

# CMPS 10 Lecture Notes: Lecture 1 (1-5-2016)

## Introduction

**Course Webpage:** [cmps010-winter16-01.courses.soe.ucsc.edu](http://cmps010-winter16-01.courses.soe.ucsc.edu)

- Class has a split personality.
  - some of it is about CS in the modern day, not a strong technical component
  - But prof also wants to demystify a lot of the technical component.
- The other part of the class is to do some work in a very primitive programming language.
  - This language is called SNAP
  - You wouldn't want to use it to create something that is particularly useful or wide release.
- **Course Textbook:** Blown to Bits: Your Life, Liberty and Happiness After the Digital Explosion
  - Online edition available from course web page.
  - Material form it will be on the test.
- Class will be using clickers.
  - can be purchased online or at the bookstore (or maybe just buy it used)
  - ONLY use Clicker or IClicker+, NOT IClicker2 or webClicker.
  - See course webpage for more details.
- And there is going to be weekly homework.
  - The only homework in the class is going to be programming in Snap.
  - Homework One: Hour of Code
  - Submit all homework assignments via eCommons (accessible from course webpage)

## Magic Trick: Are iClickers Stupid?

- Do you think iClickers are stupid?
  - How does one anonymously let the teacher know?
  - Raise hand if you think clickers are stupid, OR birthday is on an even date, OR both. (51 hands raised)
  - Then raise hand the second time if you did not the first time. (43 hands raised)
  - So we now know that for the set of 43 people, NO WAY they think clickers are stupid
  - For set of 51, there is plausible deniability.
  - There is the set of Everybody (E), 94 students. (and there is a mystery subset S for the camp that think clickers are stupid)
    - \* That is, there is the subset of people that think iClickers are stupid, that is going to be some subset of the 94 total students.
  - the hope is that there is a line that splits the set of E roughly evenly, as there are roughly the same number of even and odd days in a month.
  - So, 51 is the total even side, and the other side of the inner circle, let's call that *Count*.
  - So,  $Count = E/2 + S/2$ , and we want to solve for S!
  - $S = 2Count - E$ . Replacing variables with numbers, we get  $S = 2*51 - 94$ , which is,  $102 - 94$ , which equals **8**.
  - So only 8 people think clickers are stupid! (But then we did the actual count, and it was closer to 16).
- the smaller S is, the worse your approximation is going to be.
  - Why? Well, if S was the same size as E, then dividing E in half IS gonna divide S in half.
  - But if S is tiny, then splitting in half might MISS S entirely.

- Let us say that S only has two elements, they can be split in 4 different ways. (EE, EO, OE, OO) (E=Even, O=Odd)
- So, how many people see the connection between what we have been talking about and the Bell Curve?
  - We want to draw some connections between how computers work, and mathematics.
  - How many people want to spend time in class to talk about how does this work, how do computers work, and math?
- Gamma rays are coming from the sun, and they can go into your RAM and change a bit of memory.
  - Very rare. will never happen to you. But happens to Google a few times a day.
  - But then many members of the class didn't know what a bit was, and so we switched topics.

## Probability Thought Experiment

- One indication that something is a probabilistic question: there is a chance that a number in real life that would never be negative, \*might\* be negative.
- Another fun thought experiment: what if we flipped a coin a million times? What are the odds that it gets flipped such that exactly half of them are tails and exactly half of them are heads?
  - Class mostly guessed one in a million.
  - Correct answer is one in thousand.
  - The way you figure it out is very sophisticated.
- Our intuition about probability is pretty broken!
  - It can not be 1/1,000,000 chance because that is saying that all numbers are equally likely. But we know that must not be true, because, just imagine, if you flipped a coin a million times, getting ZERO heads is NOT equally as likely as getting at least SOME heads.
  - So the actual probability is closer to a bell curve.
  - But it is not a perfect bell curve, it a bell curve with very steep up and down parts.
  - The width of the up and down parts are the square root of the number of coin flips.
  - When you flip a coin, the amount of deviation around the center is not a percentage of the count, it is a percentage of the square root of the count.
- Imagine that there are two hour glasses, one with fine grained sand and one with coarse grain sand (or if you prefer, one is based on sand and the other is based on water). Which do you want?
  - We want the WATER one (or fine grained one). Water is like the ultimate sand.
  - As you INCREASE number of participants, relative error becomes lesser and lesser. (and with water, that is like you have each molecule of water as a participant, and you can imagine you have way more molecules of water than you have grains of sand!)
- Another thought experiment, going to a casino and going to the table where you bet on black or red (in real life there is also green, where if it lands on that you do not get any money, but we will assume that does not exist for this example).

## BREAK

## Privacy

- One thing that this comes up a lot in is in privacy.
- Imagine some kind of a grocery store, a neighborhood grocery store 50 years ago.
  - People would go in and buy things, and the grocer was in a position to gain insight into people's lives.
  - Would know who got a raise, who was an alcoholic, who was about to have a baby., based on what they would buy.

- YET there was a sense of privacy, Partly, because the grocer could not be bothered to maintain all of this information, partly because if grocer died then info is gone.
  - Then grocer got replaced with a supermarket; more employees, and employees are only going to be there for a couple years
  - But then at some point, they started taking automated track of things, to help be able to tell if something was about to run out.
- So you have some database, and your store sells 1,000 different items.
    - So you have a 1,000 different counters, one for each item that you sell, that tell you how many you have left of each item that you sell.
    - And so when someone buys things, you decrease the counter by each thing by one.
    - And so when the counter goes below a certain threshold, a bell rings, and then people can go and restock it. Not a problem, right!
    - BUT the professor claims that this is a violation of privacy!
      - \* From the point of view of the system keeping inventory, you do not NEED to know that one receipt came from one customer, and one receipt came from another. However, Stores typically LOVE that you know which customer bought what.
      - \* Because even if you do not associate them with specific customers, you can learn what pairs of products get bought together.
      - \* And then this can be used for product placement in the store. If things are frequently bought together, the store has an incentive to place those things FAR AWAY from each other so that you have to walk through as much of the store as possible, in the hopes that you will buy more things!
      - \* Grocery stores are intentionally built to be inefficient!
    - There are cameras in grocery stores, ostensibly for security but also for tracking how much you stand in front of a product. (www.nomi.com is an example of a place that does this).
  - There is also differential pricing.
    - On the web, the price that you get quoted for something ACTUALLY DEPENDS on who you are!
    - And this was happening in 2005, so it is definitely happening today.
    - Here's an example: searching for airline tickets
      - \* if you give an exact time, they figure that your time is more valuable, and so they can charge more for it.
      - \* Saying you are less flexible is an indicator of lower socio economic status.
      - \* Or looking at the cookies of browser history when someone is looking for a car. If someone has been to a price comparison site, then they are more price sensitive, and they will give you a better price.

**But this can get really ugly, really quickly.**

- Experiment that morphed people's faces with politicians WITH THE PEOPLE
  - people LIKED the politician better when they were morphed with their own faces!!!!!!!
  - When you see ads online, the faces of the people in the ads have been morphed to LOOK LIKE US, because we are more receptive to messages by people who LOOK LIKE US.
  - So it isn't just in the realm of commerce! It's happening in politics! Oh no!

**But beautiful things exist too.**

- New Neural Algorithm can create Paintings in style of Van Gogh.
  - Computer is given a photograph as input, and produces it in the style of an artist. It was ONLY given an image, an image that is part of a stack of other images from the same artist.
  - Neural Network