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Software Engineering and Programming Languages
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Introduction to Logic Programming – WS 2023
Solutions for Exercise Sheet 5

1 Exercises

Exercise 2
Define the following statements in propositional logic:

1. The system heats if the cover is closed and the power is on.
2. If the lamp shines, the power is on.
3. The lamp shines.
4. The cover is closed.

Rewrite above statements to conjunctive normal form and prove by contradiction and resolution that the system heats.

In the following, we use some abbreviations:

system heats (H), cover is closed (C), power on (P), lamp shines (L).

Here, we use another notation enumerating all clauses of the conjunctive normalform. Of course, we could also use the clause set notation of exercise 1.

1. $C \wedge P \Rightarrow H \equiv \neg\mathbf{C} \vee \neg\mathbf{P} \vee \mathbf{H}$
2. $L \Rightarrow P \equiv \neg\mathbf{L} \vee \mathbf{P}$
3. $\mathbf{L}$
4. $\mathbf{C}$
5. $\neg\mathbf{H}$ (negated goal)
6. (1.) $\wedge$ (4.) $\xRightarrow{resolution}$ $\neg\mathbf{P} \vee \mathbf{H}$
7. (2.) $\wedge$ (3.) $\xRightarrow{resolution}$ $\mathbf{P}$
8. (6.) $\wedge$ (7.) $\xRightarrow{resolution}$ $\mathbf{H}$
9. (5.) $\wedge$ (8.) $\equiv \bot$