

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 7 am on April 11.

### Exercises

- (3) 1. For each of the following sequents, either prove validity using natural deduction or explain why a natural deduction proof does not exist:
- (a)  $\vdash ((p \vee \neg q) \wedge (\neg r \rightarrow q)) \rightarrow (r \vee p)$
  - (b)  $p \rightarrow q, s \rightarrow t \vdash p \vee s \rightarrow q \wedge t$
  - (c)  $p \rightarrow \neg r, q \rightarrow \neg r \vdash r \rightarrow \neg(q \vee p)$
- (4) 2. For each of the following clausal forms, use resolution to determine satisfiability:
- (a)  $\{\{\neg p, \neg q\}, \{p, \neg q, r\}, \{p, \neg s\}, \{q\}, \{\neg r, s\}\}$
  - (b)  $\{\{p, q, r\}, \{p, \neg q, r\}, \{q, \neg r\}, \{\neg p, r\}\}$
- (3) 3. Consider the boolean function  $f(x, y, z) = (x \oplus \bar{y}) + z$ .
- (a) Construct a BDD for  $f$  that is ordered but not reduced.
  - (b) Compute two different reduced OBDDs for  $f$ .
  - (c) Construct a BDD for  $f$  that is reduced but not ordered.