Concepts of Math: Recitation 1

August 31, 2015

Welcome and Introductions

Your name and email address should be written on the board, together with a note saying that office hours will be determined this week. You will have extra copies of the syllabus. Please announce that these are available, but don't go over the syllabus again, except perhaps to note how and when to turn in homework.

Take the opportunity to tell the students a little bit about yourself: why you decided to be a TA, why you like math, what it means to you.

Interesting Little Math Problems

Let's get them thinking and engaged right from the start. In the first class we will go over why a chess board with its opposing corners removed can't be tiled by dominoes. We will also do numbers 1 and 4 from the student preface of the book.

Here are some suggestions for recitation. Note that it is great to get students participating. Do not rush through these problems, take your time. Make sure all (or almost all) students understand what is going on.

1. Two opposite corner squares are deleted from an eight by eight checker-board. Prove that the remaining squares cannot be covered exactly by dominoes (rectangles consisting of two adjacent squares).

2. You place a bean on each square of a 6x3 board. The beans can be moved horizontally or vertically to neighboring squares, but you must move exactly two simultaneously in each step. Can you collect all of them to one square?

3. Construct the truth table for the compound proposition $(p \vee \neg q) \to (p \wedge q)$.

4. Let p and q be the propositions
      p: Swimming at the South Carolina shore is allowed.
      q: Sharks have been spotted near the shore.
   Express each of these propositions as an English sentence

(a) $\neg p$

(b) $\neg p \lor q$

5. Define contradiction. A statement that is always false, regardless of the truth values assigned to its variables, is called a contradiction. Show that $(p \land q) \land ((\neg p) \lor (\neg q))$ is a contradiction. Use the truth table.

6. Define tautology. A statement that is always true, regardless of the truth values assigned to its variables, is called a tautology. Show that $((p \to q) \land (q \to r)) \to (p \to r)$ is a tautology. Use the truth table. Explain in plain English why this answer makes sense.

7. The logical operator NAND (written $p \mid q$, where p, q are propositions) is defined to be true when either p or q, or both, are false, and it is false when both p and q are true. Find an equivalent compound proposition to $p \land q$ that uses only the NAND operator. Justify your answer.

Questionnaire and Goodbyes

Have the students complete the math section questionnaire (leave 5-7 minutes for this). Tell them you hope they had fun and that this class is going to be fantastic!