CSci 1302 Assignment 3

Due Wedn., Feb. 10 in class

Problem 1 (9 points). Prove the following equivalences:

1. $(p \to q) \wedge (p \to r) \wedge p \equiv p \wedge q \wedge r$
2. $p \to (q \to r) \equiv (p \wedge q) \to r$
3. $p \leftrightarrow (q \wedge r) \equiv (p \to q) \wedge (p \to r) \wedge (\tilde{} p \to \tilde{} (q \wedge r))$

Problem 2 (4 points). Exercises 10, 11 p. 41.

Problem 3 (6 points). Exercises 42, 44 p. 43. Note that t here is just a name of a proposition, not a tautology.

Problem 4 (16 points). Prove the following using deductive proofs (not truth tables).

1. $(p \vee q) \to r$

   $\therefore \tilde{} r \to \tilde{} p$

2. $\tilde{} (p \to q)$
   $p \to r$

   $\therefore r$

3. $p \wedge \tilde{} r$ (use a proof by contradiction)
   $q \to r$

   $\therefore \tilde{} (p \to q)$

4. $(p \wedge q) \leftrightarrow r$

   $\therefore (r \to p) \wedge (r \to q)$

Problem 5 (6 points). Which of the following two arguments are valid (if any)? Justify your answer the following way: use deductive proofs or truth tables to prove a valid argument; show at least one row of a truth table to disprove an invalid argument.
You might want to guess the answer first, and then check your intuition.

A. $(p \vee q) \rightarrow s$
$(q \vee r) \rightarrow s$

$\therefore q \rightarrow s$

B. $(p \wedge q) \rightarrow s$
$(q \wedge r) \rightarrow s$

$\therefore q \rightarrow s$