

## Week 1: Challenge Problems 1

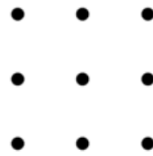
*Author: Andrew Lizarraaga*

## About These Problems

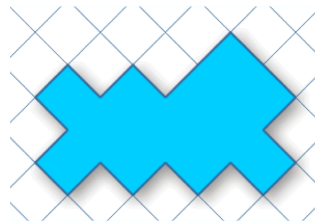
- **This will not be graded. And it's not mandatory or necessary to do these problems.**
- You should focus on homework and lectures to do well in this class.
- These are merely meant to be supplementary challenge problems for those who want them.
- Consult Andrew Lizarraaga: [andrewlizarraaga at g.ucla.edu](mailto:andrewlizarraaga@g.ucla.edu) for question or solutions.

## 1.1 Are you ready?

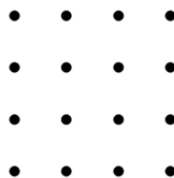
**Problem 1 (Thinking Outside the Box):** Given the  $3 \times 3$  grid below, place your pencil at any point. Then, without lifting your pencil you must draw four straight lines to cross out all the 9 dots.



**Problem 2 (One Cut - Two Shapes):** Given the shape below and using a single curve to cut the shape (the curve can be angled or have as many bends as you wish), cut the shape into two identically shaped pieces.



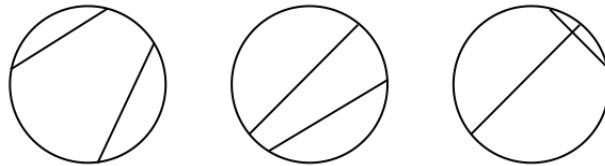
**Problem 3 (Dots and Rectangles):** Given a  $4 \times 4$  grid of dots, how many rectangles can be formed by connecting 4 of the dots, such that the sides of rectangle are parallel to the sides of the grid?



**Problem 4 (A Biased Coin):** I give you a coin that is biased in favor of heads. What can you do in order to make it into a fair coin?

**Problem 5 (Half Your Height):** At what age do you expect the average person to be half of their (full-grown) height. Without looking up a statistic on this, can you come up with a plausible way to deduce this answer?

**Problem 6 (A Circle and Two Chords):** I have a unit circle and draw two chords at random. What is the probability that the chords intersect? (Third circle below depicts two chords intersecting).



**Problem 7 (HH vs. HT):** I can choose to flip a fair coin until I see two heads in a row, denoted HH. Or I can choose to flip the coin until I see a heads followed by a tail, i.e. HT. On average should it take more flips to see HH or more flips until you see HT? Or should we expect roughly the same number of flips?