Principles of Knowledge Representation and Reasoning

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Exercise Sheet 1

Due: April 26th, 2018

Exercise 1.1 (Propositional Logic, 2+2+2)

(a) Is the infinite set of clauses

$$S = \{\neg A_1 \vee \neg A_2, A_2 \vee \neg A_3, A_3 \vee \neg A_4, A_4 \vee \neg A_5, \dots\}$$

satisfiable?

(b) Show that $(C \wedge (D \vee \neg C)) \vee (A \wedge \neg(B \vee A))$ is logically equivalent to $(C \wedge D)$ by applying the equivalences from the lecture.

(c) Prove that there is no polynomial algorithm that transforms an arbitrary propositional logic formula into a logically equivalent formula in CNF.

Hint: Find a family of formulae in DNF with n variables such that *every* equivalent formula in CNF must consist of an exponential number of clauses.

Exercise 1.2 (Resolution, 3+3)

(a) Use resolution to show that

$$F = (\neg A \wedge B \wedge C) \vee (A \wedge B) \vee (\neg A \wedge \neg C) \vee \neg B$$

is a tautology (valid).

(b) Use resolution to show that

$$\{B \wedge \neg C, (A \wedge B) \rightarrow (C \vee \neg A)\} \models \neg A$$