COS 226, Fall 2024

Algorithms
and
Data Structures

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Fine print

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Intro to COS 226

- *motivation*
- *course structure*
- *assessments*
- *resources*

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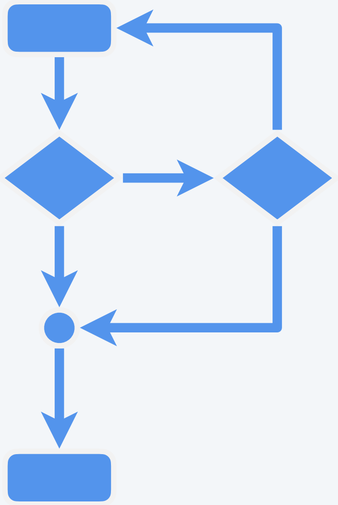
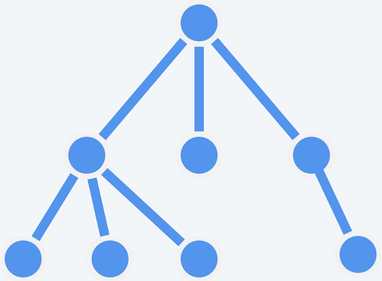
COS 226 course overview

What is COS 226?

- Intermediate-level survey course.
- Programming and problem solving, with applications.
- Algorithm: step-by-step procedure for solving a problem.
- Data structure: method for organizing data in a computer.

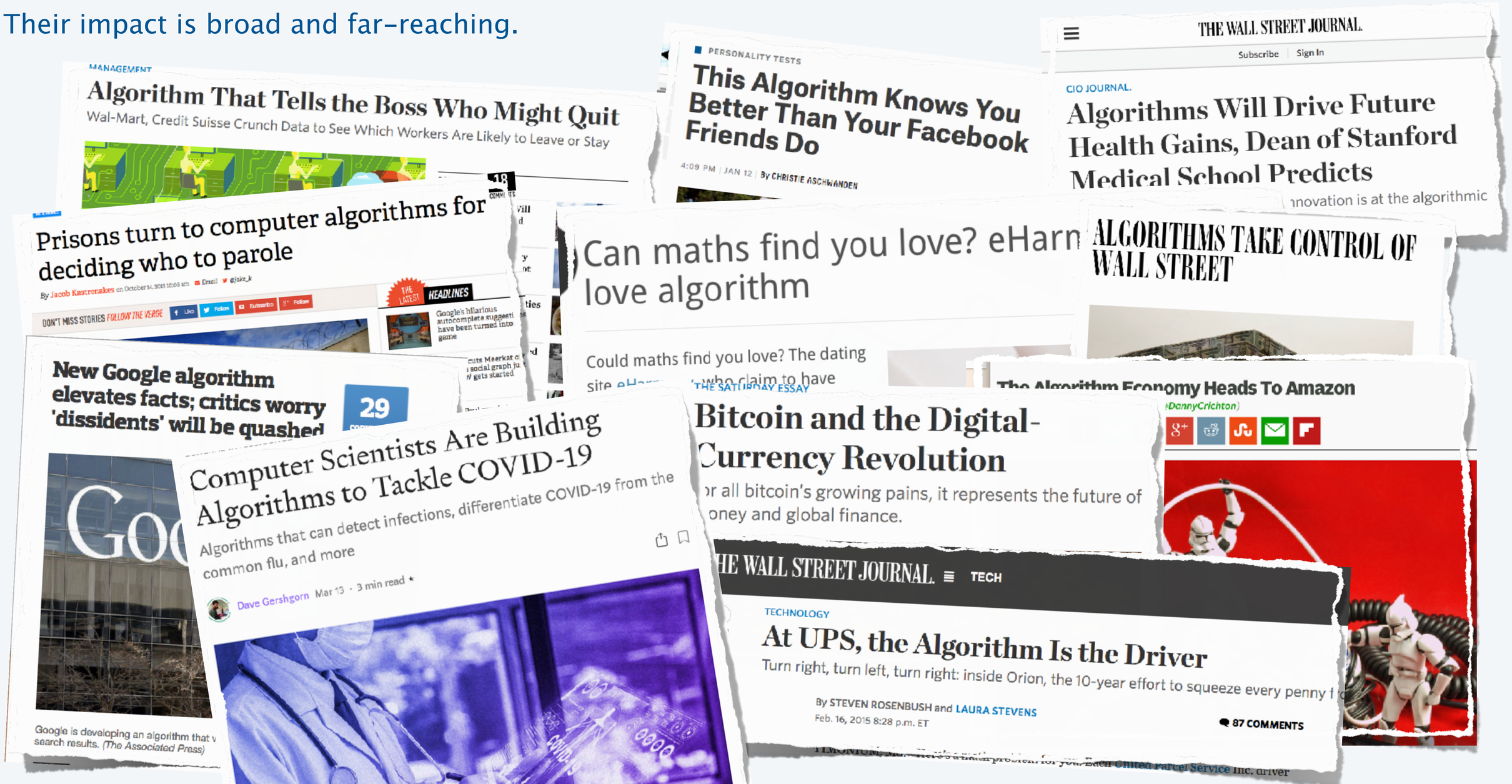




topic	algorithms and data structures
data types	stack, queue, union–find
sorting	insertion sort, quicksort, mergesort, priority queue
searching	BST, red–black tree, hash table, k-d tree
graphs	BFS, DFS, Prim, Kruskal, Dijkstra
advanced	randomness, multiplicative weights, intractability ← *new this year*

Why study algorithms and data structures?

Their impact is broad and far-reaching.



Why study algorithms and data structures?

Their impact is broad and far-reaching.

Algorithm: any process which is a sequence of simple local steps on basic units, e.g.,

Bits in computers

Pixels on screen

Atoms in matter

Cells in living tissue

Neurons in brain

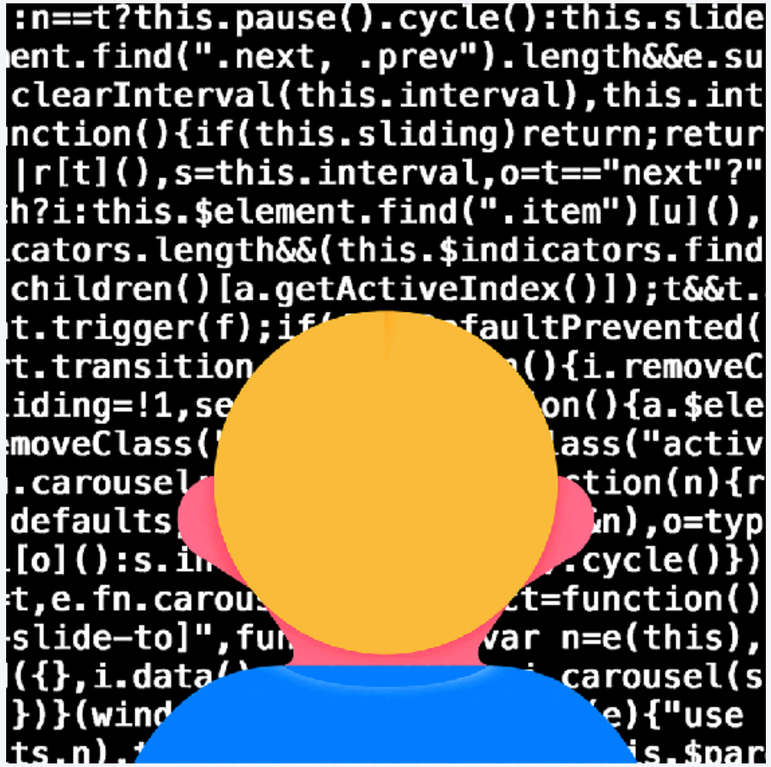
Stars in galaxy

Individuals in populations (social network, stock market, evolution, …)

⋮

Why study algorithms and data structures?

To become a proficient programmer.

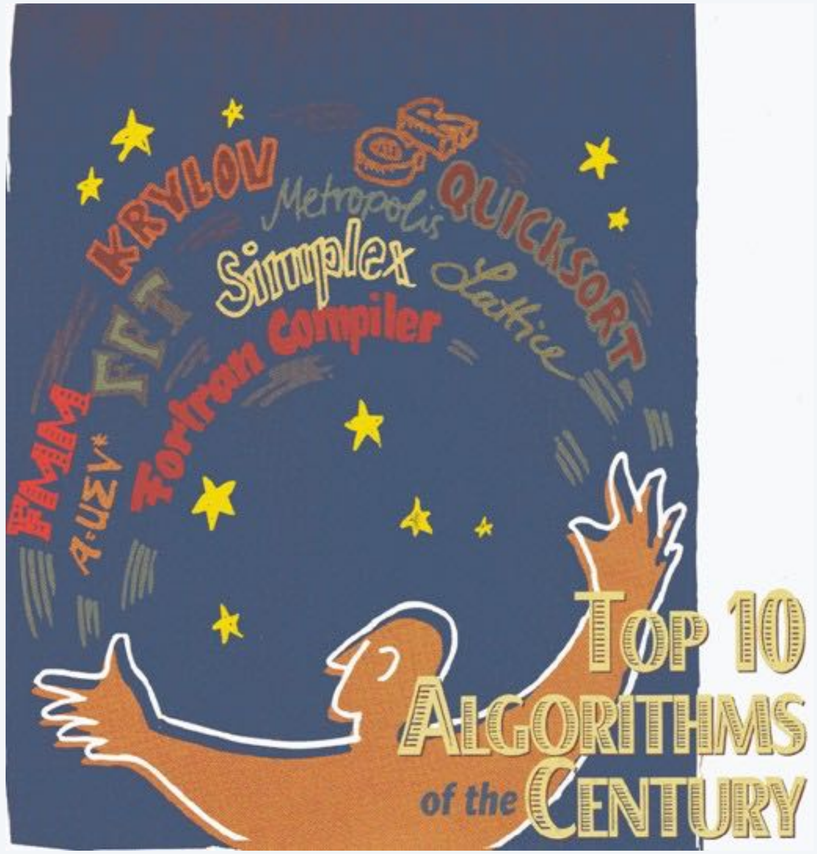


Why study algorithms and data structures?

For fun and profit.

Why study algorithms and data structures?

For intellectual stimulation.



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Lectures

Live lectures. Introduce new material.

What	When	Where	Who
L01	TTh 11–12:20pm	Friend 101	Gillat, Pedro, Marcel

Prof. Pedro Paredes

Prof. Marcel Dall'Agnol

Questions. Raise your hand and ask a question. ⟵ *carpe diem!*

Electronic devices. Permitted *only* to support lecture. ⟵ *viewing slides, taking notes, iClickers, …*

iClicker (required). To earn participation credit:

- Create iClicker Cloud account using Princeton email. ⟵ *free for Princeton students*
- Answer multiple choice questions during lecture.

https://www.iclicker.com

What's one thing you wish you had more of?

A. Fortune ($$)

B. Fame

C. Free time

D. Friends

Precepts

Active learning. Problem-solving, discussion, assignment prep, …

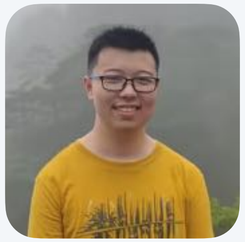
Prof. Pedro Paredes

Prof. Marcel Dall'Agnol

Dillon Lue

Juhyun (Simon) Park

Jiatong Yu



Zhiyue Zhang

Zhiyue Zhang

Ann Zhou

Abacus precept P09. F 11–12:20pm.

- Intended for students seeking a more advanced treatment of material.
- Covers topics beyond scope of the course.
- Transfer in/out in TigerHub.

Prof. Mark Braverman
(Abacus Medal '22)

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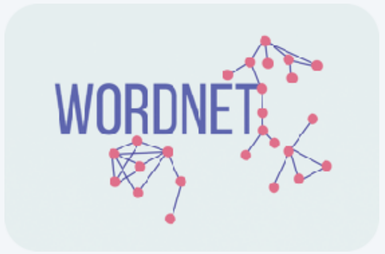
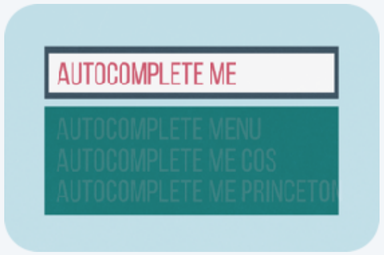
- *union–find*

Programming assignments

Implement an efficient algorithm or data structure:



Solve an interesting application using a “textbook” algorithm:

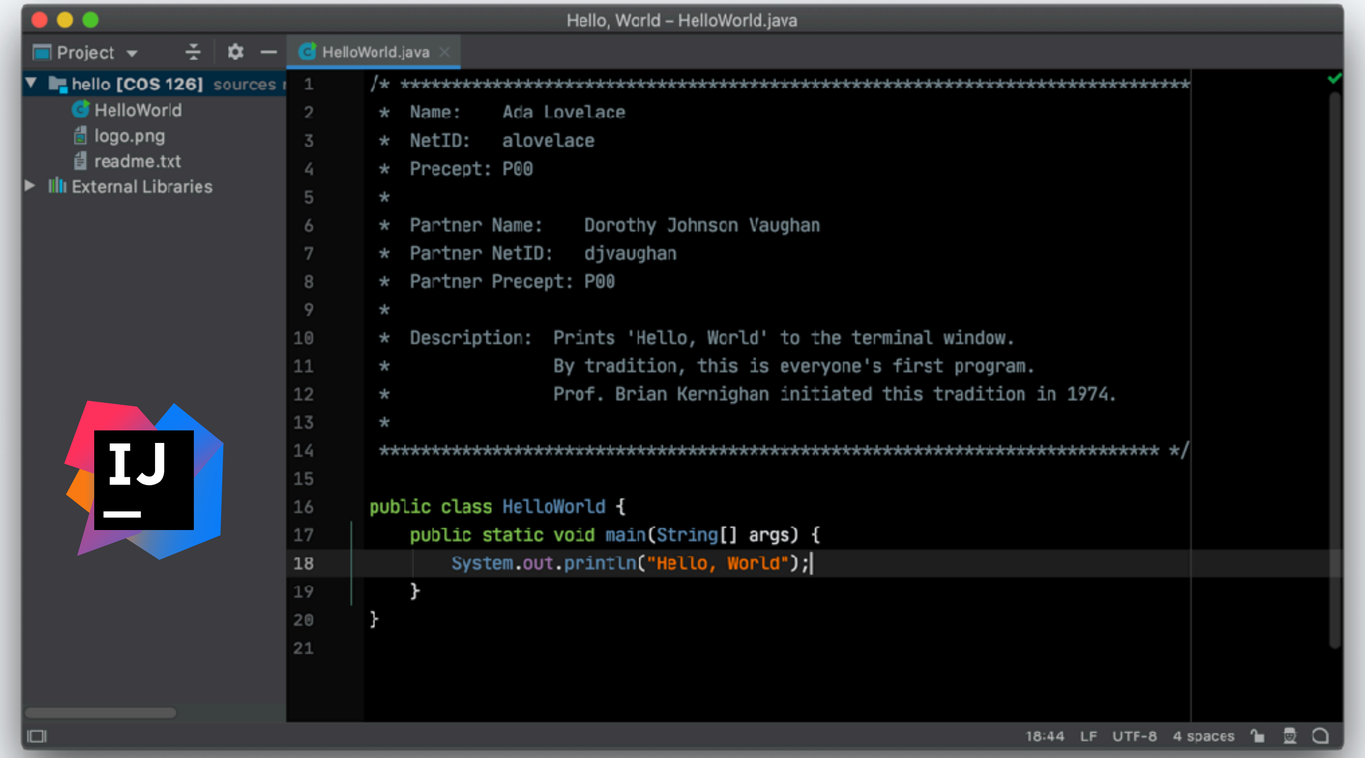


Pair programming encouraged on designated assignments.

Programming environment

Recommended IDE. Custom IntelliJ 2024.2 environment. ⟵ *upgrade to Fall 2024 version*

- Embedded Bash terminal.
- Autoformat, autoimport, autocomplete, …
- Continuous code inspection; integrated Checkstyle and SpotBugs.
- …



Quizzes

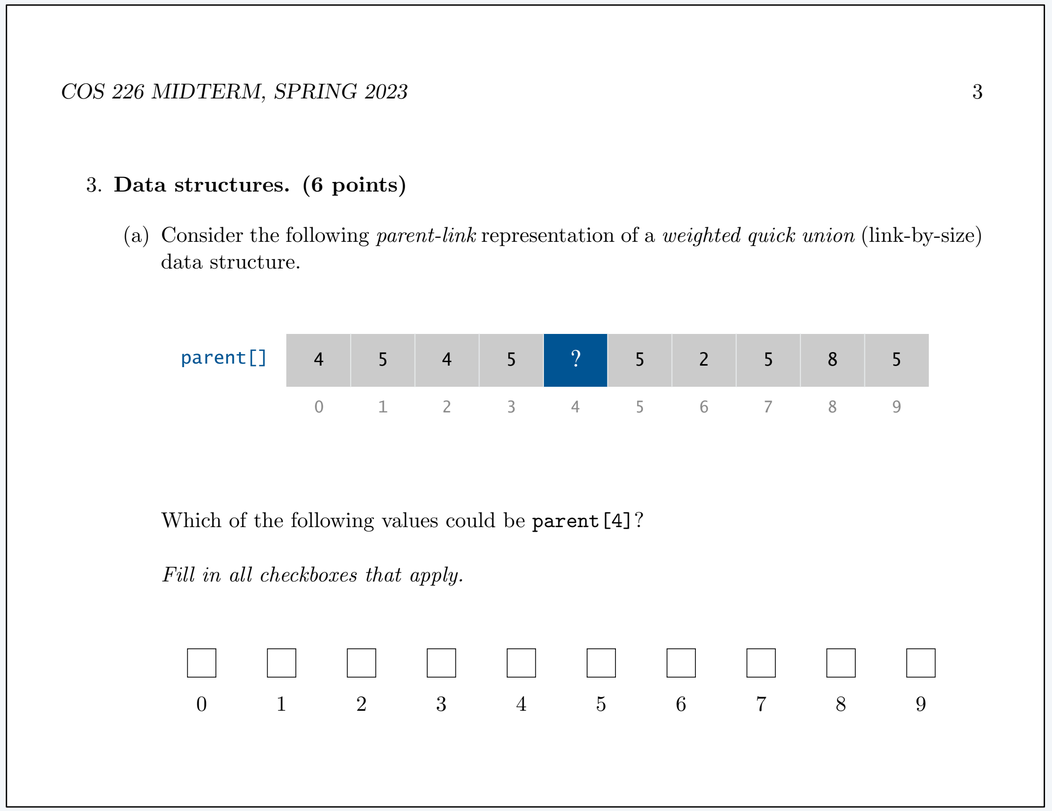
PrairieLearn platform.

- 2–3 short questions per lecture.
- Solve using pencil and paper.
- Unlimited attempts (different versions of the question), delay between attempts.
- your score = max score in all attempts.

Midterm and final

Written exams.

- Questions drawn from lectures, precepts, and quizzes.
- Emphasizes non-programming material.



COS 226 MIDTERM, SPRING 2023 3

3. **Data structures. (6 points)**

(a) Consider the following *parent-link* representation of a *weighted quick union* (link-by-size) data structure.

	0	1	2	3	4	5	6	7	8	9
parent[]	4	5	4	5	?	5	2	5	8	5

Which of the following values could be `parent[4]`?

Fill in all checkboxes that apply.

☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9

Grading A+

Programming assignments. 45%

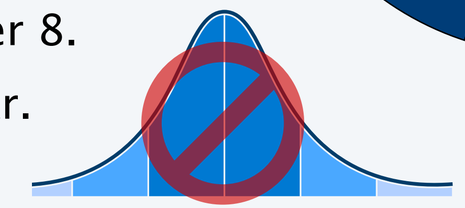
- 7 assignments, due at 11:59pm on Mondays via TigerFile.
- Policies (see web): collaboration in all but first two, 4 late days, run unit tests ≤10 times, email from dean for further extensions.

Quizzes. 10%

- Due at 11:59pm on Saturdays via PrairieLearn.
- Policies (see web): no collaboration, no late days, delay between attempts, lowest 6 questions dropped.

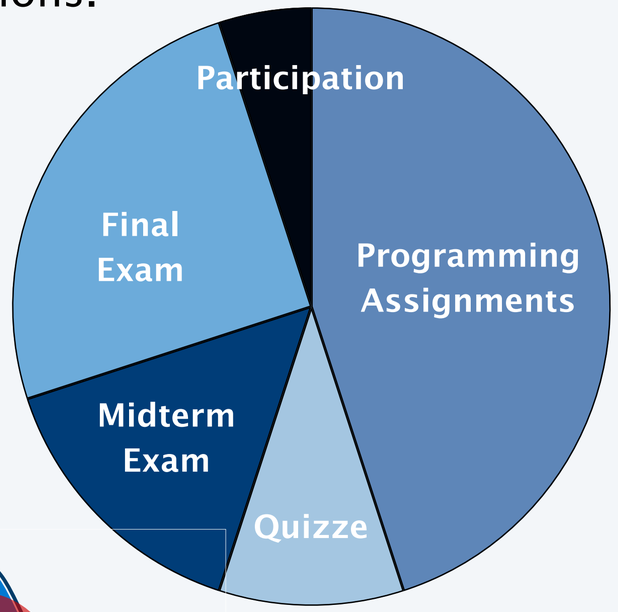
Exams. 15% + 25%

- 80-minute in-class midterm on Tuesday, October 8.
- 3-hour in-person final, as scheduled by Registrar.



Active participation. 5%

- iClicker participation in lecture, answer at least one poll, 5 absences excused.
- Collaborative participation in precept, 2 absences excused.



grade	score
A	93.0%
A–	90.0%
B+	87.0%
B	83.0%
B-	80.0%
C+	77.0%
C	73.0%
C-	70.0%
D	60.0%

please do not request an extension/waiver unless you will be exceeding the limit

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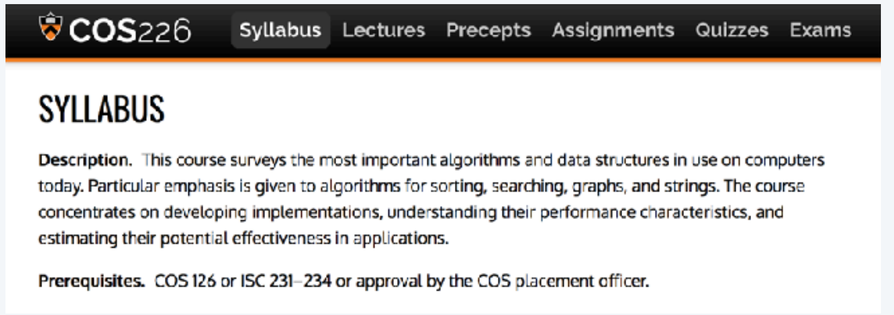
Resources

Readings (required). *Algorithms 4th edition* by R. Sedgewick and K. Wayne, Addison-Wesley Professional, 2011, ISBN 0-321-57351-X.

4th edition (2011)

Course website.

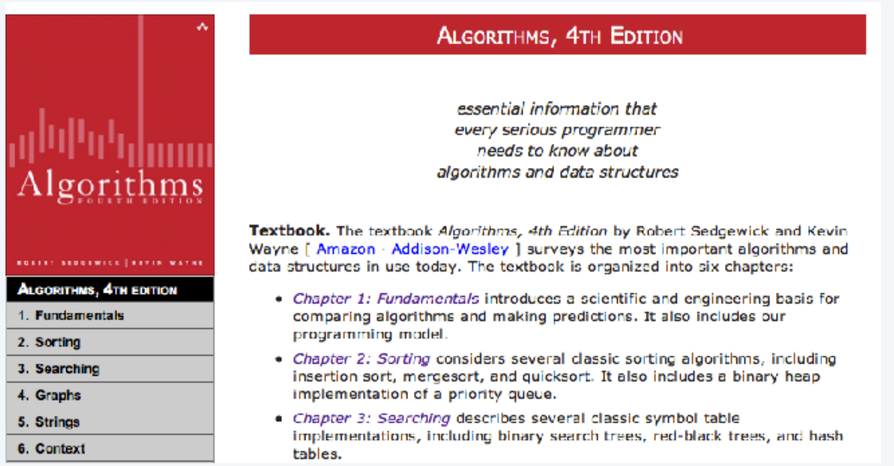
- Course info and policies.
- Lecture slides.
- Precept lessons.
- Programming assignments.
- Link to quizzes.
- Exam archive.



https://www.princeton.edu/~cos226

Booksite.

- Brief summary of content.
- Download code from book.
- APIs and Javadoc.



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Resources (people)

Online discussion forum.

- Low latency, low bandwidth.
- Designate post as private only when necessary.
- See Ed FAQ for guidelines.

https://us.edstem.org/courses/41414

Office hours.

- High bandwidth, high latency.
- See web for schedule.

https://www.princeton.edu/~cos226

Intro COS lab.

- Undergrad lab TAs.
- For help with debugging.
- See web for schedule.

https://introlab.cs.princeton.edu

Resources (ed tech)

Platform	What
Ed	*discussion forum*
IntelliJ	*Java IDE*
PrairieLearn	*quizzes*
TigerFile	*assignment submissions*
codePost	*assignment feedback*
Gradescope	*exam feedback*
Canvas	*grades*
iClicker	*in-class polls*

also use for communication with course staff

A typical week (including this one!)

you are here!

again on Thursday

support lecture material; assignment prep

Sun	Mon	Tue	Wed	Thu	Fri	Sat
1	2	3 **Lecture 1 (Union-Find)**	4	5 **Lecture 2 (Analysis)**	6 **Precept 1**	7 **Quiz 1, 2**
8	9 **Assignment 1 (Percolation)**	10	11	12	13	14

content based on week's material

content based on corresponding lectures

Administrative Q+A

Need to contact staff? Private Ed Discussion message.

Not registered? Register today.

Change precept? Use TigerHub.

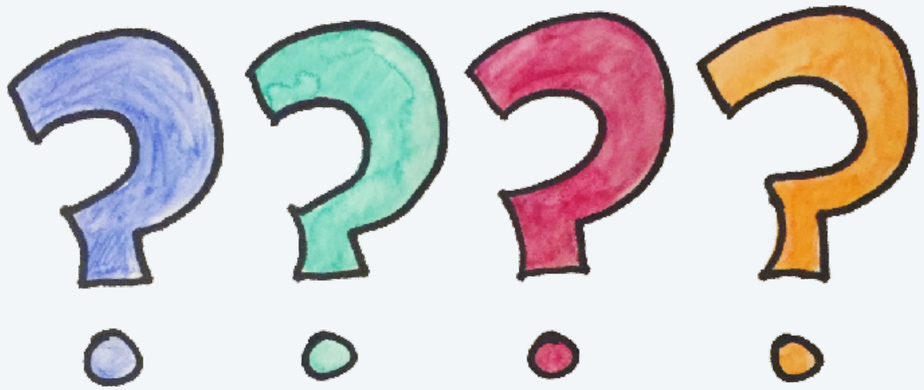
All non-conflicting precepts closed? Contact our course admin, Kobi Kaplan.

Kobi Kaplan

Haven't taken COS 126? See COS placement officer.

Placed out of COS 126? Review Sections 1.1–1.2 of Algorithms 4/e.

Additional administrative questions. Ask now, after class, or any time in Ed Discussion.



Credits

image	source	license
THX Eclipse Deep Note	THX Ltd.	
Wireframe Tiger	Audrey Cheng ’20	by author
Programmer	Wall Street Journal	
Student Raising Hand	classroomclipart.com	educational use
A is for Algorithms	comtechpass.com	
Assignment Logos	Kathleen Ma ’18	by author
Normal Distribution	Adobe Stock	education license
Pair Programming	Adobe Stock	education license
Office Hours	clipground.com	CC BY 4.0
COS Lab TAs	Pulkit Singh ’20	by author
Question Marks	pikpng.com	non-commercial use
Elbow Bump	The Noun Project	CC BY 3.0
Countdown Timer	YouTube	

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