

## Solution to Homework 26

**Problem.** On the example of the formula  $(a \vee \neg b \vee c \vee \neg d) \& (\neg a \vee \neg b \vee \neg c)$ , show how checking its satisfiability can be reduced to checking satisfiability of a 3-CNF formula.

**Solution.** Following the general algorithm, we introduce a new variable  $r_1$  meaning  $a \vee \neg b$ , and replace the original formula with the formula

$$(a \vee \neg b = r_1) \& (r_1 \vee c \vee \neg d) \& (\neg a \vee \neg b \vee \neg c).$$

Then, we replace the part  $a \vee \neg b = r_1$  with the corresponding CNF formula

$$(a \vee \neg b \vee \neg r_1) \& (a \vee b \vee r_1) \& (\neg a \vee \neg b \vee r_1) \& (\neg a \vee b \vee r_1).$$

The resulting formula is:

$$(a \vee \neg b \vee \neg r_1) \& (a \vee b \vee r_1) \& (\neg a \vee \neg b \vee r_1) \& (\neg a \vee b \vee r_1) \& \\ (r_1 \vee c \vee \neg d) \& (\neg a \vee \neg b \vee \neg c).$$