

## Solution to Homework 24

**Problem.** On the example of the formula  $(\neg a \vee b \vee c \vee \neg d) \& (a \vee \neg b \vee \neg c)$ , 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  $\neg a \vee \neg b$ , and replace the original formula with the formula

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

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

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

The resulting formula is:

$$\begin{aligned} &(\neg a \vee b \vee \neg r_1) \& (\neg a \vee \neg b \vee r_1) \& (a \vee b \vee r_1) \& (a \vee \neg b \vee r_1) \& \\ &(r_1 \vee c \vee \neg d) \& (a \vee \neg b \vee \neg c). \end{aligned}$$