

Induction

Where We Are Now

- Week 5 covered these key topics:
 - Mathematical induction
 - Variations on induction
 - Multiple base cases
 - Larger step sizes
 - Complete induction
 - DFAs and formal language theory.

The Midterm is Next Tuesday!

- **Tuesday, February 18th** from **7 – 10 pm**, location TBA
 - Covers everything up to (but not including) induction
 - Closed-book, closed-computer, etc.
 - You can bring one double-sided 8.5x11” sheet of notes
- There **will** be a problem set due that Friday
 - Manage your time carefully!
- CS103A?

Your Notes Sheet

- You can bring a double-sided, 8.5" × 11" sheet of notes with you when you take the exam.
- ***Recommendation:*** Try making a study guide for the course as a whole without regards to length, then pare it down to your final notes sheet.
- The act of creating a set of notes will help you solidify your own understanding. Trust us – do this on your own. Don't just get notes from someone else.

Review Your Problem Sets

- Make sure you've reviewed all the feedback you've received on your problem sets and looked over the solution sets.
- Make sure you *understand* all the feedback you've received on your problem sets and the solution sets.
- If one of the problems really didn't go well, rewrite your solution from scratch and without looking at the solutions set. Feel free to ask the TAs to look over your work.
- Take some time to review the results you've proved on the problem sets. Results proven on the problem sets are fair game for the midterm.

Leading up to the Exam

- The more practice you can get, the better. (E.g., work through the practice exams!)
- If you have even a little bit of time this week to work through some extra practice problems, it's probably a good idea.
- That said, please stay healthy and sane:
 - Get a good night's sleep before the exam.
 - Get dinner beforehand – don't go in hungry!

A Few Things to Keep in Mind

The Course Staff Is On Your Side

We want you to do well on this exam.
Please ask us for help if you need it. Let us
know what we can do to make you feel
more prepared.

You've Learned a Ton In Five Weeks

You've gone from zero to probing the nature of infinity in five weeks. That's incredible. You should be proud of that.

This is Not a Test of Innate Ability

We are not trying to test whether you are good at math. We are not trying to test whether you have some special aptitude. We want to see what you learned.

Topics You Wanted More Practice With

- Diagonalization/cardinality
- Graphs
 - We won't be focusing on these today
 - See the course reader & practice exams for extra problems!!
 - Ask us to check your understanding or solutions 😊
- Induction/proofwriting [today]
- Pigeonhole

Pigeonhole Principle

The **generalized pigeonhole principle** says that if you distribute m objects into n bins, then

- *some* bin will have **at least** $\lceil m/n \rceil$ objects in it, **and**
- *some* bin will have **at most** $\lfloor m/n \rfloor$ objects in it

Why is this true? Think about what would happen otherwise...

- *every* bin will have **fewer than** $\lceil m/n \rceil$ objects in it, **or**
- *every* bin will have **more than** $\lfloor m/n \rfloor$ objects in it

Either way, we end up with a contradiction.

- # objects $< n \lceil m/n \rceil \leq m$
- # objects $> n \lfloor m/n \rfloor \geq m$

Recommendation

If you haven't already read over the

- Guide to Induction
- Induction Proofwriting Checklist

you may want to do so before attempting these problems!!