Chapter 1.1-1.2: Propositional Logic
Monday, June 22

1. Let p, q, and r be the propositions "Bears have been seen in the area," "hiking is safe on the trail," and "berries are ripe along the trail," repsectively. Write these propositions using p, q, r and logical connectives:

   (a) Berries are ripe along the trail, but bears have not been seen in the area.

   (b) If berries are ripe along the trail, hiking is safe if and only if bears have not been seen in the area.

   (c) Hiking is not safe on the trail whenever bears have been seen in the areas and berries are ripe along the trail.

2. Rewrite the following phrases in the form "If P, then Q." State the contrapositive, inverse, and converse. Decide whether the biconditional "P if and only if Q" is implied.

   (a) In order to run for president, you must be at least 35.

   (b) You can't make an omelet without breaking eggs.

   (c) Surrender or die!

   (d) Be careful or you might hurt yourself.

   (e) No shirt, no shoes, no service.

   (f) Everything will be alright if we just keep dancing like we're 22.

   (g) A watched pot never boils.

   (h) You can't order alcohol unless you're over 21.

   (i) The Warriors will win as long as they play well.

   (j) The Cubs lose whenever I watch them play.

3. There is a restaurant in Chicago that displays the following sign:

   > No shirt
   > No shoes
   > No pets
   > No bikes
   > No service

   Please explain.

4. Construct truth tables for each of the following:

   (a) not (P and Q)

   (b) (not P) or (not Q)

   (c) (P or Q) $\Rightarrow$ P

5. Consider the statment "All girls are good at math." Which of the following statements mean the same thing as this statement? Which ones mean the same thing as its negation?

   (a) All girls are bad at mathematics.
   (b) All girls are not good at mathematics.
   (c) Some girl is bad at mathematics.
   (d) Some girl is not good at mathematics.
   (e) All children who are good at mathematics are girls.
   (f) All children who are not good at mathematics are boys.

6. Which of the following are necessary conditions for a number n to be divisible by 6? Which are sufficient conditions? Reword your responses as if-then statements.

   (a) n is divisible by 3.
   (b) n is divisible by 9.
   (c) n is divisible by 12.
   (d) n^2 is divisible by 6.
   (e) $n = 12$.
   (f) n is divisible by 2 and 3.

   Welcome to the island of Knights and Knaves! Knights are virtuous and always tell the truth. Knaves are wicked and always lie. Suppose you meet two people, A and B. What can you tell about them from their statements?

7. A says "I am a knight" and B also says "I am a knight."

8. A says "We are both knights" and B says "A is lying!"

9. A says "We are both knaves" and B says nothing.

10. A says "B is a knight" and B says "A is a knight."

11. A says "Either I am a knave or B is a knight" and B says nothing.