Math 234

Logical Statements Day 2

Discuss the following problems with the people at your table.

1. First, replace statements with letters to write the logical form of Argument 1.

   Argument 1:

   This day is sunny or this day is cloudy.
   This day is not cloudy.
   Therefore, this day is sunny.

   Given that Argument 2 has the same logical form as Argument 1, what statement goes in the blank?

   Argument 2:

   This sport is in the Olympics or this sport is not serious.
   This sport is serious.

   Therefore, _____.

2. Define the following statements:

   m = "This house has green paint on its exterior."
   n = "This house has gold paint on its exterior."
   p = "This house is in Wisconsin."

   Now write the following statements in symbolic form using the symbols $\vee$, $\wedge$, and $\sim$.

   (a) This house has both green and gold paint, but is not in Wisconsin.

   (b) This house is in Wisconsin and has green or gold paint.

   (c) This house is in Wisconsin and has green or gold paint, but not both. Be careful!

   (d) This house has neither green nor gold paint.

   (e) This house has neither green nor gold paint but is in Wisconsin.

3. For each of the following statements, determine whether an *inclusive or* or an *exclusive or* is intended. Explain your answers.

   (a) Coffee or tea comes with dinner.

   (b) A password must contain letters and numbers or be at least 8 characters long.

   (c) The prerequisite for this course is CSCI 221 or MATH 126.

   (d) Publish or perish.

4. Complete the following truth table for the statement $(p \vee q) \vee (\sim p \wedge \sim q)$.

p	q	$\sim p$	$\sim q$	$p \vee q$	$\sim p \wedge \sim q$	$(p \vee q) \vee (\sim p \wedge \sim q)$
T	T					
T	F					
F	T					
F	F					

   What kind of statement is $(p \vee q) \vee (\sim p \wedge \sim q)$?

5. For each pair of statements below, create two truth tables to determine whether the statements are logically equivalent.

   (a) $\sim(p \vee q)$ and $\sim p \wedge \sim q$

   (b) $\sim(p \wedge q)$ and $\sim p \vee \sim q$

6. Come up with a statement form involving p and q that is a contradiction.

7. Express the following statement using logical symbols:

   The automated reply cannot be sent when the file system is full.

8. Complete the following truth table to compare the truth values of the statements $p \to q$, $q \vee \sim p$, and $p \wedge \sim q$.

p	q	$\sim p$	$\sim q$	$p \to q$	$q \vee \sim p$	$p \wedge \sim q$
T	T					
T	F					
F	T					
F	F					

   What statement is logically equivalent to $\sim(p \to q)$?

   This is the *negation* of $p \to q$.

9. Write the negation, converse, inverse, and contrapositive of the following statement.

   If you have a ticket, then you can board the flight.

   (a) Negation:

   (b) Converse:

   (c) Inverse:

   (d) Contrapositive:

10. Write the negation, converse, inverse, and contrapositive of the following statement.

If my major is computer science, then I take Math 234.

(a) Negation:

(b) Converse:

(c) Inverse:

(d) Contrapositive:

11. Which of the following are logically equivalent?

a statement its converse its inverse its contrapositive

12. Determine whether $(p \to r) \vee (q \to r)$ and $(p \wedge q) \to r$ are logically equivalent.