

## Math 8 - Home Work

Due: October 11, 2007

1. **Every/Only.** Sometimes sentences with the words “only” and “every” can be conditional statements in disguise. For example, “Every even number is a multiple of two.” can be rephrased as “If a number is even, then it is a multiple of two.”

Rewrite the following propositions as conditional statements in the form “If ..., then ...”.

- (a) Every small dog is a puppy.
- (b) Everybody who speaks Spanish also speaks Italian.
- (c) I eat all vegetables.

Similarly, for “only”, the sentence “I only eat spaghetti.” can be rephrased as “If it is not spaghetti, then I will not eat it.” or “If I eat something, then it is spaghetti.” Notice that the second rephrasing is just the contrapositive of the first.

Rewrite the following as conditional statements in the form “If ..., then ...” in two equivalent ways (i.e., your two sentences should be the contrapositives of one another).

- (d) I only have class on Fridays.
- (e) Only squirrels have fluffy tails.
- (f) It only rains in the mornings.

2. (Optional, but recommended) You may have noticed that the word “only”, like the word “unless” in sect. 1.3 ex. 4, can be ambiguous. For example, does “I only eat spaghetti.” really mean the same thing as “If I eat something, then it is spaghetti.”? Or does it mean “I eat something if and only if it is spaghetti.”?

Think about this question for (d)-(f) above. In each case, which interpretation of “only” seems more appropriate? Also, how does the meaning of “I only eat spaghetti.” compare to the meaning of “I will not eat it, *unless* it is spaghetti.”? Can you rewrite the sentences (d)-(f) using “unless”? Finally, try to decide whether the ambiguity with “only” is equivalent to the ambiguity with “unless” that you explored in 1.3 ex. 4.

3. Recall that **Modus Ponens** is the rule of inference that says “If  $P$  and  $P \Rightarrow Q$  are true propositions, then  $Q$  is also true.” Rewrite this conditional statement symbolically. Then, check that what you get is a tautology by constructing a truth table. (In fact, any logical rule of inference corresponds to a tautology.)