Exercises are due on: Monday 11 May, noon

Semantic Theory 2020: Exercise sheet 1

Exercise 1

Translate the following sentences into first-order predicate logic. You can freely introduce predicates, but try to retain as much of the structure as possible. Also provide the key to the translation.

a. Link is scared of nothing.

b. Every princess loves her saviour.

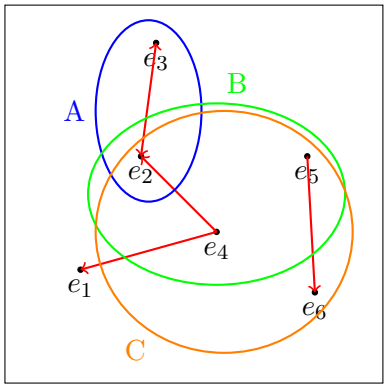
c. The Master Sword is the only sword that can defeat Agahnim.

d. If the leader of the Dark World is defeated, the Light World is free.

Exercise 2

Consider the following model $M_1 = \langle U_1, V_1 \rangle$, with $U_1 = \{e_1, e_2, e_3, e_4, e_5, e_6\}$. The interpretation function V_1 is defined as follows:

M1:



- $V_1(j) = e_1$
- $V_1(m) = e_4$
- $V_1(b) = e_6$
- $V_1(A) = \{e_2, e_3\}$
- $V_1(B) = \{e_2, e_4, e_5\}$
- $V_1(C) = \{e_2, e_4, e_5, e_6\}$
- $V_1(R) = \{\langle e_2, e_3\rangle, \langle e_3, e_2\rangle\langle e_4, e_1\rangle, \langle e_4, e_2\rangle, \langle e_5, e_6\rangle\}$

Let the assignment function g_1 be defined as follows:
$g_1(x) = e_4$, $g_1(x') = e_2$, $g_1(x'') = e_3$ and for all other variables x'^*: $g_1(x'^*) = e_5$.

2.1 Evaluate the following formulas in model M_1, with respect to assignment function g_1, showing the crucial steps.

a. $[\![R(x', x'') \wedge R(x''', b)]\!]^{M_1,g_1} = ?$

b. $[\![\exists x''(A(x'') \rightarrow R(x'', j))]\!]^{M_1,g_1} = ?$

c. $[\![\forall x(B(x) \rightarrow (A(x) \vee \neg\exists x''(R(x'', x))))]\!]^{M_1,g_1} = ?$

2.2 Provide a graphical representation of a model that satisfies the following formulas (NB: c_1 and c_2 are constants):

- $R(x, x')$
- $\forall x(A(x) \vee \exists x'(R(x, x')))$
- $\neg\exists x(R(x, c_1))$
- $\exists x''(A(x'') \wedge \neg\exists x'(A(x') \wedge R(x', x'')))$
- $\forall x'(B(x') \rightarrow (A(x') \vee R(x', c_2)))$

2.3 (Bonus) Can you think of a sensible (or: funny) interpretation for the predicates A, B and R, and the constants c_1 and c_2 in your model of the previous exercise? Given this interpretation, what is the natural language translation of the formulas given in exercise 2.2?