

## Exercises for FFL, Fall 2015, sheet 10

Return Tuesday Nov 24, in class.

**Exercise 1.** Consider the following propositions which express that the binary relation  $R$  is an equivalence relation:

$$\varphi_1: \forall x Rxx \qquad \varphi_2: \forall x \forall y (Rxy \rightarrow Ryx) \qquad \varphi_3: \forall x \forall y \forall z ((Rxy \wedge Ryz) \rightarrow Rxz)$$

Show that none of these propositions is entailed by the others by presenting  $\{R\}$ -structures that are models of two of the propositions, but not of the third.

**Exercise 2.** Using the rules from the sequent calculus, derive the rule

$$\frac{}{\Gamma \neg(\varphi \vee \neg\varphi) \zeta} \quad (\text{for any } \Gamma, \varphi, \zeta)$$

Remark: Not an easy one if you are not used to this kind of problem. Don't give up too early. I found a derivation in 8 steps.