Homework Assignment #4 (Logic)

1 Write truth tables for the following logic expressions:

    a. p''

    b. $(p' \wedge q)'$

    c. $p \Rightarrow (q \vee r')$

2 For each of the following propositions, express it as a logic expressions. You should introduce lower case letters to represent the simple propositions, and use appropriate logic operators such as $\neg, \wedge, \vee, \Rightarrow \Longleftrightarrow$ to connect them. Afterwards, write the truth table for the expressions, and comment on when the whole propositions are true (or false).

    a. You will get better in writing if you keep practice.

b. You will get better in writing only if you keep practice.

c. Either it's too hot, or it's too cold. (Note, obviously, it's not both too hot and too cold).

d. To grasp someone's mathematics background, it is sufficient to have them pronounce the name "Euler".

e. You are legally driving in Pennysylvania only if you are 16 years old.

3 Prove that the following two logic expressions are logically equivalent: $p \wedge (q \vee r)$, and $(p \wedge q) \vee (p \wedge r)$.

4 Are the follwoing propostiions tautology or contradiction? Explain your answer.

(a) $p \wedge (p \Rightarrow q) \wedge q'$

(b) $(p \wedge q)' \vee (p \wedge q)$

5 Recall the Smullyann islanders (a fictional island named after logician Raymond Smullyan), who either are truth-tellers who always tell the truth, or liars who always lie. Suppose you meet two islanders, A and B. A says, "we are same kind of islanders", and B says "We are different kinds of islands". Same kind means both are truth-tellers or both are liars, and different kinds means one is truth-teller and another is liar.