

# Artificial Intelligence

## Joint class 5314 / 4320

### Exercises – 2/1/05

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**Exercise 1 (Quine method)** Use the Quine method to answer the following questions:

- Is  $((p \wedge q) \rightarrow (r \vee s)) \rightarrow (\neg p \vee \neg q \vee r \vee s)$  a tautology? Why?
- Is  $(u \rightarrow v) \wedge (\neg p \vee \neg s \vee t) \wedge (\neg(u \rightarrow v) \vee (v \wedge \neg t)) \wedge (\neg p \vee \neg s \vee \neg q) \wedge ((\neg p \vee \neg s \vee \neg q) \rightarrow (p \wedge s \wedge t))$  a contradiction? Why?
- Is  $(q \wedge t) \vee u$  equivalent to  $q \wedge (t \vee u)$ ? Why?
- Is  $(q \wedge t) \rightarrow u$  equivalent to  $q \wedge (t \rightarrow u)$ ? Why?
- Is  $(\neg q) \wedge t$  equivalent to  $\neg(q \wedge t)$ ? Why?

**Exercise 2** Prove that  $(p \wedge (p \rightarrow q) \wedge (q \rightarrow t) \wedge (t \rightarrow u) \wedge (u \rightarrow v)) \rightarrow v$ . Use two different methods to show that this proposition is true.

**Exercise 3** Prove that  $(p \wedge \neg v) \vee z \vee (q \wedge \neg v) \vee \neg p \vee (t \wedge \neg w) \vee (q \wedge \neg t) \vee (x \wedge \neg z) \vee \neg q \vee (v \wedge \neg x) \vee (p \wedge \neg t) \vee (w \wedge \neg z)$  is a true.

**Exercise 4** Prove that  $(p \wedge (\neg x \vee z) \wedge (\neg t \vee w) \wedge (\neg v \vee x) \wedge q \wedge ((\neg p \wedge \neg q) \vee (t \wedge v)) \wedge (\neg w \vee z)) \rightarrow z$  is true.

**Exercise 5** What is a CNF? DNF?

**Exercise 6** Put the following propositions in CNF:

- $a \vee b \vee c$
- $a \rightarrow b$
- $(a \wedge b) \vee c$
- $(a \rightarrow b) \rightarrow c$
- $(a \rightarrow b) \vee (\neg c \rightarrow (a \wedge d))$
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- $(a \wedge b) \vee (c \wedge d)$