

CSc 74010 Fall 2011, Homework 2

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?
 - (f) Yohan Blake, who won at the world championship after Usain Bolt was disqualified on a false start, ran a personal-best 9.82 seconds Thursday.

(20 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) $\neg p \vee r$
- (f) $(q \wedge \neg r) \vee (\neg q \wedge r)$

(15 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) $(\neg q, p \leftrightarrow (q \wedge r)) \vdash \neg p$

(20 points)