CS243 Homework Assignment 1

Due Tuesday, September 11

Please hand in a hard copy of your solutions before class on the due date. The answers to the homework assignment should be your own individual work. You may discuss problems with other students in the class; however, your write-up must mention the names of these individuals.

1. (10 points) Construct a truth table for the following formula:

$$((p \wedge \neg q) \rightarrow (r \vee p))$$

2. (16 points, 4 points each) Let s be the proposition "I will go swimming", h the proposition "It's hot", and r the proposition "It's raining". Express the following sentences in propositional logic:

   (a) "If it's hot and it isn't raining, I will go swimming"

   (b) "I will go swimming unless it is raining"

   (c) "I will go swimming only if it is hot"

   (d) "For me to go swimming, it is necessary that it's not raining"

3. (12 points, 3 points each) Consider the proposition "If an animal is a rabbit, then it is also a mammal."

   (a) State in English the contrapositive of this proposition

   (b) State in English the converse of this proposition

   (c) State in English the inverse of this proposition

   (d) Of the three propositions above in (a)-(c), identify which ones are true and which ones are false

4. (18 points, 6 points each) For each of the formula below, state whether they are valid, unsatisfiable, or contingent. Prove your answer using a truth table.

(a) $(\neg p \lor q) \to q$

(b) $(((p \to q) \to p) \to p)$

(c) $\neg((\neg(p \land q) \to (p \to \neg q)))$

5. (10 points) Prove that $\neg((p \lor q) \to \neg q)$ and q are equivalent by using the logical equivalences we showed in class. Specifically, you may use any of the equivalences given in Table 6 , p.24 of the book and the equivalence $a \to b \equiv \neg a \lor b$. You should clearly label the equivalence you use (e.g., De Morgan's law, absorption law etc.)