Artificial Intelligence for Robotics 1

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1 Propositional Logic

Formalize the following sentences:

1. If Paolo is thin, then Carlo is not blonde or Roberta is not tall.
2. If Roberta is tall then Sandra is lovely.
3. If Sandra is lovely and Carlo is blonde then Paolo is thin.
4. Carlo is blonde

Considering the sentences above, can we deduce that Roberta is not tall? State your answer as a proof using a deduction mechanism of your choice or a semantic argument. Truth-tables are not accepted as an answer.

2 First Order Logic

Consider the following sentences:

1. All actors and journalists invited to the party are late.
2. There is at least one person who is on time.
3. There is at least an invited person who is neither a journalist nor an actor.

Formalize the sentences and prove that 3. is not a logical consequence of 1. and 2. Please state your answers using a deductive mechanism of your choice or a semantic argument.

3 Description Logic

Consider a knowledge base Σ in $\mathcal{ALC}$ where the TBox is the following:

- $\mathit{Person} \sqsubseteq \mathit{Animal} \sqcap \mathit{Biped}$
- $\mathit{Woman} \equiv \mathit{Person} \sqcap \mathit{Female}$

- $Mother \equiv Woman \sqcap \exists ParentOf.Person$
- $Parent \equiv Mother \sqcup Father$
- $Man \equiv Person \sqcap \neg Woman$

and the ABox is the following:

- Man(John)

First tell what additional facts should be added to the Abox to make it consistent with the TBox. Motivate each addition with the related statements in the TBox. Let Σ' be the knowledge base obtained by making the Abox consistent with the TBox of Σ. Then, using a deduction mechanism or a semantic argument, tell whether the following assertions hold:

- $\Sigma' \models Woman \sqsubseteq Biped$
- $\Sigma' \models \exists ParentOf.Person \sqsubseteq Woman$
- $\Sigma' \models (\neg Woman)$(John)