

LIN380M Semantics I Homeworks

Zeyuan Hu, iamzeyuanhu@utexas.edu

EID:zh4378 Spring 2018

1 HW1

Translate the following sentences into predicate logic. (You may choose your own letters to serve as non-logical constants. Translate “but” as if it were “and”)

1. John loves Mary, but she doesnt love him.

$$\text{love}(J, M) \wedge \neg \text{love}(M, J)$$

2. John believes all things that Mary believes and some other things as well.

$$(\forall y)((\text{things}(y) \wedge \text{believe}(M, y)) \rightarrow \text{believe}(J, y)) \wedge (\exists x)(\text{things}(x) \wedge \text{believe}(J, x) \wedge \neg \text{believe}(M, x))$$

3. If a cat and a mouse are in the same room and the mouse doesnt run away, then either the mouse is dead or the cat is dead.

$$(\forall x)(\forall y)(\text{cat}(x) \wedge \text{mouse}(y) \wedge \text{inTheSameRoom}(x, y) \wedge \neg \text{runAway}(y)) \rightarrow (\text{dead}(x) \vee \text{dead}(y))$$
¹

4. Everyone who has two jobs neglects one of them.

$$(\forall x)(\exists y)(\exists z)(\text{Human}(x) \wedge \text{job}(y) \wedge \text{job}(z) \wedge \text{hasJob}(x, y) \wedge \text{hasJob}(x, z)) \rightarrow ((\text{neglect}(y) \wedge \neg \text{neglect}(z)) \vee (\text{neglect}(z) \wedge \neg \text{neglect}(y)))$$

5. If an argument with two premises is valid and its conclusion is false, then one of the premises is false.

$$(\forall x)(\forall y)(\forall z)(\forall k)((\text{argument}(x) \wedge \text{premise}(y) \wedge \text{premise}(z) \wedge \text{belongToArgument}(y, x) \wedge \text{belongToArgument}(z, x) \wedge \text{valid}(x) \wedge \text{conclusion}(k) \wedge \neg \text{conclusionIsTrue}(k) \wedge \text{belongToArgument}(k, x)) \rightarrow (\neg y \vee \neg z))$$
²

¹Here, I interpret “either ... or” as OR in logic term. If we treat “either ... or” as XOR instead, the PC of the sentence then becomes $(\forall x)(\forall y)(\text{cat}(x) \wedge \text{mouse}(y) \wedge \text{inTheSameRoom}(x, y) \wedge \neg \text{runAway}(y)) \rightarrow ((\text{dead}(x) \wedge \neg \text{dead}(y)) \vee (\text{dead}(y) \wedge \neg \text{dead}(x)))$

²Since an argument is consisted of premises and conclusion, $\text{conclusion}(k)$ may be ambiguous as it can either represent whether k is a conclusion or not in an argument (it can be premise) or it can represent the truth value of a conclusion. Thus, I think it is necessary to avoid this ambiguity by introducing another predicate conclusionIsTrue to indicate the truth value of a conclusion and use conclusion predicate to indicate whether the given variable is a conclusion or not.

6. There are three dishes that John doesn't like.

$$((\exists x)(\exists y)(\exists z)(\text{dish}(x) \wedge \text{dish}(y) \wedge \text{dish}(z))) \rightarrow (\neg \text{like}(J, x) \wedge \neg \text{like}(J, y) \wedge \neg \text{like}(J, z)))$$