STOR 435.001 Lecture 1

Overview

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What is the course about?

Plan for today

1. Motivation: why is this the greatest subject on the planet?

2. Thanks to Prof. Bhamidi for letting me use his beamer slides!

3. Start with the basics of Combinatorics (why Combinatorics? Wait and find out).

Topics

Advanced undergraduate course in probability. Cover random variables, moments, binomial, Poisson, normal and related distributions, generating functions, sums and sequences of random variables, and statistical applications.

Why do I love it / care?

Age of data

- Modern times inundated with data
- Almost anything you do later, you will come across probabilistic models at some point.
- Understanding underlying models and methodology based on them essential for interpreting results, help in making rational decisions and protecting you from making **bad decisions**.

2014 Forbes top 3 careers (1 and 2 were the same in 2016 modulo name changes)

Was looking this up when giving graduation speech in STOR dept.

- **Number 1:** Mathematician analyzing big data.
- **Number 2:** Statistician.
- **Number 3:** Actuaries

In the early 1900's the great writer H.G.Wells said "Statistical thinking will one day be as necessary for efficient citizenship as the ability to read and write." Click on this
http://www.ted.com/talks/arthur_benjamin_s_formula_for_changing_math_education?language=en

Ok: Still why care?

- You might not be in the least interested in all this as a "career". Perhaps you already know what you are interested in ("doctor, lawyer, financial analyst, journalist etc")
- Understanding of probability is still very important in our society.

Why?

- Deep connections in how we handle uncertainty to areas such as *neuroscience/sociology/anthropology/economics*

- Turns out our risk response firmly grounded in both emotion and rationality. Judgement of risk depends both on risk **and** how we feel about these risks.

- This is very dangerous both indirectly in terms of stress that it causes (heart disease, diabetes etc) and directly. For example after 9/11 much more people on the roads as this "felt" safer than flying. Lead to a statistically significant increase in accidents. This gap causes major stress and can cause you to loose lots of money in investments

- In this course: the kinds of **mathematical techniques** required to model and understand probability.

Probability and the law

Misuse of probability: Case of Sally Clark

Case of Sally Clark

- 1996: first son died suddenly within few weeks of birth
- 1998: second son died in a similar manner. She was subsequently arrested
- Pediatrician testified that chance of two children from affluent family suffering SIDS was

$$\frac{1}{8500} * \frac{1}{8500} = \frac{1}{72,250,000}$$

- 1999: Convicted, life imprisonment
- **Why should the two deaths independent of each other?**
- January 2003: Released
- March 2007: Died of alcohol intoxication

Think-Pair-Share

Politics vs. sports

- A lot has been said about forecasters missing Trump's 2016 victory.
- How does the final fivethertyeight.com prediction compare to average MLB bating average?
  - A average BA is much smaller
  - B average BA is about the same
  - C average BA is much bigger
- It is easy to misperceive the meaning of moderate probability values.