

Solved exercises must be marked and solutions (as a single PDF file) uploaded in [OLAT](#). Solutions for bonus exercises must be submitted separately. The (strict) deadline is 6 am on March 9.

Exercises

- (1) 1. Master the Greek alphabet.
- (2) 2. For each of the following propositional formulas, draw the parse tree and list all subformulas.
- (a) $\neg(p \rightarrow (\neg(q \rightarrow (r \vee \neg p))))$
 - (b) $p \wedge \neg(p \vee \neg q) \rightarrow q \rightarrow p$
- (2) 3. Compute the truth table of the following propositional formulas. Which of these formulas are satisfiable? Which are valid?
- (a) $(p \rightarrow q) \rightarrow (p \rightarrow \perp) \rightarrow \neg q$
 - (b) $((q \rightarrow (\perp \rightarrow p)) \rightarrow q) \rightarrow \top \rightarrow p$
 - (c) $((p \vee q) \rightarrow r) \rightarrow ((p \rightarrow r) \vee (r \rightarrow q))$
- (3) 4. Determine which of the following semantic entailments are true.
- (a) $(p \rightarrow q) \rightarrow p, \neg(q \wedge p) \models \neg(\neg p \rightarrow q)$
 - (b) $p \rightarrow q, q \rightarrow \neg r, r \rightarrow \neg p \models r$
 - (c) $\neg p \wedge \neg(\neg p \rightarrow \top) \models \perp$
- (2) 5. Transform the following propositional formulas into conjunctive normal form.
- (a) $p \vee ((q \vee \neg r) \wedge (p \vee (q \wedge r)))$
 - (b) $\neg(p \rightarrow (q \wedge (\neg p \rightarrow q)))$

Bonus Exercise

- (2) 6. A *disjunctive normal form* (DNF) is a disjunction of conjunctions of literals.
- (a) Explain how a truth table can be used to obtain an equivalent DNF and illustrate your procedure on the truth tables obtained in Exercise 3(a,b).
 - (b) Show that the satisfiability of DNFs is efficiently decidable.