

Assignment8 – Propositional Logic

Given: Dec 13 Due: Dec 18

Problem 8.1 (FOL-Signatures)

1. Model the following situation as a FOL signature. (FOL and PLNQ signatures are the same.)
 - We have constants (= nullary functions) called zero and one.
 - We have a binary function called plus.
 - We have a unary function called minus.
 - We have a binary predicate called less.
2. Now consider the signature given by
 - $\Sigma_0^f = \{a, b\}$
 - $\Sigma_1^f = \{f, g\}$
 - $\Sigma_2^f = \{h\}$
 - $\Sigma_0^p = \{p\}$
 - $\Sigma_1^p = \{q\}$
 - $\Sigma_2^p = \{r\}$
 - all other sets empty
3. Give a term over this signature that uses all function symbols
4. Give a formula over this signature that uses all function and predicate symbols

Problem 8.2 (Natural Deduction)

Prove the following formula using the propositional Natural Deduction calculus.

$$(A \vee B) \wedge (A \Rightarrow C) \wedge (B \Rightarrow C) \Rightarrow C$$

Problem 8.3 (Proving in Tableau Calculus)

We use the *propositional variables* P , Q , and R and define *formulae* A , B , and C by

$$A = Q \wedge (Q \Rightarrow R)$$

$$B = P \Rightarrow A$$

$$C = P \Rightarrow R$$

Prove the *formula* $B \Rightarrow C$ using the *propositional tableau calculus* \mathcal{T}_0 .