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

**Need pennies, notecards, poster paper, markers.**

**Penny trick activity:** [30 minutes]

* *Materials:* pennies, poster paper
* *Introduce by demonstrating the following trick:* Some pennies are spread out on a table. Each coin is lying either heads up or tails up. You are blindfolded, so you cannot see the coins or the table. Someone tells you how many coins are lying heads up. You choose that many coins, turn each of them over, and move them to the side. You now have two groups of coins (the ones that you moved, and the ones that you did not move). Magically, the number of coins lying heads up in the first group is the same as the number of coins lying heads up in the second group.
* *Activity directions:* Prove or disprove: The magic will happen every time. Write down your ideas on poster paper. (Students will have pennies so they can try the trick again). 15-20 minutes for this part. The trick is outlined on a slide.
* *Discussion:* Have students talk about the ideas from their groups. Start a discussion of what it means to prove something. Assign competence! Specifically discuss “how do we decide if a statement is true or false?” (from Section 1.1)
  + *Guesswork and conjectures/constructing appropriate examples/looking for a counterexample/examples don’t prove things/working backwards might be helpful/assigning variables, but not too many variables can be helpful/use of prior knowledge/cooperation and brainstorming*
  + *Proof: Say the original pile has n coins and k heads. So we move k coins and have 2 piles, one with n-k P1 coins and one with n-k coins, P2. Say we eliminate the extra step of flipping the coins. Then the statement becomes that the number of heads in the first pile equals the number of tails in the second pile. Suppose P1 has c heads. Here’s what we know BEFORE flipping:*
    - P1 has n-k coins
    - P1 has c heads
    - So P1 must have n-k-c tails
    - P2 has k coins
    - Since there were k heads in total, P2 has k-c heads (c of them are in the other pile)
    - In P2 everything else is a tail, meaning k – (k-c) = c tails. Done!

**Group norms discussion:** [15-20 minutes]

* *Materials:* Notecards
* Think/pair/share: Write down two things you expect your groupmates to do/not do when working together. Pair with someone not in your penny group to discuss. Discuss as a class what our norms should be.

---Take a 10 minute break -----

**Cover Section 1.1 (40 minutes):** [Statements and conditional statements] See worksheet.

* 8 minutes: What’s a statement
* 25 minutes: Have them work on card tasks, go over, go over truth tables
* 15 minutes: Have them work on applying conditional statements task

**Hand out syllabus/discuss what to do for next time** [5 minutes]

* Preview activity: For Sections 1.2 and 2.1. Read syllabus, what questions do they have on it.
* Synthesis activity: Section 1.1 Question 3, Question 7 (a)-(c)