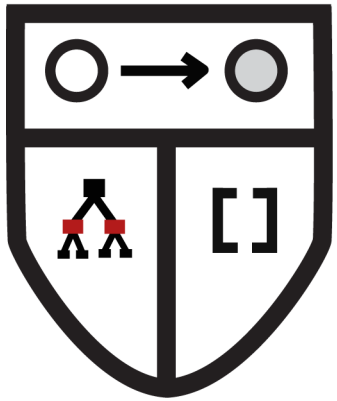

CS 3110

Balanced Trees

Nate Foster

Spring 2020

Interactive Lectures

Goals:

- Increase depth of understanding
- Answer questions
- Work examples

Non-Goals:

- Cover the material (again)
- Assessment

Commitment to Academic Integrity, Equitable Instruction, Trust, and Respect

AN S20 COMMITMENT TO ACADEMIC INTEGRITY, EQUITABLE INSTRUCTION, TRUST, AND RESPECT

The switch to online instruction in the context of the pandemic creates vulnerabilities and opportunities associated with teaching and learning. All members of the Cornell community are being challenged: faculty and staff hastily converting to virtual instruction and students coping with the loss of personal connection and in-person education. Difficult times require empathy, patience, and a renewed commitment to the following principles, many of which also have foundation in various Cornell policies[1]:

For Students:

1. I will be a respectful, professional online member of the course, who supports my classmates' ability to participate and access course materials and who does not undermine the work of the instructor. This includes rejecting and not engaging in any form of device-enabled harassment or disruption.
2. I will respect principles of academic freedom for instructors and classmates and will maintain the privacy of the virtual classroom environment: I will not record, photograph, or share online interactions that involve classmates or any member of the teaching team. I will not enable anyone who is not enrolled in the course to participate in any activity that is associated with the course. Exceptions require the instructor's written permission.
3. I will respect the intellectual property rights of the instructor by not making course materials accessible to anyone who is not enrolled in the course without the instructor's written permission.
4. I will follow the rules set forth by the instructor that concern online, device-enabled, and in-person collaboration, discussion, and sharing.
5. I will complete assignments and examinations in a manner that respects the instructor's guidance and the integrity of the instructor's evaluation of my work.

My Commitment to You

April 6: Grades and S/U

Nate Foster

Apr 6 at 2:27am

All Sections

There has been much discussion among students and faculty about Cornell's policies around grades this semester and the recent Faculty Senate vote to endorse opt-in S/U grades.

I want to briefly remind you what the syllabus says about grades:

> We urge you not to focus on numeric scores and grades. **Most students get good grades in this course.** The median is typically between a B and a B+, and almost no one ever fails the class. So instead, focus on where the assessments show that you can or need to improve. A decade from now the grade you got in this course will be irrelevant, but what you learned about programming might just be crucial.

I also want to remind you what I wrote when instruction was suspended in mid-March.

> **my top priority now is to deliver the rest of course in a way that makes it possible for anyone to successfully complete it if they put in an honest effort**, and to learn as much as they can.

I do have my own opinions about what the policy would have been best, but I am obliged to go along with what the university recommends. So I will offer both letter grades and S/U as an option this semester. And you will be free to drop the course or change the grading basis until the last day of classes. I will do my best to have as much grading done by then as possible so you can have an accurate picture of where things stand.

I also want to say that there is absolutely no stigma in taking the course S/U this semester. Students are in vastly different situations now (e.g., see https://www.nytimes.com/2020/04/04/us/politics/coronavirus-zoom-college-classes.html) and outcomes in the course may depend as much on external factors like whether you have a quiet place to work and fast Internet than anything else. Transcripts this semester will have a disclaimer noting the Covid-19 disruption, and I expect that most organizations that rely on GPAs to evaluate candidates will discount this semester.

CANVAS CALENDAR

Demo

PANOPTO

Demo

ANNOUNCEMENTS

Demo

DISCUSSION & SLACK

Demo

CONSULTING HOURS

Demo

RED-BLACK TREES

Red-black trees

- [Guibas and Sedgewick 1978], [Okasaki 1998]
- Binary search tree with:
  - Each node colored red or black
  - Leaves and root colored black
- RI: BST +
  - Local invariant: No red node has a red child
  - Global invariant: Every path from the root to a leaf has the same number of black nodes

Questions

- Suppose I tell you that I have a red-black tree with 3 nodes. Do you know how many are red?
- Now suppose I tell you that I have a red-black tree with 4 nodes. Now do you know how many are red?
- Is it possible to color an arbitrary BST so it satisfies the red-black tree invariant?

Set implementations: performance

	Workload 1		Workload 2	
	`insert`	`mem`	`insert`	`mem`
`ListSet`	35s	106s	35s	106s
`BstSet`	130s	149s	0.07s	0.07s
`RbSet`	0.12s	0.07s	0.15s	0.08s

MacBook, 1.3 GHz Intel Core m7, 8 GB RAM, median of three runs

Upcoming events

- [Monday] A4 released
- [Tuesday] Discussion sections start
- [Wednesday] Form project teams on CMS
- [Friday] MS0 due

This is blissfully balanced.

THIS IS 3110