Assignment 2 – COMP 426: Automated Reasoning

Fall 2007
Due Sep 28 2006

Exercise 1: De Morgan's Law **(50 pts)**

In this exercise we try to prove the de Morgan's laws in constructive logic. One of the following conjectures only holds in classical logic. Give constructive proofs for all the conjectures which you believe are true in constructive logic and identify the one conjecture, which is not provable in constructive logic. Give your proofs using the proof tutor Tutch.

Provide a classical proof using the excluded middle for the conjecture which only holds in classical logic.

1. $\neg(A \wedge B) \supset (\neg A \vee \neg B)$.
2. $\neg\neg\neg A \supset \neg A$
3. $\neg A \vee \neg B \supset (\neg(A \wedge B))$.
4. $\neg A \wedge \neg B \supset \neg(A \vee B)$.
5. $\neg(A \vee B) \supset \neg A \wedge \neg B$.

Exercise 2: Annotated proofs **(25 pts)** Annotate the following two proofs (you have done these proofs in Assignment 1):

1. $(A \wedge B \wedge C) \supset (A \wedge B)$
2. $(A \vee (B \wedge C)) \supset ((A \vee B) \wedge (A \vee C))$
3. $(A \supset C) \wedge (B \supset C) \supset (A \vee B) \supset C$

Exercise 3: Provide proof terms for the following propositions **(25 pts)**

- $(A \supset B \supset C) \supset (A \supset B) \supset A \supset C$
- $(A \supset B \supset C) \supset B \supset A \supset C$
- $((A \supset B) \wedge (A \vee C)) \supset (B \vee C)$
- $(A \supset \neg A) \supset (\neg A)$
- $(\neg A \wedge \neg B) \supset \neg(A \vee B)$