

Exercises for “Formal Specification and Verification” Exercise sheet 2

Exercise 2.1:

Consider the following deductive system for propositional logic (with signature \neg, \rightarrow):

Axiom schemata:

- (1) $\neg p \rightarrow (p \rightarrow q)$
- (2) $p \rightarrow (q \rightarrow p)$
- (3) $(p \rightarrow q) \rightarrow ((\neg p \rightarrow q) \rightarrow q)$
- (4) $(p \rightarrow (q \rightarrow r)) \rightarrow ((p \rightarrow q) \rightarrow (p \rightarrow r))$

Inference rules

Modus Ponens: $\frac{p, p \rightarrow q}{q}$

Give a proof for $F \rightarrow F$ in this system.

Hint: You can e.g. use instances of axiom schema 2 (twice), 4, and Modus Ponens (twice).

Exercise 2.2:

Give a proof for

$$\Rightarrow ((P \rightarrow (Q \rightarrow R)) \rightarrow ((P \rightarrow Q) \rightarrow (P \rightarrow R)))$$

in the sequent calculus for propositional logic presented in the lecture.

Exercise 2.3:

Use a DPLL procedure to find a model of each of the following formulae, or prove that the particular formula has no model:

- (1) $(P \vee \neg Q) \wedge (\neg P \vee Q) \wedge (Q \vee \neg R) \wedge (\neg Q \vee \neg R)$
- (2) $(P \vee Q \vee \neg R) \wedge (P \vee \neg Q) \wedge (P \vee Q \vee R) \wedge (R \vee Q) \wedge (R \vee \neg Q) \wedge (\neg P \vee \neg R) \wedge \neg U$

Please submit your solution until Sunday, November 4, 2018 at 17:00. Please do not forget to write your name on your solution.

Submission possibilities:

- By e-mail to sofronie@uni-koblenz.de with the keyword “Homework FSV” in the subject.
- Put it in the box in Room B 222.