

COS 226, SPRING 2026

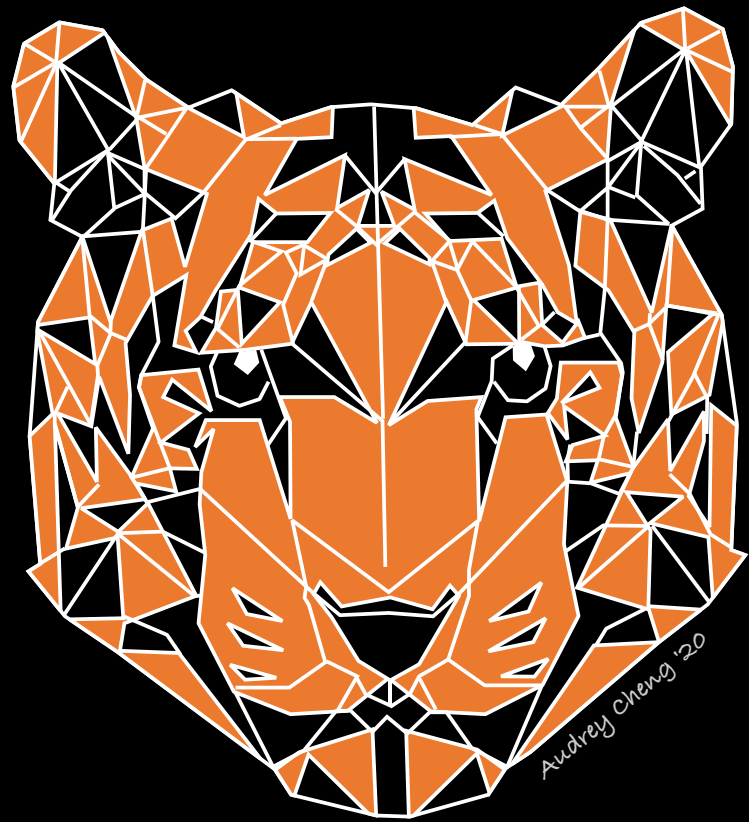
ALGORITHMS
and
DATA STRUCTURES

MARYAM HEDAYATI · GILLAT KOL · PEDRO PAREDES



PRINCETON
UNIVERSITY

FINE PRINT



*Because of privacy, compliance, and legal considerations,
you may not record or redistribute recordings of this class.*



<https://algs4.cs.princeton.edu>

INTRO TO COS 226

- *motivation*
- *course structure*
- *grading and assessments*
- *support and resources*



<https://algs4.cs.princeton.edu>


INTRO TO COS 226

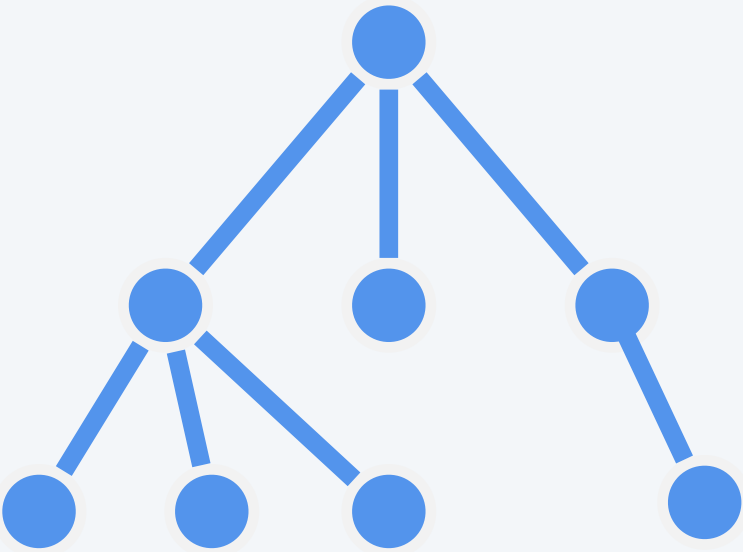
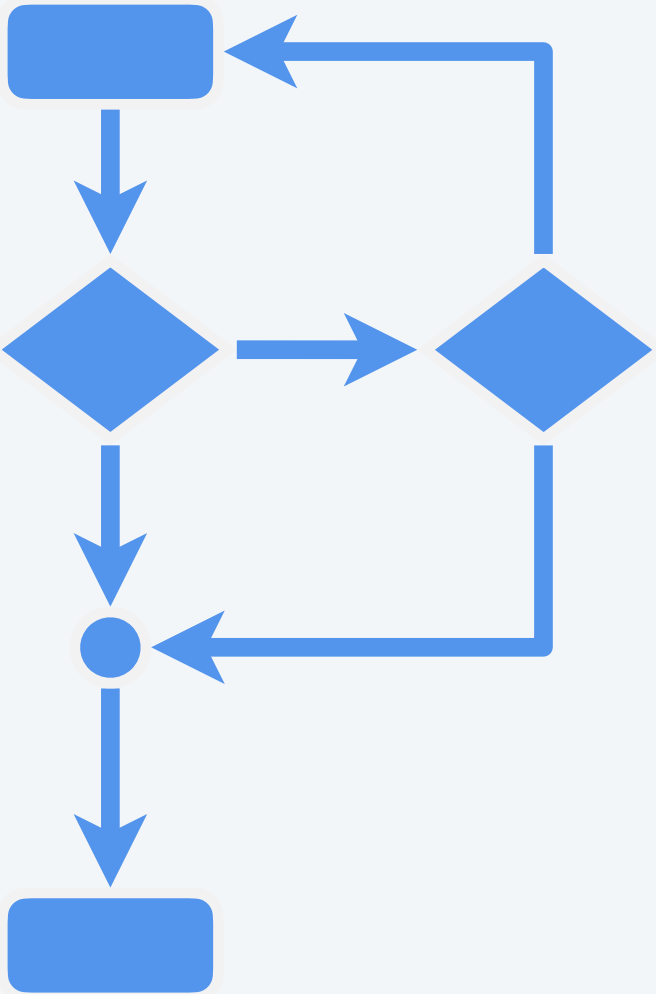
- *motivation*
- *course structure*
- *grading and assessments*
- *support and resources*

COS 226 course overview

What is COS 226?

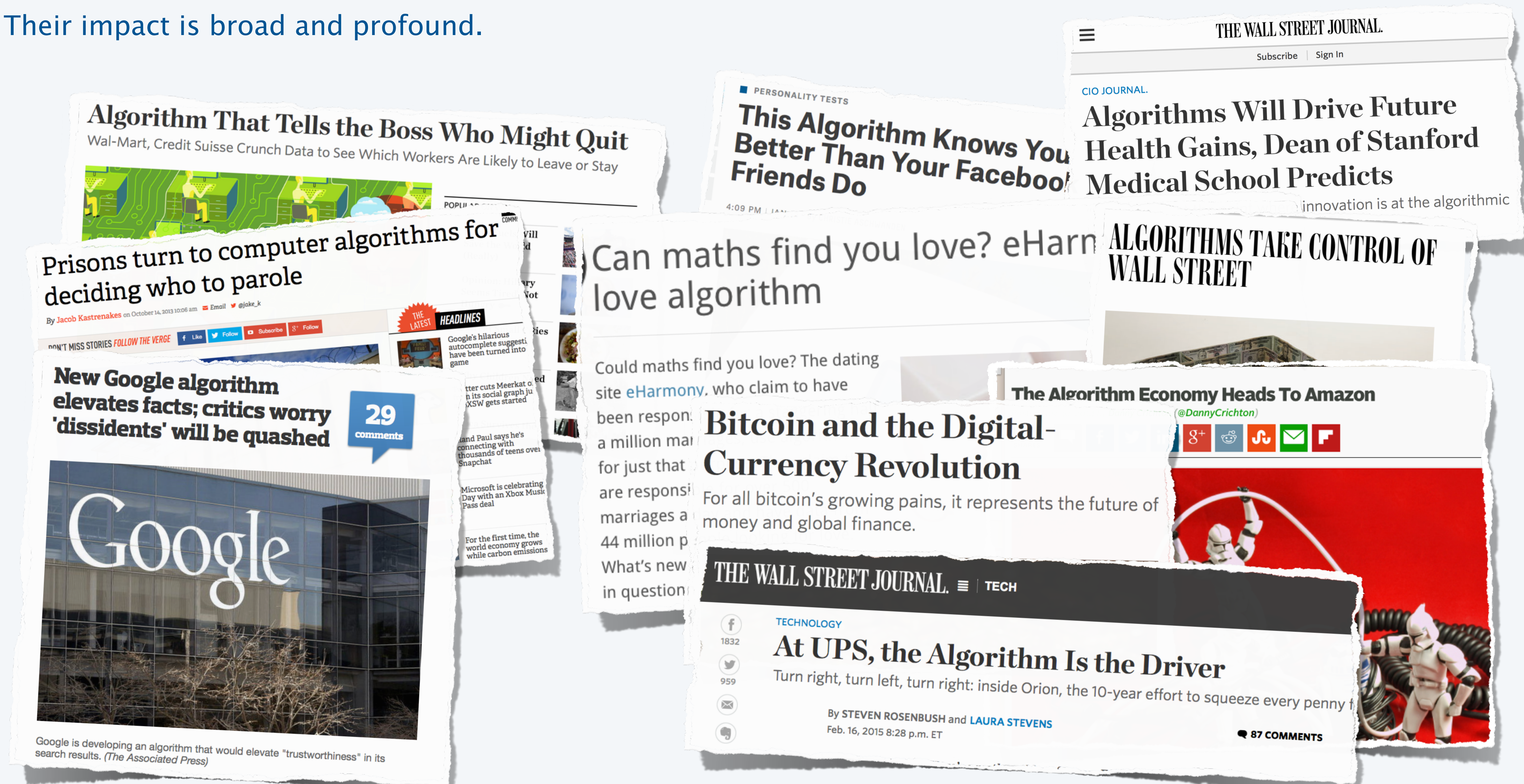
- **Algorithm:** A step-by-step, well-defined procedure for solving a problem.
- **Data structure:** A way to organize data in a computer for efficient access and update.
- Programming and problem solving, with applications.

topic	algorithms / data structures	
data types	<i>stack, queue, union-find</i>	
sorting	<i>insertion sort, quicksort, mergesort, priority queue</i>	
searching	<i>BST, red-black tree, hash table, k-d tree</i>	
graphs	<i>BFS, DFS, Prim, Kruskal, Dijkstra</i>	
advanced	<i>randomness, multiplicative weights, intractability</i>	



Why study algorithms and data structures?

Their impact is broad and profound.



Why study algorithms and data structures?

To become a strong programmer.

```
:n==t?this.pause().cycle():this.slide  
ent.find(".next, .prev").length&&e.su  
clearInterval(this.interval),this.int  
nction(){if(this.sliding)return;retur  
|r|t|(),s=this.interval,o=t=="next"?  
h?i:this.$element.find(".item")[u](),  
cators.length&&(this.$indicators.find  
children()[a.getActiveIndex()]);t&&t.  
t.trigger(f);if(/<\/>/.test(f))defaultPrevented(  
t.transition(t.$element.children()[a.getActiveIndex()]){i.removeC  
iding=!1,se on(){a.$ele  
moveClass("active", "inactive", o);a.$ele  
.carousel("cycle");  
defaults(n),o=typ  
[o]():s.in .cycle()})  
t,e.fn.carousel.prototype=function()  
slide-to]",fun var n=e(this),  
({}),i.data("bs.carousel",n);n.carousel(s  
}})(wind e){use  
ts,n).is($par
```

*“ I will, in fact, claim that the difference between a bad programmer and a good one is whether [they] consider [their] code or [their] data structures more important. Bad programmers worry about the code. Good programmers worry about **data structures** and their relationships.”* — Linus Torvalds (architect of Linux and git)



Why study algorithms and data structures?

For intellectual stimulation.



*“For me, **great algorithms are the poetry of computation.** Just like verse, they can be terse, allusive, dense, and even mysterious. But once unlocked, they cast a brilliant new light on some aspect of computing.”* — Francis Sullivan

Why study algorithms and data structures?

For fun—and, eventually, profit.

Google



GitHub



facebook

RSA
SECURITY

airbnb

NETFLIX



slack

CISCO SYSTEMS

Square

in

Morgan Stanley

IBM

lyft



nVIDIA

TESLA

JANE STREET

SPACEX



Adobe



UBER

zoom

P X A R
ANIMATION STUDIOS

DE Shaw & Co

ORACLE

YAHOO!

amazon

intel

Microsoft

Akamai

Why study algorithms and data structures?

- Their impact is broad and profound.
- To become a strong programmer.
- For intellectual stimulation.
- For fun—and, eventually, profit.

Why study anything else?





<https://algs4.cs.princeton.edu>

INTRO TO COS 226

- *motivation*
- *course structure*
- *grading and assessments*
- *support and resources*

Lectures

Live lectures. We introduce new material.

What	When	Where	Who	Office Hours
L01	TTh 1:20–2:40pm	Friend 101	Gillat Kol Maryam Hedayati Pedro Paredes	<i>see course website</i>



Prof. Maryam Hedayati



Prof. Gillat Kol



Prof. Pedro Paredes

Questions. Please raise your hand and ask. ← *carpe diem!*

Electronic devices. Only for supporting the lecture (viewing slides, taking notes, iClickers).







iClicker (required). To earn participation credit:

- Create an iClicker Cloud account. *← use your Canvas-preferred email*
- Answer multiple-choice questions during lecture. *← must answer 75% of questions
please enable location sharing!*



<https://www.iclicker.com>

If you could have more of one of the following, which would you choose?

- A. Fame. 
- B. Fortune. 
- C. Friends. 
- D. Free time. 

Precepts

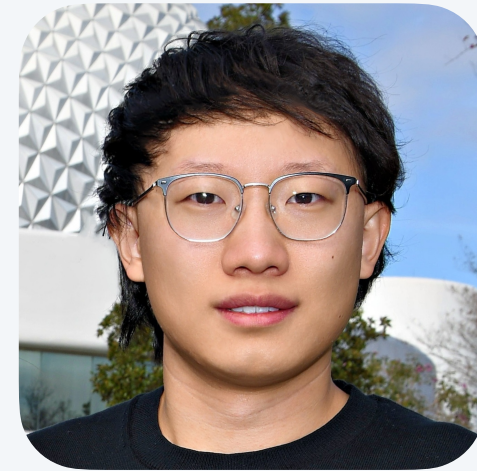
Active learning. Problem solving, discussion, assignment preparation, ...



Prof. Maryam Hedayati



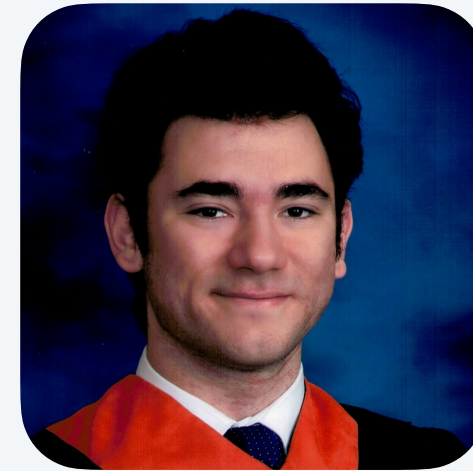
Jiatong Yu



Yang Duan



Frederick Qiu



Alkin Kaz



Lacey DeLucia



Andy Nguyen



Patty Liu

Special precept P04. Friday 1:20–2:40pm.

- Intended for students seeking a more advanced treatment of the material.
- Covers topics beyond the scope of the course.
- Add/drop via TigerHub.



Prof. Pedro Paredes



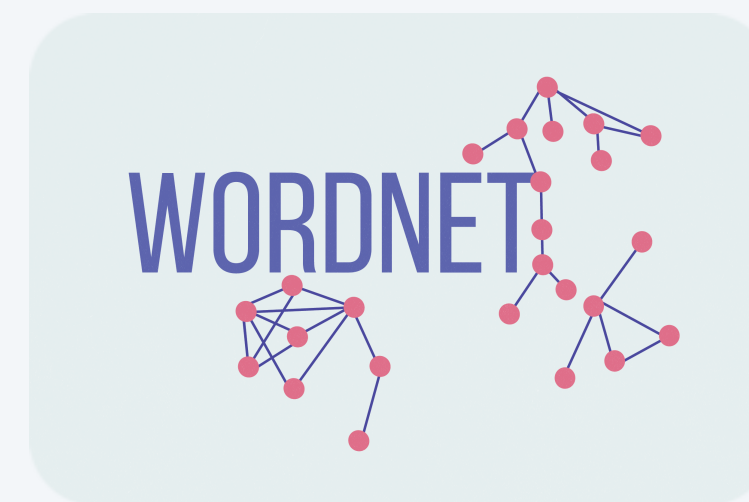
<https://algs4.cs.princeton.edu>

INTRO TO COS 226

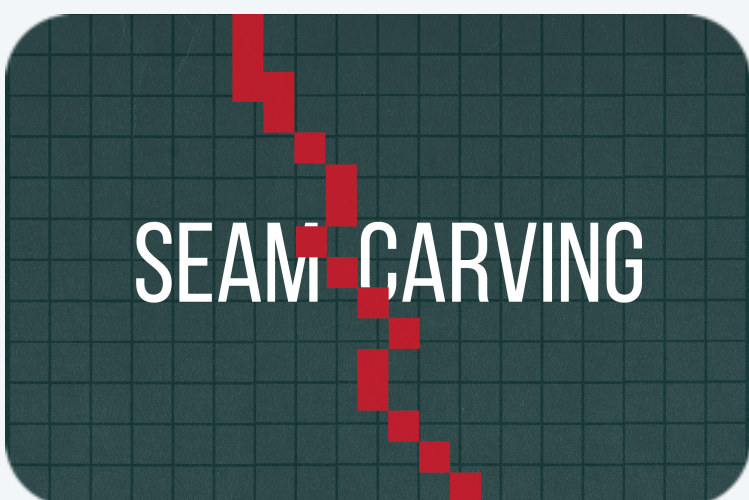
- *motivation*
- *course structure*
- *grading and assessments*
- *support and resources*

Programming assignments

Implement efficient **algorithms** and **data structures**.




Apply “textbook” algorithms to interesting **applications**.



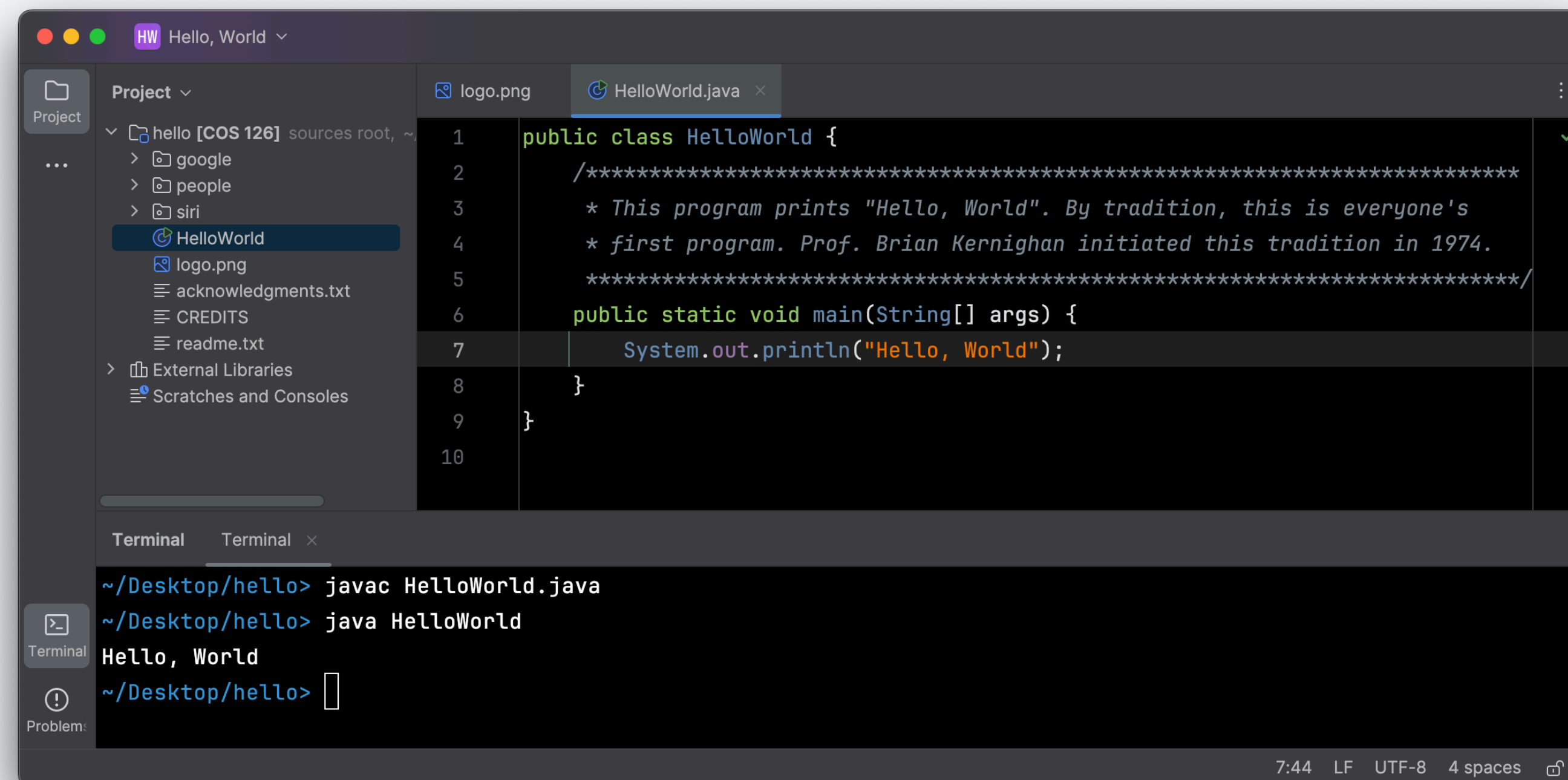
Pair programming is encouraged on designated assignments.



Programming environment (IntelliJ)

Recommended IDE: custom IntelliJ 2025.2 environment.  *use our fall 2025 version
(see lab TAs for troubleshooting)*

- Embedded terminal (Bash).
- Highlights common errors as you type.
- Automatic formatting, imports, and code completion.
- ...

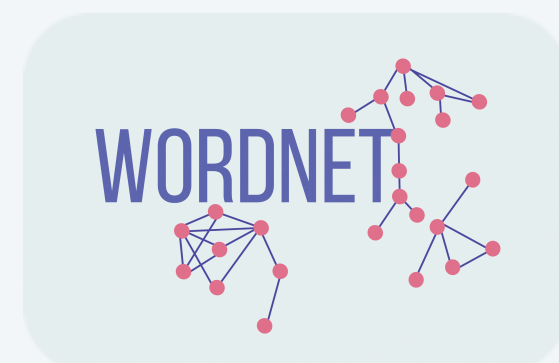


Completion credit (7%).

- Earned by submitting any code that compiles by the completion deadline (1% per assignment).
- You will receive autograder feedback for any code you submit by the completion deadline.
- Autograder feedback is helpful for making sure your code works, so we highly encourage submitting the complete assignment on time.
- Your grade doesn't depend on autograder feedback

Code review credit (28%).

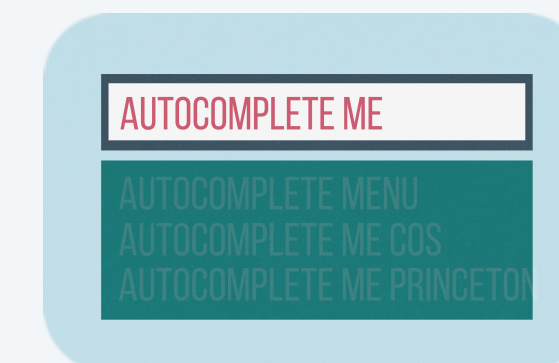
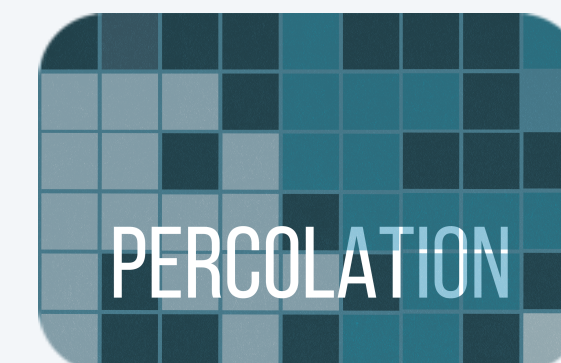
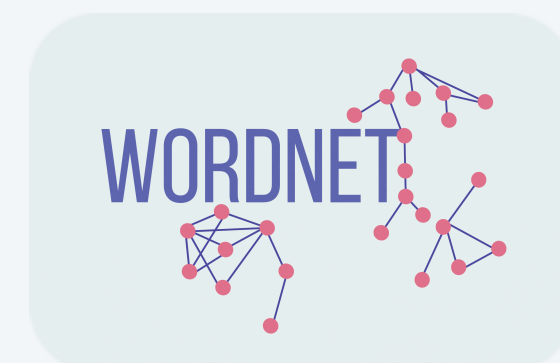
- Earned by demonstrating your understanding of your code during a one-on-one code review with a TA (4% per assignment).
- Code reviews are 20 minutes with a TA, dates listed on assignments pages.
- The TA is not trying to trick you, and the questions should be easy if you wrote your own code.
- 25% partial credit per component for acknowledging incomplete work.




Programming assignment recommendations

Our recommendation.

- Write your own code from scratch and aim to finish by completion deadline
- Start early to give yourself time to debug
- Use the autograder to catch bugs and check completeness
- When you're stuck, use course resources (Ed, office hours, lab TAs)
- Honest partial progress is better than code you don't understand



PrairieLearn platform.

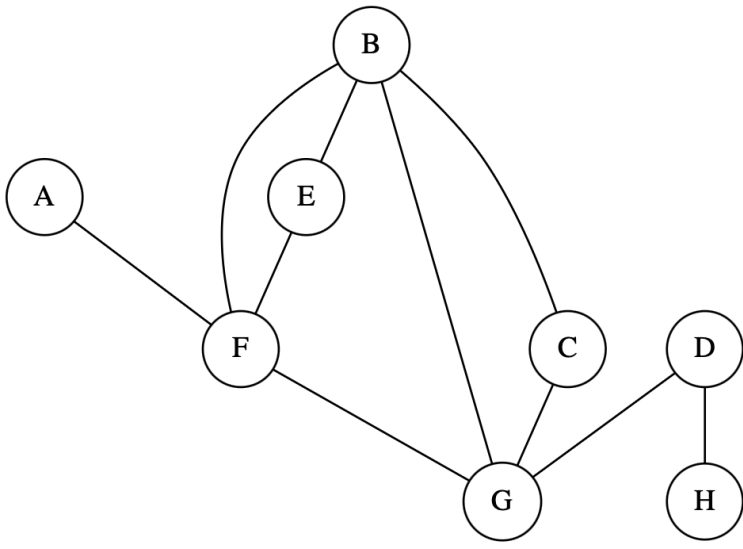
- 2–3 short questions after each lecture.
- Solve using pencil and paper (not GenAI).
- Unlimited attempts per question.  *different variant each attempt;
short delay between attempts*
- Your score = best score over all attempts.

Q7.2. Breadth-First Search Trace

Consider the following adjacency-lists representation of a graph with **8** vertices and **10** edges:

```
A: F
B: G E C F
C: G B
D: H G
E: B F
F: G A B E
G: B C F D
H: D
```

Here is a graphical representation of the same graph:



Run breadth-first search (using the adjacency-lists representation) from vertex **A**. Give the sequence in which the vertices are dequeued from the FIFO queue.

Your answer should be a sequence of **8** uppercase letters starting with **A**, separated by whitespace.

dequeued =

Save & Grade 2 attempts left **Save only**

Additional attempts available with new variants ⓘ
Can only be graded once every 2 minutes ⓘ



Written exams.

- Questions drawn from lectures, precepts, programming assignments, and quizzes.
- Emphasizes **conceptual** questions rather and code-writing.

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.

parent[]

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

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 breakdown A+

Programming assignments (35%).

- Completion credit & code reviews
- Due at 11:59pm on Mondays (2 optional late days per assignment).
- Collaboration/lateness policies: see course website.

Quizzes (10%).

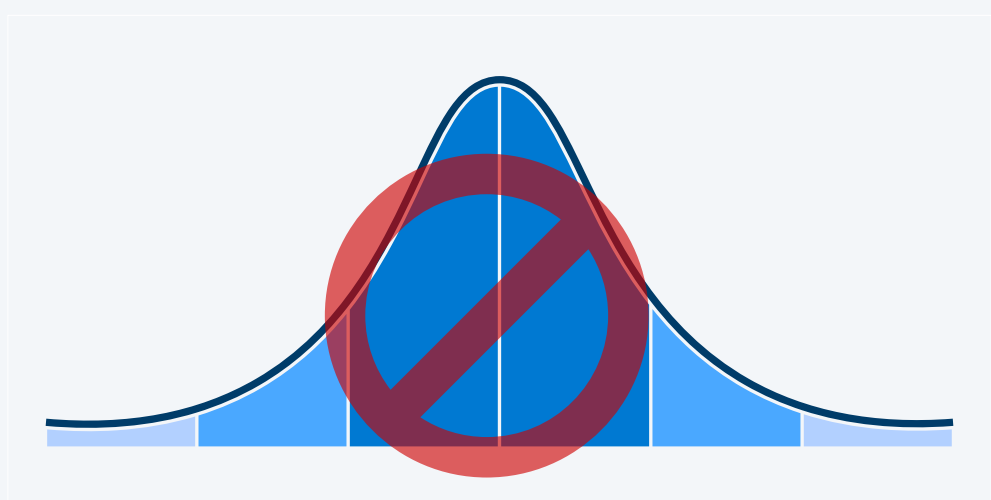
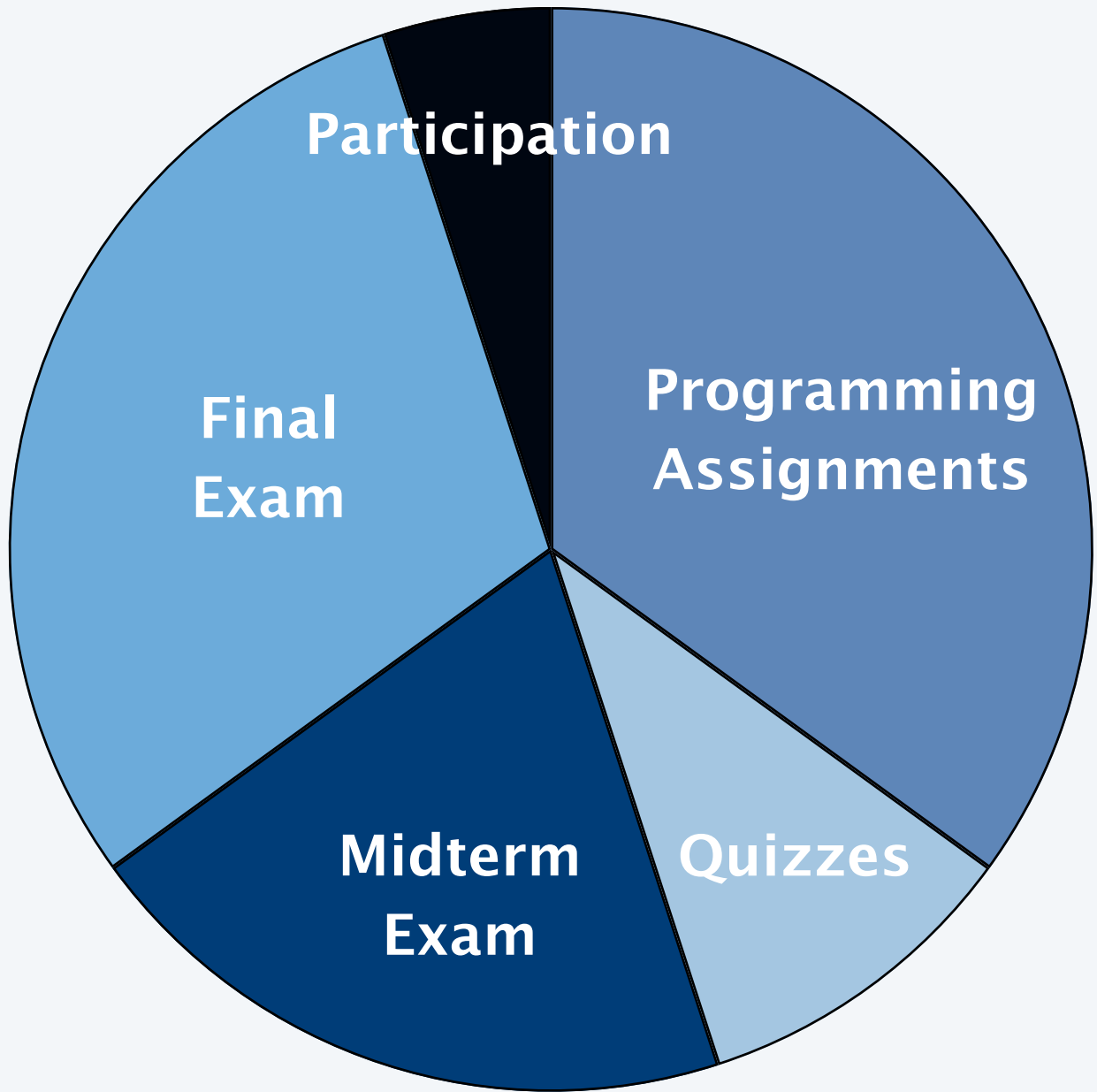
- Due at 11:59pm on Saturdays.
- Collaboration/lateness policies: see course website.

Written exams (50%).

- 80-minute midterm exam on Tuesday, March 3.
- 3-hour in-person final exam on Saturday, May 9.

Active participation (5%).

- iClicker participation in lectures.
- Collaborative participation in precepts.



grade	score
A	93.0%
A-	90.0%
B+	87.0%
⋮	⋮

course grades and uncurved
(no rounding of percentages)



<https://algs4.cs.princeton.edu>

INTRO TO COS 226

- *motivation*
- *course structure*
- *grading and assessments*
- *support and resources*

Required textbook



Textbook readings. From *Algorithms 4th edition* by R. Sedgewick and K. Wayne, Addison–Wesley Professional, 2011, ISBN 0–321–57351–X.

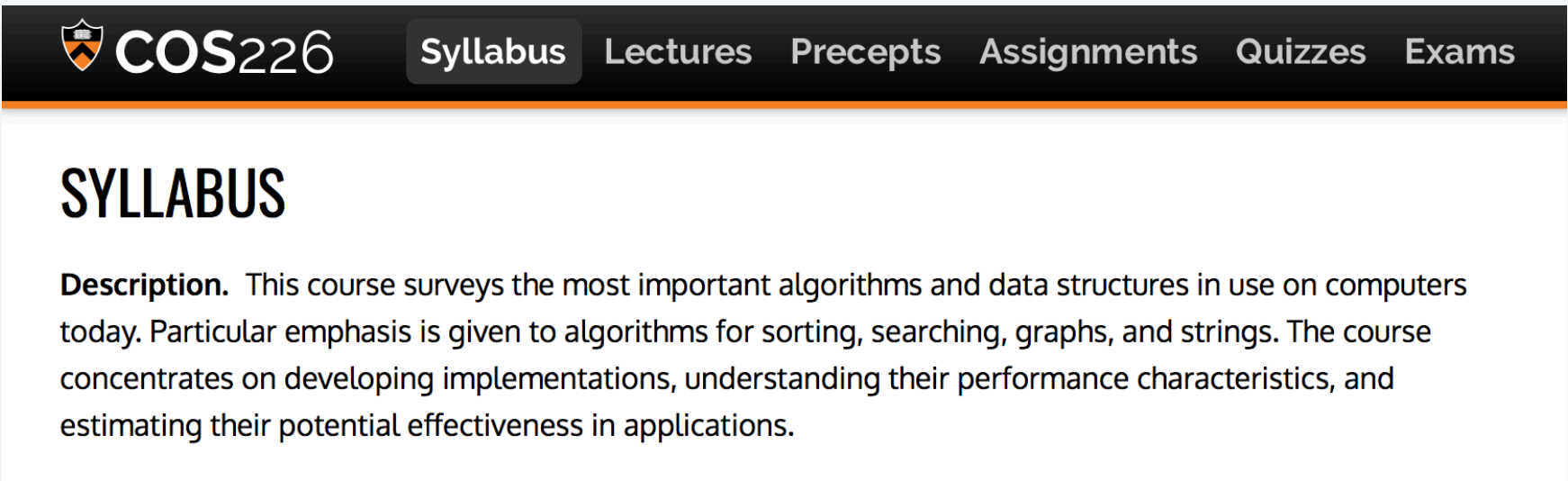
← *eCampus, Amazon, ...*



4th edition (2011)

Course website.

- Syllabus and course policies.
- Lecture slides.
- Precept worksheets.
- Programming assignments.
- Quizzes.
- Exam archive.

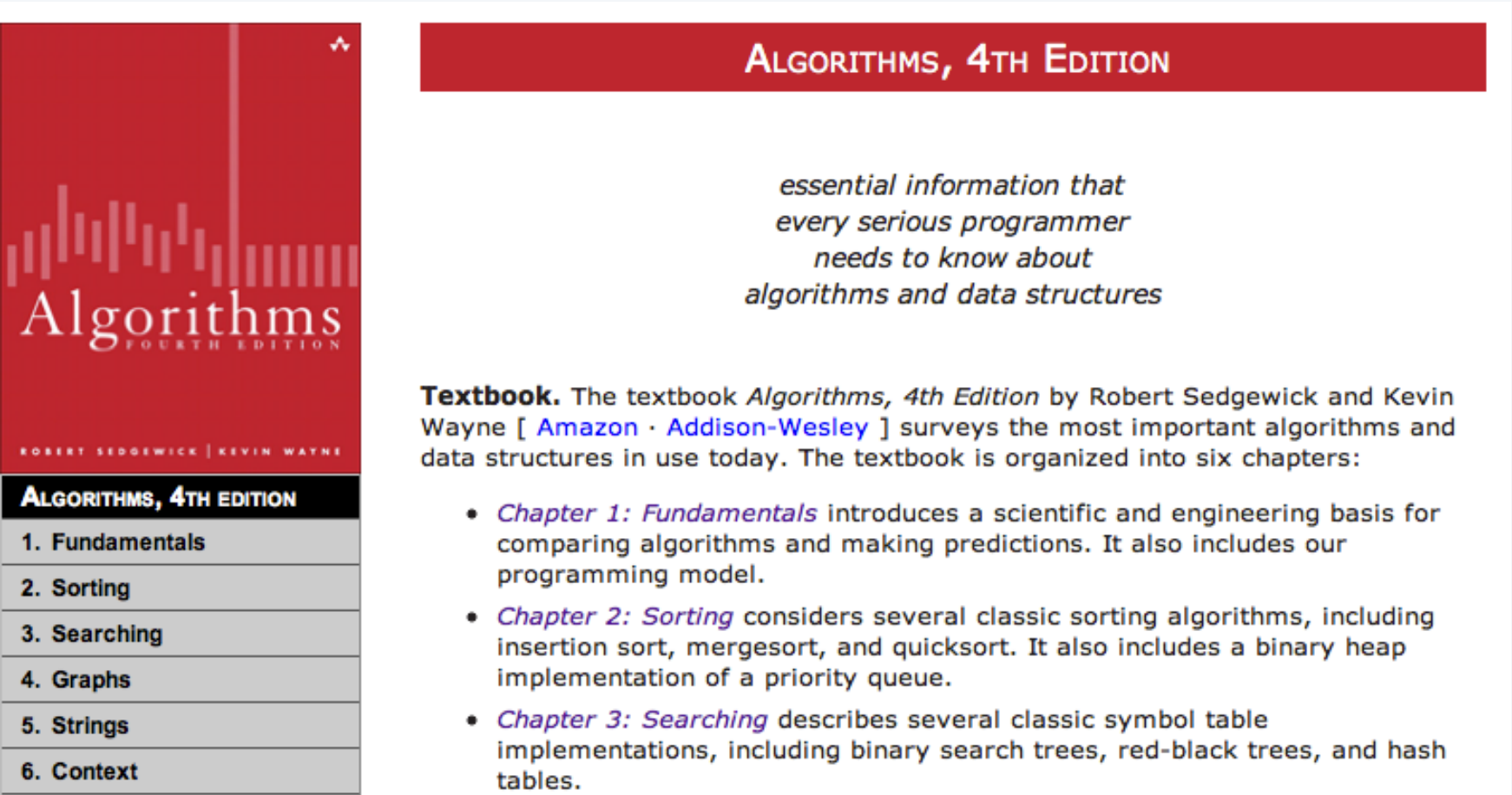


The screenshot shows the COS226 course website. At the top is a navigation bar with links: Syllabus, Lectures, Precepts, Assignments, Quizzes, and Exams. Below the navigation bar is a section titled "SYLLABUS". Under "SYLLABUS" is a "Description" paragraph: "This course surveys the most important algorithms and data structures in use on computers today. Particular emphasis is given to algorithms for sorting, searching, graphs, and strings. The course concentrates on developing implementations, understanding their performance characteristics, and estimating their potential effectiveness in applications."

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

Book website (booksite).

- Brief chapter summaries.
- Downloadable code from the book.
- APIs and Javadoc.



The screenshot shows the website for the book "Algorithms, 4th Edition" by Robert Sedgwick and Kevin Wayne. On the left is the book cover, which is red with the title "Algorithms" and "FOURTH EDITION" in white. Below the cover is a table of contents with the following chapters: 1. Fundamentals, 2. Sorting, 3. Searching, 4. Graphs, 5. Strings, and 6. Context. To the right of the cover is a red header with the text "ALGORITHMS, 4TH EDITION". Below the header is a quote: "essential information that every serious programmer needs to know about algorithms and data structures". Below the quote is a "Textbook" paragraph: "The textbook *Algorithms, 4th Edition* by Robert Sedgwick and Kevin Wayne [[Amazon](#) · [Addison-Wesley](#)] surveys the most important algorithms and data structures in use today. The textbook is organized into six chapters:". Below the paragraph is a list of chapters with brief descriptions:

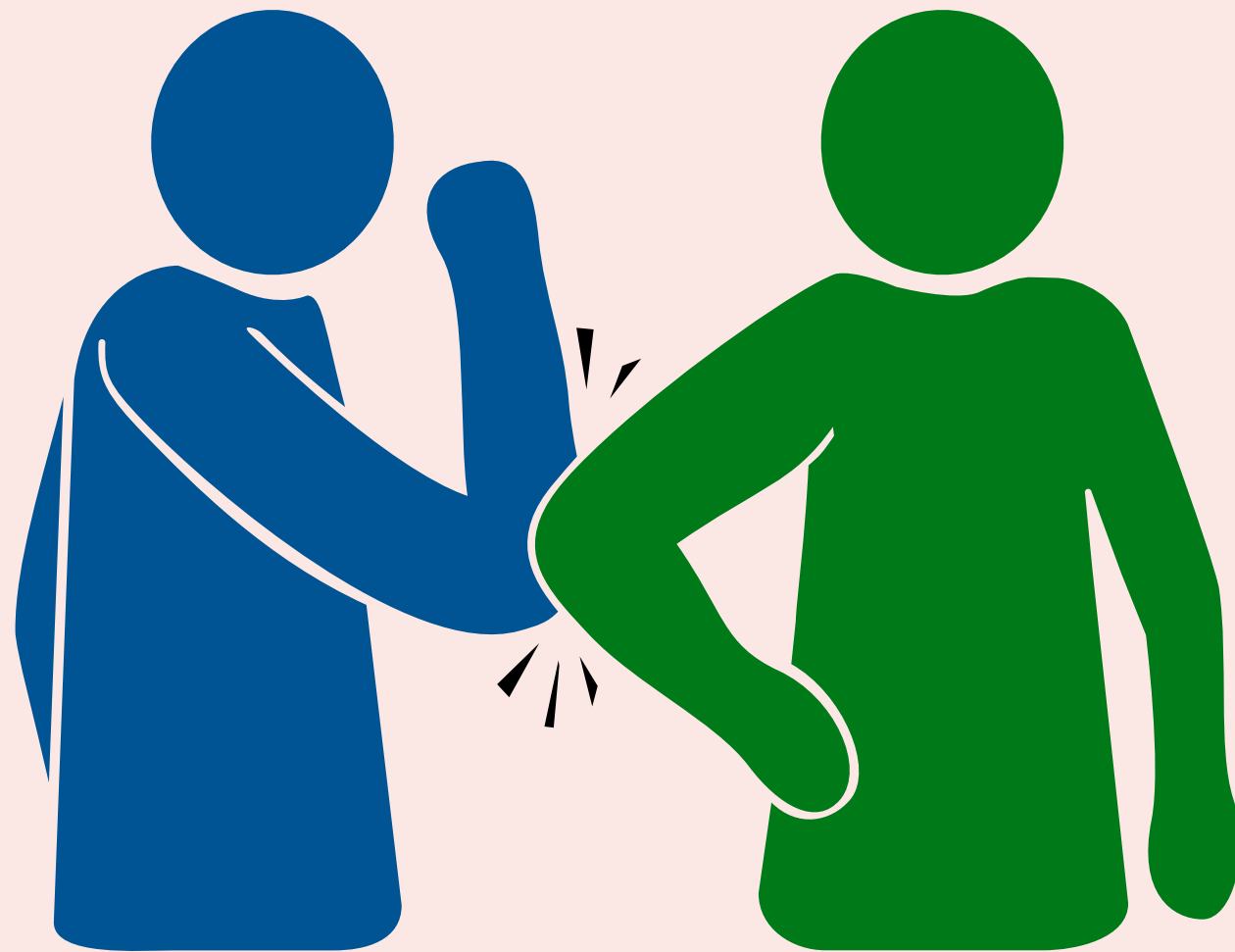
- *Chapter 1: Fundamentals* introduces a scientific and engineering basis for comparing algorithms and making predictions. It also includes our programming model.
- *Chapter 2: Sorting* considers several classic sorting algorithms, including insertion sort, mergesort, and quicksort. It also includes a binary heap implementation of a priority queue.
- *Chapter 3: Searching* describes several classic symbol table implementations, including binary search trees, red-black trees, and hash tables.

<https://algs4.cs.princeton.edu>



Have you already met the person sitting next to you?

- A. Yes.
- B. No.



Ed discussion forum. *please use Ed, not email*

- For quick questions.
- Designate post as private only when necessary.
- Read the Ed FAQ for guidelines.



<https://edstem.org/us/courses/94725/>

Office hours.

- For longer discussions.
- See the course website for the schedule.



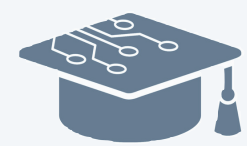
<https://www.princeton.edu/~cos226>








Intro COS lab.

- Run by undergrads.
- For help with debugging.
- See the course website for the schedule.



<https://introlab.cs.princeton.edu>



Platform	What it's for
 Ed	<i>discussion forum, precept lessons</i>
 IntelliJ	<i>Java IDE (programming environment)</i>
 PrairieLearn	<i>quizzes</i>
 TigerFile	<i>assignment submissions</i>
 Gradescope	<i>exam grading and feedback</i>
 Canvas	<i>grades</i>
 iClicker	<i>in-lecture polls and participation</i>

← *also use for communication with course staff
(do not email)*

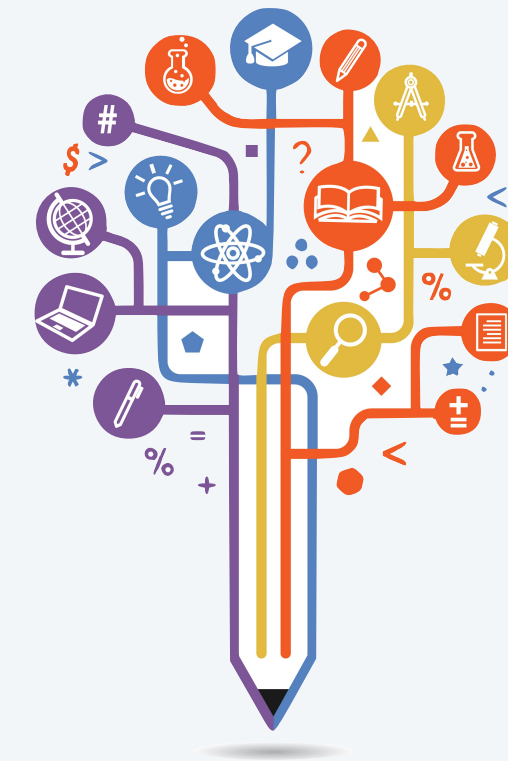
Non-resources: generative AI tools

GenAI policy. Using GenAI is **not permitted** on exams and quizzes, and **highly discouraged** on assignments



Pedagogical rationale.

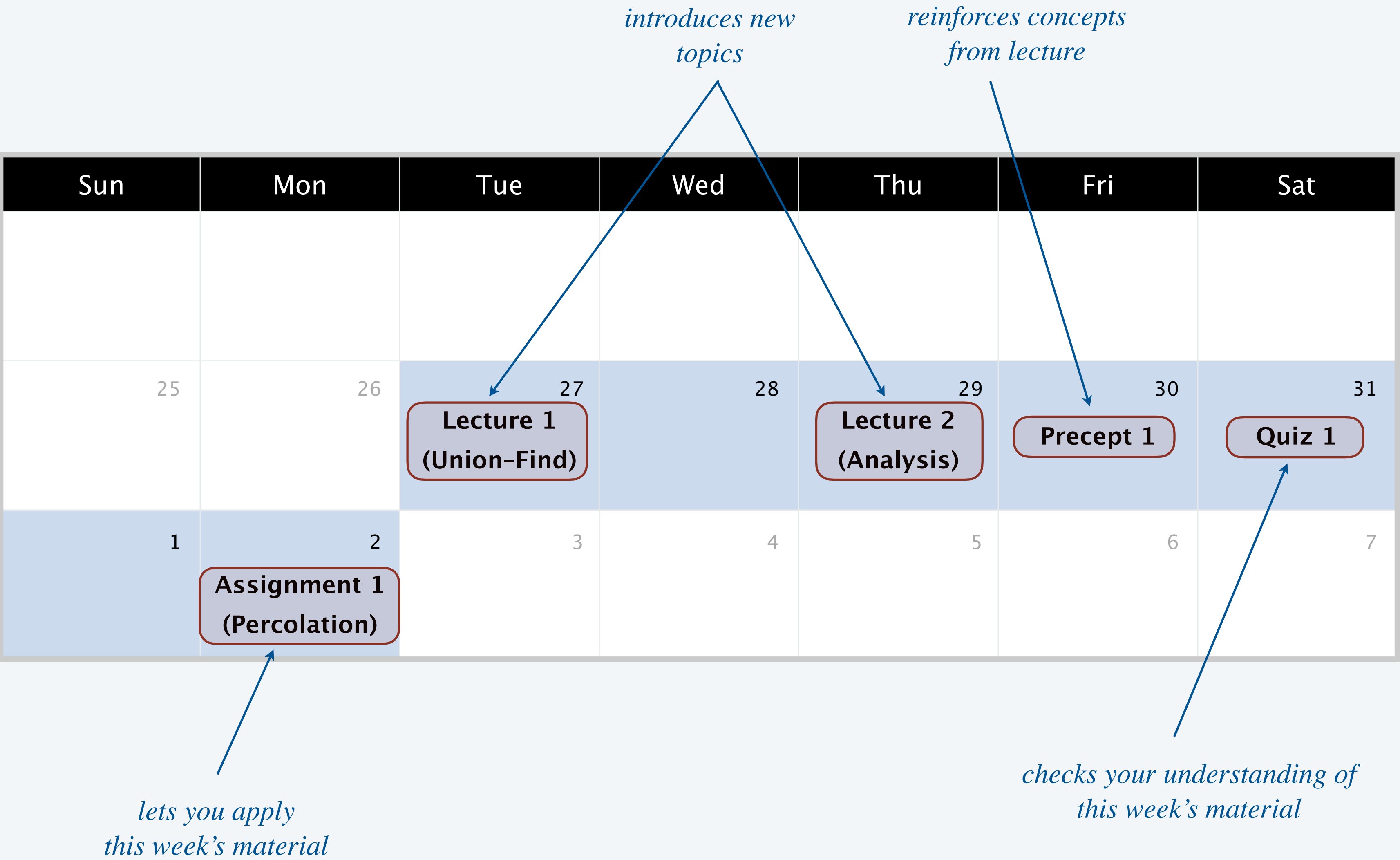
- Build a strong foundation in programming.
- Strengthen critical-thinking and problem-solving skills.
- Prepare to use GenAI effectively and responsibly in the future.
- Crush exams and technical interviews.




Grade incentive.

- Code reviews require you to understand how your code works and was written.
- Partial credit for honest incomplete work.

A typical week in COS 226 (including this one!)



Administrative questions ?

Not yet registered? Register today.  *must be enrolled to access various platforms*

Change your precept? Use TigerHub.

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



Kobi Kaplan

Placed out of COS 126 / ECE 115? Review Sections 1.1–1.2 of Algorithms 4/e.

Haven't completed the COS 226 prerequisites? See the COS placement officer.

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



Credits

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