Automated Theorem Proving, SS 2016. Homework 2 (due March 30, 2016)

0. Remaining exercises from the previous homework.

1.(a) Write the tables of the boolean functions corresponding to $\neg$, $\wedge$, $\vee$, $\Rightarrow$, $\Leftrightarrow$. Using them, determine the truth value of:

1.(b) The formula $(A \wedge (A \Rightarrow B)) \Rightarrow B$ under the interpretation $I = \{A \rightarrow \mathbb{T}, B \rightarrow \mathbb{F}\}$.

1.(c) The formula $(P \Rightarrow Q) \iff (\neg Q \Rightarrow \neg P)$ under the interpretation $I = \{P \rightarrow \mathbb{F}, Q \rightarrow \mathbb{F}\}$.

1.(d) The formula $((A \vee B) \Rightarrow C) \iff ((A \Rightarrow C) \wedge (B \Rightarrow C))$ under the interpretation $I = \{A \rightarrow \mathbb{T}, B \rightarrow \mathbb{T}, C \rightarrow \mathbb{F}\}$.

(*Hint: The tables of boolean functions corresponding to* $\neg$, $\wedge$, $\vee$, $\Rightarrow$, $\Leftrightarrow$ *correspond to the tables which we have outlined in the first lab and used for defining the semantics of logical connectives.*)

2. Is it possible to have a formula that is both in conjunctive and disjunctive normal form. If so, give 5 examples.

3. Give an example which shows that proving equivalence of two formulas by bringing them into conjunctive normal form is incomplete. By incompleteness, we mean that there are examples of formulas which are equivalent but their conjunctive normal form is not the same.

4. Show that proving validity of a formula by conjunctive normal form is complete. Give an example. Completeness is formulated as follows: " If formula F is valid then there exists a proof of F." In our case, we have to construct a validity proof of F.

5. Show that proving unsatisfiability of a formula by disjunctive normal form is complete. Give an example.