Artificial Intelligence for Robotics 1

Armando Tacchella

Sample test 3

1 Propositional Logic

Formalize the following sentences in propositional logic:

- Francesco or Giovanni are going to the restaurant.
- Chiara or Maria are going to the restaurant.
- If Francesco goes to the restaurant, then Chiara does not go.
- If Giovanni goes to the restaurant, then Maria does not go.

Show whether the sentence "Francesco is not going to the restaurant or Giovanni is not going to the restaurant" is a logical consequence of the sentences above, considered as a theory. 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. (**Note**: interpret "or" as inclusive disjunction.)

2 First Order Logic

Consider the following first order theory about pizza:

1. $\forall x.(Pizza(x) \rightarrow HasTomato(x))$
2. $\forall x.(Pizza(x) \rightarrow HasCheese(x))$
3. $\exists x.\neg Pizza(x)$.

and tell whether each of the following sentences is either a logical consequence of the theory or not:

1. $\exists x.(\neg HasTomato(x) \wedge \neg HasCheese(x))$
2. $\forall x.(\neg HasTomato(x) \rightarrow \neg HasCheese(x))$
3. $\forall x.((HasTomato(x) \wedge HasCheese(x)) \rightarrow Pizza(x))$
4. $\forall x.(\neg Pizza(x) \vee (HasTomato(x) \wedge HasCheese(x)))$
5. $\forall x.((\neg HasTomato(x) \vee \neg HasCheese(x)) \rightarrow \neg Pizza(x))$

Please state your answers using a deductive mechanism of your choice or a semantic argument.

3 Description Logic

Create an ontology (a TBox in $\mathcal{ALC}$) to model the following scenario about books and readers:

- Every object in the domain is either a book or a reader; a book cannot be a reader (and viceversa).
- All the readers read books.
- There are three kinds of books: novels, essays and comics.
- There are two kinds of readers: casual and addicted.
- Addicted readers read some essays.
- Casual readers read some novels or comics.

Show an example of an ABox which is consistent with the TBox and contains at least two readers and three books. Modify the example to make it inconsistent.