CIT592

Welcome

Intro

CIT 592

- Mathematical foundations of Computer Science
- Primary focus = discrete math
- Does not cover Linear Algebra, Optimization, Calculus etc

Topics

- Sets
- Permutations and Combinations
- Discrete Probability and Expectations
- Logic/Proofs
- Mathematical Induction
- Recursion
- Graph Theory

Additional potential ‘side’ topic

- Some very basic Python programming.
- The goal is to teach you just enough Python to ensure that you can some applications of the math concepts.

- More on this after the first midterm.
- Do not worry about trying to learn Python while you are also trying to learn Java.

Math is needed for programming?

Perhaps the most commonly asked question in both 592 (and sadly even in 596) is …

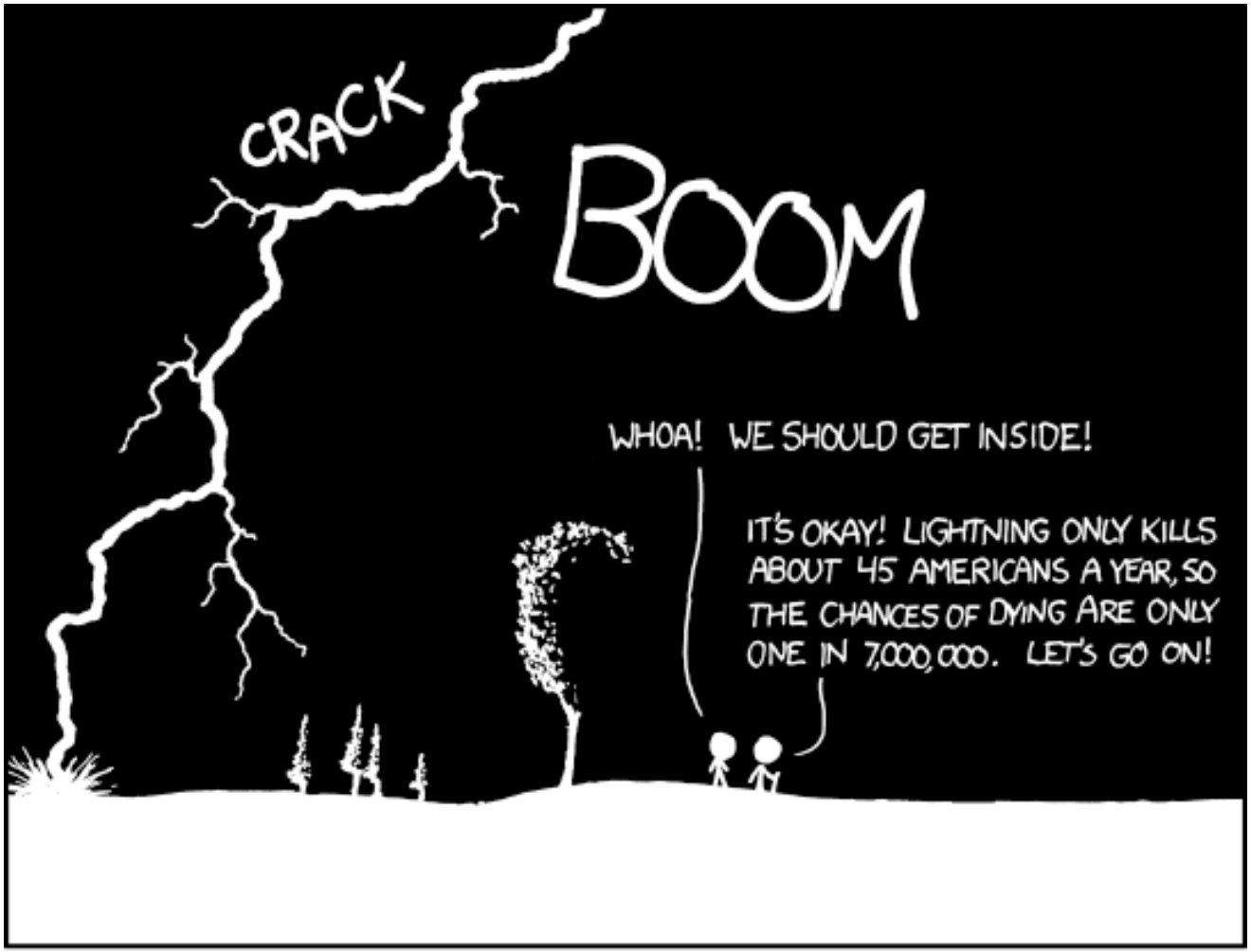
‘Where will I use this????’

Think of these topics as tools in your toolbox.

Tools in toolbox(??)

- But I thought the computer was the only tool I needed!
- Computers are dumb. They need humans to think for them
- Math gives you the structured approach that is most directly associated with the way computer programs/algorithms are written

Discrete math saves lives!



THE ANNUAL DEATH RATE AMONG PEOPLE WHO KNOW THAT STATISTIC IS ONE IN SIX.

$$x^2 = \underbrace{x + x + \cdots + x}_{(x \text{ times})}$$

$$\frac{d}{dx}x^2 = \frac{d}{dx}[\underbrace{x + x + \cdots + x}_{(x \text{ times})}]$$

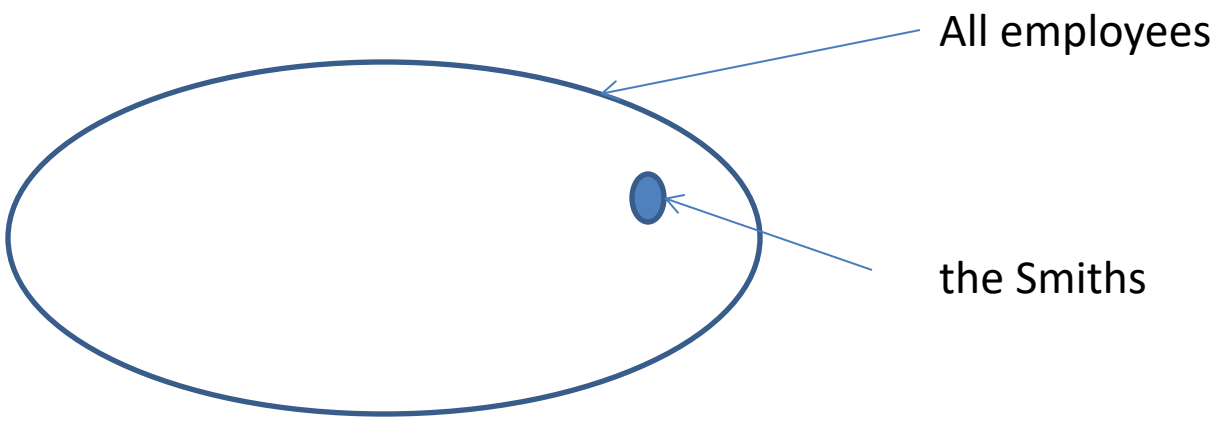
$$2x = 1 + 1 + \cdots + 1 = x$$

$$2 = 1$$

Sets

- Databases

SELECT EMP_ID, LAST_NAME FROM EMPLOYEE_TBL WHERE LAST_NAME = ‘Smith';



Logic

- Day to day logical reasoning does incorporate aspects of ‘formal logic’
  - All 592 students are in MCIT
  - All MCIT students meet Abdul
  - Therefore Abdul will know about any 592 student I talk about ….
- You can greatly simplify code if you can simplify logical statements.
- Imperative for digital circuit design

Mathematical proof

- The most controversial topic taught in this course because …
- ‘I’ve never proven anything in the software industry’
  - Maybe you haven’t programmed airplanes/rockets/medical devices
- The ability to write a good proof is not too far removed from the ability to write a program with v few bugs
- Very useful for an Algorithms course

Probability usages

- Where is probability used?
  - Las Vegas, Atlantic City, Monte Carlo, Macau
  - Making(and losing) millions and billions on Wall Street
  - Machine learning
  - Randomized algorithms
    - what is the ‘expected’ running time of quicksort

Counting/combinatorics usages

- How long is my program going to take?
  - Anyone can write inefficient code
  - A good programmer is able to analyze their program
- Analysis of programs almost always begins with having some idea of the ‘number of operations’
- Larger the data, longer the time taken. But how does it scale?

Mathematical induction

- Breaking up a problem into smaller problems
- Use the smaller problem solutions to solve the big problem
- When used in proofs = induction
- When used in programming = recursion!

Graph Theory

- Graph theory + probability + 2 PhD students + the internet = ….

- Navigation applications
  - What is the shortest route from point A to point B?
- Any social networking site will have to use graph theory.
- Lots more …

Administrivia

- Sign up for Piazza (link also on website)
  - piazza.com/upenn/fall2018/cit592
  - All HW and HW submissions on canvas
- All syllabus and readings on canvas

Grading

You final grade will be based on

weekly HWs - 55%
exams - 45%

There will be 3 exams. 2 midterms and a final. Your top scoring examwill be weighted more - 19%. The other two will be weighted 13%each. This is to ensure that one bad day does not affect your grade toomuch.

Grading

- My courses tend to require work.
- Grading is lenient in the end.
- Don’t commit an act of academic dishonesty.
  - More on this when HW comes out

Office hours

See Piazza post for hours and locations.

Book

- Zybook – interactive textbook
- The zybook is mandatory!
  - Please see Piazza for how to sign up
- If you cannot afford it please let me know. We might be able to make some arrangements.
- I will type up basic notes for each class and post them in the syllabus section in canvas
- Relevant portions of other textbooks will be scanned and put on canvas as readings

Latex

- Most popular tool for writing math
- http://en.wikibooks.org/wiki/LaTeX
- overleaf.com
- Useful to have a local installation as well
  - Texmaker is my personal recommendation
- Check the piazza post

HW submission

- **Latex**
- **Only in pdf form and all on canvas**
- **NO IMAGES OF HANDWRITTEN SOLUTION**
- **Homeworks will generally be due on Thursday night.**

Recitation

TAs will run the recitation.

You will be doing practice problems in the recitations.

They will let you know more about the format next Tuesday.

No recitation today!

Collaboration policy

- You are allowed to collaborate on HW with 1 other person
- Write the name of your collaborator at the top of your HW.
- In the end you have to write your own solution. NO COPY PASTE ALLOWED.
- Individual submission
- You and your collaborator can and usually will get different scores on HW.

Internet search = plagiarism

- The internet does not consist of a bunch of 592 TAs.
- Ask us, not them.
- We have 12 hours of office hours between the 6 of us. Please come see us!
  - If you cannot make ANY of those 12 hrs please let us know ASAP.

Basic math background

- This is the only first semester MCIT course that DOES assume something
- Basic algebra
- Most of you have seen it in some form. Might be rusty.
- HW0 is designed to give you practice
- Does not contribute to your grade
- Please try and do these by yourself.
- If it is a struggle, watch the videos