Hometask #3

1. Write negations for each of the following statements:
   a. John is 6 feet tall and he weighs at least 200 pounds.
   b. The bus was late or Tom's watch was slow.

2. Construct truth tables for the statement forms:
   a. $(\sim p \vee q) \rightarrow \sim q$
   b. $(p \wedge \sim q) \rightarrow r$

3. Let **p, q**, and **r** be the propositions
   ***p**: Grizzly bears have been seen in the area.*
   ***q**: Hiking is safe on the trail.*
   ***r**: Berries are ripe along the trail.*

   Write these propositions using **p, q**, and **r** and logical connectives (including negations).
   a) Berries are ripe along the trail, but grizzly bears have not been seen in the area.
   b) Grizzly bears have not been seen in the area and hiking on the trail is safe, but berries are ripe along the trail.
   c) If berries are ripe along the trail, hiking is safe if and only if grizzly bears have not been seen in the area.

4. Find the bitwise OR, bitwise AND, and bitwise XOR of each of these pairs of bit strings.
   a. 101 1110, 010 0001
   b. 1111 0000, 1010 1010

5. Given any statement form, is it possible to find a logically equivalent form that uses only ~ and ∧?

Q: Prove or Disprove the following statements by completing the truth table for 6-8:

p	q
T	T
T	F
F	T
F	F

6. Prove the following,
   i. Disjunctions is Commutative? (p∨ q), is equivalent to (q ∨ p)?
   ii. Disjunction is Associative? (p ∨ q) ∨r, is equivalent to p ∨ (q ∨ r)?

7. Prove that the statements given bellow are logically equivalent (or not). Justify your answers.
   i. $\neg (p \wedge q)$ and $\neg p \wedge \neg q$?
   ii. $\neg (p \wedge q)$ and $\neg p \vee \neg q$?

8. Prove the statements
   i. Is implication logically equivalent to its inverse?$(p \rightarrow q)$ and $(\neg p \rightarrow \neg q)$?
   ii. Is converse logically equivalent to the contrapositive? $(q \rightarrow p)$ and $(\neg p \rightarrow \neg q)$?

9. Symbolically prove or disprove the following with explanation on each step on used law.
   i. $(p \leftrightarrow q)$ equivalent to $(p \rightarrow q) \rightarrow (q \rightarrow p)$?
   ii. $(p \wedge q)$ equivalent to $(p \vee \neg q) \wedge q$?