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Tutorials for “Automated Reasoning”
Exercise sheet 4

Exercise 4.1: (3 P)

Use CDCL to decide satisfiability of the following clause set.

$$\begin{array}{lll} (1) & \neg P_1 \vee \neg P_2 & (2) & P_3 \vee P_2 \vee P_4 & (3) & P_2 \vee \neg P_4 \\ (4) & \neg P_3 \vee P_2 & (5) & P_1 \vee P_2 \vee P_4 & & \end{array}$$

Exercise 4.2: (4 P)

Use CDCL to decide satisfiability of the following clause set.

$$\begin{array}{lll} (1) & P_1 \vee P_2 \vee P_3 & (2) & P_4 \vee P_5 \vee P_6 & (3) & \neg P_3 \vee P_5 \\ (4) & \neg P_1 \vee \neg P_4 & (5) & \neg P_2 \vee \neg P_5 & (6) & \neg P_3 \vee \neg P_6 \\ (7) & \neg P_6 & (8) & \neg P_5 \vee P_2 & & \end{array}$$

Exercise 4.3: (4+2 P)

a) Use CDCL to decide satisfiability of the following clause set.

$$\begin{array}{lll} (1) & P_1 \vee P_2 \vee P_3 & (2) & P_1 \vee \neg P_2 & (3) & \neg P_1 \vee \neg P_2 \\ (4) & \neg P_1 \vee P_2 & (5) & P_4 \vee P_5 \vee \neg P_3 & (6) & P_4 \vee \neg P_5 \\ (7) & \neg P_4 \vee \neg P_5 & (8) & \neg P_4 \vee P_5 & & \end{array}$$

b) Consider the following resolution refutation of the clause set

$$\begin{array}{llll} (2)R(3) & \Rightarrow_{\text{RES}} & (9) & \neg P_2 & (9)R(1) & \Rightarrow_{\text{RES}} & (10) & P_1 \vee P_3 \\ (3)R(4) & \Rightarrow_{\text{RES}} & (11) & \neg P_1 & (11)R(10) & \Rightarrow_{\text{RES}} & (12) & P_3 \\ (12)R(5) & \Rightarrow_{\text{RES}} & (13) & P_4 \vee P_5 & (6)R(7) & \Rightarrow_{\text{RES}} & (14) & \neg P_5 \\ (14)R(13) & \Rightarrow_{\text{RES}} & (15) & P_4 & (7)R(8) & \Rightarrow_{\text{RES}} & (16) & \neg P_4 \\ (15)R(16) & \Rightarrow_{\text{RES}} & (17) & \perp & & & & \end{array}$$

and present a CDCL run that first learns clause (9) and then clause (10). You may use Restart to this end.

Exercise 4.4: (4 P)

Prove that a reasonable CDCL run never learns a tautology.

Submit your solution in lecture hall E1.3, Room 001 during the lecture on November 29. Please write your name and the date/time of your tutorial group (Wed-Fabian, Wed-Tobias) on your solution.

Joint solutions, prepared by up to three persons together, are allowed (but not encouraged). If you prepare your solution jointly, submit it only once and indicate all authors on the sheet.