

CS 161: Discussion 6

Friday, May 5, 2011

1. First-Order Logic Examples

Convert the following from English to first-order logic:

- (a) Everybody loves somebody sometime. (Note: $Loves(x, y, t)$ means x loves y at time t .)

Everybody loves somebody. $\forall x \exists y [Loves(x, y)]$
 $\forall x \exists y \exists t Loves(x, y, t)$

- (b) Optimus Prime likes trucks.

$\forall x Truck(x) \implies Likes(Optimus\ Prime, x)$

- (c) Optimus Prime likes all big trucks.

$\forall x [Truck(x) \wedge Big(x)] \implies Likes(Optimus\ Prime, x)$

- (d) Optimus Prime doesn't like any (type of) airplane.

$\forall x Airplane(x) \implies \neg Likes(Optimus\ Prime, x)$
 OR
 $\neg \exists x Airplane(x) \wedge Likes(Optimus\ Prime, x)$

- (e) Not all robots can transform into both a truck and an airplane.

$\neg \forall x Robot(x) \implies Transform(x, Truck) \wedge Transform(x, Airplane)$

- (f) Some students at Hogwarts took Potions in the winter.

$\exists x StudentAt(x, Hogwarts) \wedge Takes(x, Potions, winter)$

- (g) There is a person who sells lightsabers only to people who are not Jedis.

$\exists x Person(x) \wedge \forall y, z Lightsaber(y) \wedge Sells(x, y, z) \implies Person(z) \wedge \neg Jedi(z)$

- (h) There is a Jedi who defends all Wookiees who do not defend themselves.

$\exists x Jedi(x) \wedge \forall y Wookiee(y) \wedge \neg Defends(y, y) \implies Defends(x, y)$

- (i) Politicians can fool some of the people all of the time, and they can fool all of the people some of the time, but they can't fool all of the people all of the time.

$\forall x Politician(x) \implies [(\exists y \forall t Person(y) \wedge Fools(x, y, t))] \wedge$
 $[\forall y \exists t Person(y) \implies Fools(x, y, t)] \wedge$
 $[\neg (\forall y, t Person(y) \implies Fools(x, y, t))]$