

## CSci 1302 Assignment 3

Due Wedn., Feb. 13 in class

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

1.  $p \vee (q \wedge r \wedge s) \equiv (p \vee q) \wedge (p \vee r) \wedge (p \vee s)$
2.  $(p \wedge q \wedge r) \vee s \equiv (p \vee s) \wedge (q \vee s) \wedge (r \vee s)$
3.  $p \leftrightarrow (q \wedge r) \equiv (p \rightarrow q) \wedge (p \rightarrow r) \wedge (\sim p \rightarrow \sim(q \wedge r))$

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

**Problem 3 (6 points).** Exercises 42, 44 p. 43.

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

1. 
$$\frac{(p \vee q) \rightarrow r}{\therefore \sim r \rightarrow \sim p}$$
2. 
$$\frac{\sim(p \rightarrow q) \quad p \rightarrow r}{\therefore r}$$
3. 
$$\frac{p \wedge \sim r \quad (p \rightarrow r)}{\therefore \sim(p \rightarrow q)}$$
 (use proof by contradiction)
4. 
$$\frac{(p \wedge q) \leftrightarrow r}{\therefore (r \rightarrow p) \wedge (r \rightarrow q)}$$

**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 the truth table to disprove an invalid argument.

You might want to guess the answer first, and then check your intuition.

$$\begin{array}{l} A. \quad (p \vee q) \rightarrow s \\ \quad (q \vee r) \rightarrow s \\ \hline \therefore q \rightarrow s \end{array}$$

$$\begin{array}{l} B. \quad (p \wedge q) \rightarrow s \\ \quad (q \wedge r) \rightarrow s \\ \hline \therefore q \rightarrow s \end{array}$$