Q₁

(i) Represent as propositional expressions:

Tom is a math major but not computer science major and use De Morgan's Laws to write the negation of the expression, and translate the negation in English.

(ii) Let

p : "John is healthy"
q : "John is wealthy"
r : "John is wise"

Represent:

John is healthy and wealthy but not wise,

John is not wealthy but he is healthy and wise,

John is neither healthy nor wealthy nor wise.

Q₂ Given the hypotheses:

(i) "It is not sunny this afternoon and it is colder than yesterday"
(ii) "We will go swimming only if it is sunny"
(iii) "If we do not go swimming, then we will take a canoe trip"
(iv) "If we take a canoe trip, then we will be home by sunset"

Does this imply that "we will be home by sunset"?

Q₃ Find the DNF of $(p \to q) \to \sim r$.

Q₄ Find the DNF of $p \veebar q$.

Q₅ Find an expression equivalent to $p \to q$ that uses only $\wedge$ and $\sim$.

Q₆ Convert the following statement into CNF. $(p \to q) \to (\sim r \wedge q)$.

Q₇ Show that

(1) $(p \rightarrow q) \wedge \sim q \implies \sim p$.

(2) $p \wedge (p \rightarrow q) \rightarrow \sim q$ is a contingency using a truth table.

(3) $p \rightarrow (p \vee q)$ is a tautology using a truth table.

(4) $(p \wedge q) \rightarrow p$ is a tautology using the table of logical equivalences.

(5) $[(p \rightarrow q) \wedge (q \rightarrow r)] \implies (p \rightarrow r)$ using a truth table.

(6) $[(p \vee q) \wedge \sim p]) \implies q$ using a truth table.

(7) $(p \wedge q) \rightarrow (p \vee q)$ is a tautology using the table of logical equivalences.

(8) $[p \rightarrow (q \rightarrow r)] \equiv [(p \wedge q) \rightarrow r]$ using a truth table.

(9) $[p \rightarrow (q \rightarrow r)] \equiv [q \rightarrow (p \rightarrow r)]$ using a truth table.

(10) $[(p \wedge q) \rightarrow p] \equiv [q \rightarrow (p \vee \sim p)]$ using a truth table.

(11) $[(p \rightarrow q) \wedge (p \rightarrow r)] \equiv [p \rightarrow q \wedge r]$ using a truth table.

(12) $[(p \rightarrow q) \wedge (p \rightarrow r)] \equiv [(p \vee q) \rightarrow r]$ using a truth table.

(13) $[(p \rightarrow q) \wedge (r \rightarrow s)] \implies [(p \vee r) \rightarrow (q \vee s)]$ using a truth table.

(14) $[(p \leftrightarrow q) \wedge (r \leftrightarrow s)] \implies [(p \vee r) \leftrightarrow (q \vee s)$ using a truth table.

(15) $[(p \rightarrow q) \wedge (p \vee r)] \implies (q \vee r)$ using a truth table.

(16) Is $\veebar$ commutative or associative?

(17) Is $\veebar$ distributive over $\wedge$, $\vee$, or $\rightarrow$?

(18) Is this true $p \veebar q \equiv p \leftrightarrow \sim q$?

Q8 Determine whether the following arguments are valid or invalid:

(1) Premises:

(i) If I read the newspaper in the kitchen, my glasses would be on the kitchen table.
(ii) I did not read the newspaper in the kitchen.

Conclusion : My glasses are not on the kitchen table.

(2) Premises:

(i) If I don't study hard, I will not pass this course
(ii) If I don't pass this course I cannot graduate this year.

Conclusion: If I don't study hard, I won't graduate this year.