ICS 171, Summer 2000: Lecture 6 Homework

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Due: August 31, 2000

(1) Use truth tables to show the following sentences are valid:

- $P \Rightarrow Q \Leftrightarrow \neg P \vee Q$
- $\neg(P \wedge Q) \Leftrightarrow \neg P \vee \neg Q$
- $\neg(P \vee Q) \Leftrightarrow \neg P \wedge \neg Q$

(2) Read Question 6.2 in the course text (Russell & Norvig, page 180). Be familiar with these equivalence relations.

(3) Question 6.3 in the course text (Russell & Norvig, page 180).

(4) Question 6.7 in the course text (Russell & Norvig, page 181)

(5) Consider the knowledge base:

> If it is hot and humid, then it is raining. If it is humid, then it is hot. It is humid.

(a) Describe a set of propositional letters which can be used to represent the knowledge base.

(b) Translate the KB into propositional logic using your propositional letters from part a.

(c) Is it raining? Answer this question by using logical inference rules with the KB.

(6) Modus Tollens is an inference rule which states

$$\frac{P \Rightarrow Q, \quad \neg Q}{\neg P}$$

Prove that Modus Tollens is sound. Use either a truth table or sound logical inference rules.

(7) Consider the knowledge base:

> If it is raining out then Ann puts the top up on her convertible. Ann did not put the top up on her convertible.

(a) Describe a set of propositional letters which can be used to represent the knowledge base.

(b) Translate the KB into propositional logic using your propositional letters from part a.

(c) Is it raining? Answer this question by using logical inference rules with the KB.

(8) Bonus Question. Consider the following:

> If the unicorn is mythical, then it is immortal, but if it is not mythical, then it is a mortal mammal. If the unicorn is either immortal or a mammal, then it is horned. The unicorn is magical if it is horned.

Answer the following questions using propositional logic.

(a) Is the unicorn horned?

(b) Is the unicorn magical?