Discrete Structure

Assignment # 1

Q1. Write each of these statements in the form "if *p*, then *q*" in English

i. A sufficient condition for the warranty to be good is that you bought the computer less than a year ago.
ii. Ali gets caught whenever he cheats.
iii. You can access the website only if you pay a subscription fee.
iv. Getting elected follows from knowing the right people.
v. The apple trees will bloom if it stays warm for a week.
vi. That the Pistons win the championship implies that they beat the Lakers.
vii. It is necessary to walk 8 miles to get to the top of Long's Peak.

Q2. State the converse, contrapositive, and inverse of the conditional statement (also indicate the hypothesis p and conclusion q part)

i. If Erik is a poet, then he is poor.
ii. Only if Marc studies will he pass the test.
iii. Asad will go swimming unless the water is too cold.

Q3: Construct a truth table for the compound proposition

i. $(p \rightarrow q) \vee (\sim p \rightarrow r)$
ii. $(q \rightarrow \sim p) \leftrightarrow (p \leftrightarrow q)$

Also state that what conclusion you can draw.

Q4. Show the equivalence of given statements without using tables.

i. $\sim(p \wedge q) \vee (\sim p \wedge q) \equiv \sim p$
ii. $(p \rightarrow r) \wedge (q \rightarrow r) \equiv (p \vee q) \rightarrow r$

Q5. Verify that the proposition $(p \wedge q) \wedge \sim(p \vee q)$ is a contradiction.

Q6. Let *p* denote "He is rich" and let *q* denote "He is happy." Write each statement in symbolic form using *p* and *q*. Note that "He is poor" and "He is unhappy" are equivalent to ¬*p* and ¬*q*, respectively.

i. If he is rich, then he is unhappy.
ii. It is necessary to be poor in order to be happy.
iii. He is neither rich nor happy.
iv. To be poor is to be unhappy.

Q7. 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.

i. Berries are ripe along the trail, but grizzly bears have not been seen in the area.
ii. Grizzly bears have not been seen in the area and hiking on the trail is safe, but berries are ripe along the trail.
iii. If berries are ripe along the trail, hiking is safe if and only if grizzly bears have not been seen in the area.
iv. It is not safe to hike on the trail, but grizzly bears have not been seen in the area and the berries along the trail are ripe.
v. For hiking on the trail to be safe, it is necessary but not sufficient that berries not be ripe along the trail and for grizzly bears not to have been seen in the area.
vi. Hiking is not safe on the trail whenever grizzly bears have been seen in the area and berries are ripe along the trail.

Q8: There are two people, A, and B, each of whom is either a knight or knave. Suppose A says, "I am a knave, but B is not". What are A and B?

Q9: There are three people, A, B and C, each of whom is either a knight or knave. Suppose A and B makes the following statements, then what are A, B and C?
A says, "All of us are knaves".
B says, "Exactly one of us is a knight".

Q10. You are about to leave for school in the morning and discover that you don't have your glasses. You know the following statements are true:

a) If my glasses are on the kitchen table, then I saw them at breakfast.
b) I was reading the newspaper in the living room or I was reading the newspaper in the kitchen.
c) If I was reading the newspaper in the living room then my glasses are on the coffee table.
d) I did not see my glasses at breakfast.
e) If I was reading my book in bed, then my glasses are on the bed table.
f) If I was reading the newspaper in the kitchen, then my glasses are on the kitchen table.

Where are the glasses?