

CMPT 310, Spring 2019, Written Assignment 05

Due date: February 11, 2019

Problem 1. Convert the following set of sentences to clausal form.

S1 : $A \Leftrightarrow (B \vee E)$.

S2 : $E \Rightarrow D$.

S3 : $C \wedge F \Rightarrow \neg B$.

S4 : $E \Rightarrow B$.

S5 : $B \Rightarrow F$.

S6 : $B \Rightarrow C$.

Give a trace of the execution of DPLL on the conjunction of these clauses.

Problem 2. Use resolution to prove the sentence $\neg A \wedge \neg B$ from the clauses in Problem 1.

Problem 3 (Optional). Is a randomly generated 4-CNF sentence with n symbols and m clauses more or less likely to be solvable than a randomly generated 3-CNF sentence with n symbols and m clauses. Explain.

Problem 4 (Optional). Any propositional logic sentence is logically equivalent to the assertion that each possible world in which it would be false is not the case. From this observation, prove that any sentence can be written in CNF.

Problem 5 (Optional). A sentence is in disjunctive normal form (DNF) if it is the disjunction of conjunctions of literals. For example, the sentence $(A \wedge B \wedge \neg C) \vee (\neg A \wedge C) \vee (B \wedge \neg C)$ is in DNF.

- Any propositional logic sentence is logically equivalent to the assertion that some possible world in which it would be true is in fact the case. From this observation, prove that any sentence can be written in DNF.
- Construct an algorithm that converts any sentence in propositional logic into DNF. (*Hint:* The algorithm is similar to the algorithm for conversion to CNF).
- Construct a simple algorithm that takes as input a sentence in DNF and returns a satisfying assignment if one exists, or reports that no satisfying assignments exists.

d. Apply the algorithms in (b) and (c) to the following set of sentences:

- $A \Rightarrow B$
- $B \Rightarrow C$
- $C \Rightarrow \neg A$.

e. Since the algorithm in (b) is very similar to the algorithm for conversion in to CNF, and since the algorithm in (c) is much simpler than any algorithm for solving a set of sentences in CNF, why is this technique not used in automated reasoning?