- *Represent the argumentation frameworks graphically.*
- *Compute the following extensions of* F_1 *and* F_2 *respectively:*
  - *Conflict-free*
  - *Admissible*
  - *Preferred*
  - *Complete*
  - *Stable*
  - *Grounded*
- *What does this indicate regarding the existence of stable extensions?*

Problem 2. *Let $F = (A, R)$ be an argumentation framework and let $E \subseteq A$. Define the characteristic function as the mapping $\Gamma : 2^a \rightarrow 2^a$ with:*

$$\Gamma(E) = \{a \in A \mid E \text{ defends } a\} \tag{1}$$

Do the following:

- *Apply the characteristic function to arguments $\{a\}$ and $\{a, b\}$ of the argumentation framework F_1 from the previous problem.*
- *Prove that the characteristic function is monotonic,*
  i.e. $X \subseteq Y \Rightarrow \Gamma(X) \subseteq \Gamma(Y)$.

Problem 3. *In our argumentation setting, conflicts are solved using appropriate semantics. The different semantics reflect different intuitions about what can be considered reasonable [Brewka, Polberg, Woltran: 2014].*

For instance, the admissible extension seems rational since it gives us a conflict-free set of arguments that defends itself against outside attacks. Intuitively, admissibility requires one to be able to give reasons for accepted and rejected arguments but leaves one free to abstain about any argument.

Can you give similar, intuitive, descriptions of the complete, grounded, and stable extension?