Intro to Proofs Day 9 Outline (This class meets for 1 hour and 50 minutes.)

**Need 3.3 worksheets, quizzes and synthesis to hand back, snacks/pens**

**Discuss Synthesis/Exam 1**  [0-5 minutes]

* It is unacceptable to just not do parts of the synthesis. Start it early, email me and ask, come to office hours.
* How it’s graded. How revisions work.

**Present Synthesis Activities** [5-20 minutes]

* Section 3.1 #3b
  + For all integers a and b with a not 0, if 6|ab then 6|a or 6|b.
  + Counterexample: a = 3, b =2
* Section 3.1 #9
  + A = 7 (mod 8) and B = 3 (mod 8)
  + 8k=a-7 and 8j = b-3. Then a=8k+7 b=8j+3
  + a+b = 8k+7+8j+3 = 8k+8j+10 = 8(k+j+1)+2. So a+b – 2 = 8r so 8 divides a+b -2, i.e., a+b = 2 (mod 8)
  + a\*b = (8k+7)(8j+3) = 64kj + 24k+56j + 21 = 8(8kj+3k+7j+2)+5 so 8 divides ab – 5 or ab = 5 (mod 8)

**Proof by Contrapositive Example** [20-30 minutes]

* Prove that if n^2 is odd then n is odd.
* When to use proof by contrapositive
  + If more algebraically complicated thing is in the hypothesis
  + If the hypothesis is hard to work and the negation of the conclusion is easier to work with.

**Section 3.2 Worksheet- Part 1** [30-40]

* Fill in together. They do examples. Put up Section 3.1 page 96 for inspiration
* Emphasize – for a biconditional proof they need to prove P implies Q and Q implies P

**Section 3.2 Worksheet – Part 2** [40-60 minutes]

* They work on proving the biconditional statement.

-----------------------BREAK ----------------------------

**Section 3.3** [70-100 minutes]

* What is proof by contradiction?

**Play-Conjecture-Prove** [100-110 minutes]

You and two others are prisoners. The warden has 3 red hats and 2 blue hats. You stand in a single file line, with you in the front, so that the person in the back can see the two people in front of them, the person in the middle can see the person in front of them, and you can't see any hats.  The warden puts one of the hats on each of you and says you can be released if you can guess the color of your hat. The warden starts by asking the person in the back, who says they don't know. Then the person in the middle, who also says they don't know. Then when they ask you, in the front, who can see no hats, you know. How do you know and what's the color of your hat?

For next time: SA9:

* Read some proofs: Theorem 1.8 on pages 21-22 (direct proof), page 91 halfway down, the conjecture (proving something false using a counterexample), Theorem 3.7 on page 105 (proof by contrapositive). Proposition 3.11 on pages 108-109 (biconditional statement)
* Questions: 1 – What’s something that surprised you about the way the proof is written? What is one thing you will try to do in your own proof? What do you need to know how to do in LaTeX?
* Section 3.2 #5 on page 112. You should type up a proof. You must email me or come to office hours if you do not know how to do this proof.

Preview activity 7 – Section 3.3 preview