CMPS/MATH 2170 Discrete Mathematics – Fall 14

9/10/14

2. Homework

Due **9/19/14** at the beginning of class

Remember, you are allowed to turn in homeworks in groups of two. One writeup, with two names.

1. **Translation (4 points)**
   Let $C(x, y)$ mean that student x is enrolled in class y, where the domain for x consists of all students at Tulane and the domain for y consists of all classes being offered at Tulane.
   (a) Express the statement below by a simple English sentence:
   $\exists x \exists y \forall z : ((x \neq y) \wedge (C(x, z) \leftrightarrow C(y, z)))$
   (b) Express the statement below using symbolic notation:
   For every student there are at least two classes that he or she has not taken.

2. **Negation (6 points)**
   For each of the propositions below, express it using symbolic notation, then negate this expression in symbolic notation, and finally translate the negated expression back into English.
   (a) Everything is in the correct place and in excellent condition.
   (b) There is a student at Tulane who has taken every course offered by the Computer Science department.

3. **More Quantifiers (2 points)**
   Express the following statements using predicates, quantifiers, logical connectives, and mathematical operators where the domain consists of all integers:
   The difference of two negative integers is not necessarily negative.

4. **Rules of Inference (6 points)**
   (a) Use rules of inference to show that the hypotheses "If it does not rain or if it is not foggy, then the sailing race will be held and the lifesaving demonstration will go on", "If the sailing race is held, then the trophy will be awarded", and "The trophy was not awarded" imply the conclusion "It rained".
   (b) For each of these arguments determine whether the argument is correct or incorrect and explain why.
   i. If a student is enrolled in the university, that student has lived in a dormitory. Mia has never lived in a dormitory. Therefore, Mia is not enrolled in the university.
   ii. If a car is a convertible, it is fun to drive. Isaac's car is not a convertible. Therefore, Isaac's car is not fun to drive.

5. **Proofs (6 points)**
   (a) Disprove that for all real numbers a and b, if $a^2 = b^2$ then $a = b$.
   Hint: What is $\neg(p \rightarrow q)$*?*
   (b) Prove that if m and n are integers and mn is even, then m is even or n is even.