CISC 3410 Fall 2012, Homework 5

1. Which, if any, of the following sentences is a proposition? In each case, justify your answer.

   (a) Twice two is four.

   (b) The square root of ten is three.

   (c) $5 > 6$

   (d) Please write a specimen of your signature in the space provided.

   (e) Would you believe Lady Gaga once stood in exactly that spot?

   (15 points)

2. Using the following propositions:

p	Its is raining
q	I have an umbrella
r	I get wet

   Formulate the following expressions in words:

   (a) $(p \wedge q)$

   (b) $(p \wedge \neg q) \wedge r$

   (c) $\neg p \wedge \neg r$

   (d) $p \wedge (q \vee r)$

   (e) $\neg p \vee r$

   (10 points)

3. For each of the propositions in the previous question, write out the truth table.

   (15 points)

4. For each of the propositions in question 2, say whether it is: consistent, inconsistent and/or a tautology.

   (15 points)

5. Use the truth table method to decide whether the following statements are true:

   (a) $(p \wedge q) \models \neg(p \vee q)$

   (b) $p, (p \Leftrightarrow q) \models p \wedge q$

   (c) $(p \Rightarrow q) \models ((p \Rightarrow r) \Rightarrow (p \Rightarrow r))$

   (15 points)

6. There is a list of natural deduction proof rules for propositional logic on the class web page. Using these, try to prove the following:

   (a) $(p, p \Rightarrow (q \wedge r)) \vdash (p \wedge r)$

   (b) $(p, p \Rightarrow (q \wedge r)) \vdash (s \vee r)$

   (c) $(p \wedge (p \Rightarrow (q \wedge r))) \vdash (p \Rightarrow r)$

   (d) $(p \Rightarrow (q \wedge r)) \vdash (p \Rightarrow r)$

   (e) $(\neg q, p \Leftrightarrow (q \wedge r)) \vdash \neg p$

   (30 points)