COS 423, SPRING 2018

THEORY

of

ALGORITHMS

Kevin Wayne
“An algorithm is a finite, definite, effective procedure, with some input and some output.”

— Donald Knuth
**COS 226 vs. COS 423**

**COS 226.** Implementation and consumption of classic algorithms.
- Stacks and queues.
- Sorting.
- Searching.
- Graph algorithms.
- String processing.

Emphasizes critical thinking, problem-solving, and code.
COS 226 vs. COS 423

COS 423. Design and analysis of algorithms.

- Greed.
- Divide-and-conquer.
- Dynamic programming.
- Duality.
- Data structures.
- Intractability.

\[
\sum_{i=1}^{n} \sum_{j=i+1}^{n} \frac{2}{j-i-1} = 2 \sum_{i=1}^{n} \sum_{j=2}^{n-i+1} \frac{1}{j} \\
\leq 2n \sum_{j=1}^{n} \frac{1}{j} \\
\sim 2n \int_{x=1}^{n} \frac{1}{x} dx \\
= 2n \ln n
\]

Emphasizes critical thinking, problem-solving, and rigorous analysis.
Why study algorithms?

“Algorithms are the life-blood of computer science… the common denominator that underlies and unifies the different branches.” — Donald Knuth
Why study algorithms?

**Internet.** Web search, packet routing, distributed file sharing, ...

**Biology.** Human genome project, protein folding, ...

**Computers.** Circuit layout, databases, caching, networking, compilers, ...

**Computer graphics.** Movies, video games, virtual reality, ...

**Security.** Cell phones, e-commerce, voting machines, ...

**Multimedia.** MP3, JPG, DivX, HDTV, face recognition, ...

**Social networks.** Recommendations, news feeds, advertisements, ...

**Physics.** Particle collision simulation, $n$-body simulation, ...

We emphasize algorithms and techniques that are useful in practice.
Lectures

- Monday and Wednesday 11–12:20pm in Green 0-S-6.
- Attendance is required.
- No electronic devices except to aid in learning.

viewing lecture slides

taking notes
Student response system (required).

- Register your iClicker in Blackboard.
- Available at Labyrinth Books ($30).
- Use only one device per lecture.

Which model of iClicker are you using?

A. iClicker.
B. iClicker+.
C. iClicker 2.
D. iClicker Reef.
TECHNICAL JOB INTERVIEW QUESTIONS

Google
Apple
Cisco Systems
Facebook
IBM
Nintendo
Jane Street
Adobe
RSA Security
Morgan Stanley
Netflix
DE Shaw & Co
Oracle
Pandora
Akamai
Yahoo!
Amazon
Microsoft
Pixar
Precepts

- Friday 11–11:50am in Friend 004 or Monday 7:30–8:20pm in Friend 006.
- Preceptor solves problems and answers questions.
- Attendance is strongly recommended.

Qasim Nadeem

James Bartusek
Course website

- Office hours.
- Problem sets.
- Lecture slides.
- Course policies.
- Electronic submission.
- ...

www.cs.princeton.edu/courses/archive/spring18/cos423
Grades

Problem sets.

• “Weekly” problem sets, due via electronic submission.
• Graded for correctness, efficiency, rigor, clarity, and conciseness.
• Use \LaTeX template for writing solutions.

Course grades.

• Primarily based on problem sets.
• iClicker participation.
• Staff discretion used to adjust borderline cases.
Collaboration

**Collaboration policy.** [see course website for full details; ask if unsure]

- Course materials (textbook and lecture slides) are always permitted.
- No external resources, e.g., can’t Google for solutions.

“Collaboration permitted” problem sets.

- You may discuss ideas with classmates.
- You must write up solutions on your own, in your own words.

“No collaboration” problem sets.

- You may discuss ideas with course staff only.
Where to get help?

Textbook. Read the textbook—it’s good!

Piazza. Online discussion forum.
  • Low latency, low bandwidth.
  • Mark as private any solution-revealing questions.

Office hours.
  • High bandwidth, high latency.
  • See course website for schedule.
Questions?

Not registered? Get registered.
Haven’t taken COS 226 and COS 340? See me.