COSC 030, Fall 2016: Problem Set #1

Assigned: Tuesday, 9/1/16.
Due: Tuesday, 9/13, at the beginning of class (hand in hard copy).
Lectures Covered: Weeks 1 and 2.
Academic Integrity: You must work alone on the problem set and not consult outside sources (with the exception of the professor and teaching assistants). See the syllabus for details on the academic integrity policy for problem sets.

Problems

1. Let proposition $p =$ "it is raining today," proposition $q =$ "it is a holiday today", and proposition $r =$ "the traffic is bad today." Describe in words the following compound proposition: $\neg r \rightarrow p \oplus q$.

2. Consider the proposition $\neg r \rightarrow p \oplus q$ where p, q, and r are defined as in the previous problem. Assume you check and it turns out that the traffic is bad, but it is not raining, and it is not a holiday. Is this proposition true or false?

3. Prove that $(p \wedge q) \vee q \equiv (q \vee p) \wedge q$ by drawing the relevant truth table.

4. Prove that $(p \wedge q) \vee q \equiv (q \vee p) \wedge q$ by using the method of replacing propositions with known equivalent propositions. (Hint: Your answer should use one of the distributive laws learned in class as well as the following equivalence: $s \vee s \equiv s$.)

5. Demonstrate why the following argument form is *not* valid:

   $\neg(p \wedge q) \rightarrow r$
   $r \leftrightarrow s$

   $\therefore s$

6. Add an additional premise to the argument form from above that makes it valid. Your premise *cannot* include r or s.

7. Consider the following theorem:

   > **Theorem.** Assume that if someone is tall then they are confident, and if someone is shy then they are not confident. My friend bob is shy, therefore he is not tall.

   Prove this theorem using the direct proof method. You can use any rules of inference or propositional equivalences discussed in class. (Hint: work with an argument *form* in your proof.)