

**CS 340 Written Homework Assignment #7**  
**Due: Beginning of Class Thursday June 1, 2009.**

Name \_\_\_\_\_

1. Prove that the following wff is a tautology by using the CP rule. No T's allowed.

$$(A \vee B \rightarrow C) \wedge (C \vee D \rightarrow E \wedge F) \rightarrow (A \rightarrow F).$$

2. Prove that the following wff is a tautology by using the CP rule. Do not use any T's.

$$(\neg A \vee \neg B) \wedge (B \vee C) \wedge (C \rightarrow D) \rightarrow (A \rightarrow D).$$

3. Prove that the following wff is a tautology by using the IP rule. Use T only for false.

$$(A \vee B) \wedge (A \rightarrow B) \rightarrow B.$$

4. Describe a model for each of the following wffs.

a.  $\exists x p(x) \wedge \exists x \neg p(x)$ .

b.  $\forall x \exists y (p(x, y) \wedge \neg p(y, x))$ .

5. Describe a countermodel for each of the following wffs.

a.  $\exists x p(x) \rightarrow \forall x p(x)$ .

b.  $\exists x p(x) \wedge \exists x q(x) \rightarrow \exists x (p(x) \wedge q(x))$ .

c.  $\forall y \exists x p(x, y) \rightarrow \exists x \forall y p(x, y)$ .

6. Let  $C(x)$  mean  $x$  is a child,  $V(x)$  mean  $x$  is a vegetable, and  $L(x, y)$  mean  $x$  likes  $y$ . Find a wff to formalize each of the following sentences about things.

a. Every child hates some vegetable.

b. Some child hates all vegetables.

c. Only adults like vegetables.

7. Prove the correctness of the following wff where  $x$  and  $y$  are integers.

$$\{x > y + 1\} x := x - 1; y := y + 1 \{x \geq y\}.$$

8. Prove the correctness of the following wff, where  $x$  and  $y$  take integer values.

$$\{\exists x (y = 2x)\} y := y - 5 \{\exists x (y = 2x + 1)\}.$$