

Exercises due on: Thursday, May 15, 10 AM (before class)

## Semantic Theory 2018: Exercise sheet 2

### Exercise 1

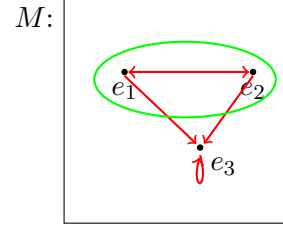
**1.1** Derive the types of the underlined expressions in the following sentences. The subscripts indicate the types of the relevant expressions. Also provide the (simplified) logical form you derived for each sentence.

- $[\text{Darth Vader}]_e$  is  $[\text{the father of Luke}]_e$ .
- $\text{Every Jedi}_{\langle e, t \rangle}$  has  $[\text{a lightsaber}]_e$ .
- $[\text{Padmé Amidala}]_e$  is the  $[\text{most beautiful}]$   $\text{woman}_{\langle e, t \rangle}$  on  $\text{Naboo}_e$ .

**1.2** Is it possible to have two type theoretic expressions  $A$  and  $B$  such that both  $A(B)$  and  $B(A)$  are well-formed? Motivate your claim.

### Exercise 2

The diagram on the right graphically represents a model structure  $M = \langle U_M, V_M \rangle$  with a universe consisting of three entities:  $U_M = \{e_1, e_2, e_3\}$ . The interpretation function  $V_M$  describes the first-order property “Jedi” (indicated by the green circle) and the two-place relation “to help” (indicated by the red arrows).



**2.1** Give the type-theoretic denotation of the interpretation function  $V_M$  for the following non-logical constants:

- $\text{anakin}', \text{yoda}', \text{padmé}' \in \text{CON}_e$
- $\text{jedi}' \in \text{CON}_{\langle e, t \rangle}$
- $\text{help}' \in \text{CON}_{\langle e, \langle e, t \rangle \rangle}$

**2.2** Compute the type-theoretic denotations of the following expressions relative to the model structure  $M$  and some arbitrary variable assignment  $g$ . Here,  $x$  is a variable of type  $e$ , and  $F$  is a variable of type  $\langle e, t \rangle$ .

- $\llbracket \text{help}'(\text{padmé}') \rrbracket^{M, g} = ?$
- $\llbracket \forall x (\text{help}'(x)(x) \rightarrow \neg \text{jedi}'(x)) \rrbracket^{M, g} = ?$
- $\llbracket \forall F \exists x (F(x)) \rrbracket^{M, g} = ?$