WORKSHOP 1: §1.1-5 JANUARY 12, 2017

Name: _____

(1) Determine the truth value of $p \wedge \neg q \vee r$ given the truth values p: T, q: F, r: F. (Make sure to use the correct order of operations.)

(2) Consider the statement "If today is Thanksgiving, then tomorrow is Friday."
   (a) Is this a proposition?
   (b) Is it true or false?
   (c) What is its converse? Is that true or false?
   (d) What is its inverse? Is that true or false?
   (e) What is its contrapositive? Is that true or false?
   (f) What is its negation? Is that true or false?

(3) Why is the proposition "if Ben owns a unicorn, then $0 = 1$" true?

(4) Let h be "John is healthy," w be "John is wealthy," and s be "John is wise." Rewrite each of the following using the symbols $\neg, \wedge, \vee, \rightarrow, h, w, s$:
   (a) John is healthy and wealthy but not wise.
   (b) John is not wealthy but he is healthy and wise.
   (c) John is neither healthy, wealthy, nor wise.
   (d) John is neither wealthy nor wise, but he is healthy.
   (e) John is wealthy, but he is not both healthy and wise.
   (f) John is wise only if he is healthy.
   (g) John's being healthy and wise is sufficient to make him wealthy.

(5) (a) Complete the following truth table.

p	q	r	$q \vee r$	$p \wedge (q \vee r)$	$p \wedge q$	$p \wedge r$	$(p \wedge q) \vee (p \wedge r)$	$p \wedge (q \vee r) \leftrightarrow (p \wedge q) \vee (p \wedge r)$
T	T	T						
T	T	F						
T	F	T						
T	F	F						
F	T	T						
F	T	F						
F	F	T						
F	F	F						

   (b) Is the last proposition above a tautology, a contradiction, or neither?
   (c) What does that say about the propositions $p \wedge (q \vee r)$ and $(p \wedge q) \vee (p \wedge r)$?
   (You've just finished proving one of §1.5's Laws of Logic.)

(6) In our order of operations, we didn't specify whether $p \vee q \vee r$ should mean $(p \vee q) \vee r$ or $p \vee (q \vee r)$. Why not?

(7) (Smullyan's Knights and Knaves, adapted) An island consists of a tribe of Honest people who always tell the truth and a tribe of Liars who always lie. You meet there Alice and Bob. Alice says to you "Bob is Honest," and Bob tells you "Alice and I are from opposite tribes." Can you determine which tribes Alice and Bob are from?

   You can do this using a truth table and cleverly chosen propositions. Let p be the proposition "Alice is Honest" and q be the proposition "Bob is Honest." The key idea is that the truth value of p is the same as the truth value of Alice's statement (if Alice is Honest, then her statement is true; if Alice is a Liar, then her statement is false). When you complete an appropriate truth table, that fact (and the analogous fact about Bob) will rule out some of the possible rows.

A linguistics professor was lecturing to his class one day. “In English,” he said, “a double negative forms a positive. In some languages though, such as Russian, a double negative is still a negative.

“However,” he pointed out, “there is no language wherein a double positive can form a negative.”

A voice from the back of the room piped up, “Yeah, right.”