JOHNS HOPKINS
WHITING SCHOOL
of ENGINEERING

Computer Science EN.601.433/633
Introduction to Algorithms
Fall 2024 (3 credits, CS-THRY)

Instructor

Professor Michael Dinitz, mdinitz@cs.jhu.edu, https://www.cs.jhu.edu/~mdinitz/
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Office hours: posted on course webpage

Teaching Assistant

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Office hours: posted on course webpage

Meeting

Tuesday, Thursday 9am–10:15 am, Remsen Hall 101

Textbook

Required: Cormen, Leiserson, Rivest, and Stein, *Introduction to Algorithms, Third Edition*, MIT Press (2009).

Online Resources

Course webpage: http://www.cs.jhu.edu/~mdinitz/classes/IntroAlgorithms/Fall2024/

Online discussion: Courselore. Invite link: https://courselore.org/courses/1217863134/invitations/6119062569 .

Homework submission and grading: Gradescope (https://gradescope.com).

Course Information

- This course concentrates on the design of algorithms and the rigorous analysis of their efficiency. Topics include the basic definitions of algorithmic complexity (worst case, average case); basic tools such as dynamic programming, sorting, searching, and selection; advanced data structures and their applications (such as union-find); graph algorithms and searching techniques such as minimum spanning trees, depth-first search, shortest paths, design of online algorithms and competitive analysis.
- **Prerequisites**
  Data Structures (EN.601.226 or equivalent)
  Mathematical Foundations of Computer Science (EN.601.230 or equivalent) OR Discrete Mathematics (EN.550.171 or equivalent) OR Automata and Computation Theory (EN.601.231 or equivalent)

- **Required, Elective or Selective Elective**: Required

Course Goals

Specific Outcomes for this course are that

- Students will learn the basic definitions of algorithmic complexity, and how to analyze the complexity of algorithms.
- Students will learn basic algorithmic tools used to design efficient algorithms.
- Students will learn how to design efficient algorithms and to recognize situations where this is not possible.

This course will address the following Criterion 3 Student Outcomes

Graduates of the program will have an ability to:

(1) Analyze a complex computing problem and to apply principles of computing and other relevant disciplines to identify solutions.
(2) Function effectively as a member or leader of a team engaged in activities appropriate to the program's discipline.
(3) Apply computer science theory and software development fundamentals to produce computing-based solutions.

Course Topics

- Basic definitions of algorithmic complexity (worst case, average case).
- Basic tools such as dynamic programming, sorting, searching, and selection.
- Advanced data structures and their applications (such as union-find).
- Graph algorithms and searching techniques such as minimum spanning trees, depth-first search, and shortest paths.
- Design of approximation and online algorithms.

Course Expectations & Grading

There will be 9 homework assignments (approximately one each 1.5 weeks), each of which will be worth approximately 5.55% of your grade. You will be allowed 120 late hours (equivalent to 5 late days) for the semester without penalty. Gradescope keeps track of your total late time. Homeworks turned in with no remaining late days will not be accepted (and will be scored as a 0). Exceptions and extensions can be given in exceptional circumstances; please contact the course instructor to discuss your circumstances.

There will also be a midterm exam during one lecture time, and an in-person 3-hour final exam. Grades will be calculated as follows:

Homeworks: 50%

Midterm: 15%

Final exam: 35%

This class will be graded on a curve, but not a strict one. That is, the correspondence between numeric and letter grades will be determined by the final distribution of numeric grades, but there is no specific letter grade distribution that will be targeted.

You are free to work on the homework in groups of up to 3, but you must write up your solutions entirely on your own. That is, collaboration is limited to discussing the problem, and does not include writing down the solution. Please list the members of your group on your submission, which must be submitted as a typeset (*not* handwritten) PDF using Gradescope.

Key Dates

Midterm exam: Oct 22

Final Exam: Dec 17, 6pm–9pm

These dates are subject to change. If they do change, new dates will be announced online and in class.

Assignments & Readings

These will be posted on the course webpage.

Ethics

The strength of the university depends on academic and personal integrity. In this course, you must be honest and truthful, abiding by the *Computer Science Academic Integrity Policy*:

> Cheating is wrong. Cheating hurts our community by undermining academic integrity, creating mistrust, and fostering unfair competition. The university will punish cheaters with failure on an assignment, failure in a course, permanent transcript notation, suspension, and/or expulsion. Offenses may be reported to medical, law or other professional or graduate schools when a cheater applies.
>
> Violations can include cheating on exams, plagiarism, reuse of assignments without permission, improper use of the Internet and electronic devices, unauthorized collaboration, alteration of graded assignments, forgery and falsification, lying, facilitating academic dishonesty, and unfair competition. Ignorance of these rules is not an excuse.
>
> Academic honesty is required in all work you submit to be graded. Except where the instructor specifies group work, you must solve all homework and programming assignments without the help of others. For example, you must not look at anyone else's solutions (including program code) to your homework problems. However, you may discuss assignment specifications (not solutions) with others to be sure you understand what is required by the assignment.
>
> If your instructor permits using fragments of source code from outside sources, such as your textbook or on-line resources, you must properly cite the source. Not citing it constitutes plagiarism. Similarly, your group projects must list everyone who participated.
>
> Falsifying program output or results is prohibited.
>
> Your instructor is free to override parts of this policy for particular assignments. To protect yourself: (1) Ask the instructor if you are not sure what is permissible. (2) Seek help from the instructor, TA or CAs, as you are always encouraged to do, rather than from other students. (3) Cite any questionable sources of help you may have received.
>
> On every exam, you will sign the following pledge: "I agree to complete this exam without unauthorized assistance from any person, materials or device. [Signed and dated]". Your course instructors will let you know where to find copies of old exams, if they are available.

In addition, the specific ethics guidelines for this course are:

(1) Homeworks may be done in groups of up to three, but you must list your group members on the first page of your submission.
(2) On all assignments each person should hand-in their own writeup. That is, collaboration should be limited to talking about the problems, so that your writeup is written entirely by you and not copied from your partner. In addition, list all members of your group.
(3) While you are allowed to use outside resources to help your understanding and knowledge of course material, you *must not* go looking for outside resources to get answers for homework questions.

That is, you can look up concepts that you do not understand, but you cannot simply go looking for solutions. That includes searching on the Internet, using LLMs such as ChatGPT, etc.

(4) Moreover, you are not allowed to upload, download, or access solutions to homework or exam questions, *including homeworks or exams from previous semesters that are not explicitly released by the instructor*. In particular, you are not allowed to get old tests from other students or use "backtest" websites, Chegg, Course Hero, etc.

Report any violations you witness to the instructor.

Classroom Climate

I am committed to creating a classroom environment that values the diversity of experiences and perspectives that all students bring. Everyone here has the right to be treated with dignity and respect. I believe fostering an inclusive climate is important because research and my experience show that students who interact with peers who are different from themselves learn new things and experience tangible educational outcomes. Please join me in creating a welcoming and vibrant classroom climate. Note that you should expect to be challenged intellectually by me, the TAs, and your peers, and at times this may feel uncomfortable. Indeed, it can be helpful to be pushed sometimes in order to learn and grow. But at no time in this learning process should someone be singled out or treated unequally on the basis of any seen or unseen part of their identity.

If you ever have concerns in this course about harassment, discrimination, or any unequal treatment, or if you seek accommodations or resources, I invite you to share directly with me or the TAs. I promise that we will take your communication seriously and to seek mutually acceptable resolutions and accommodations. Reporting will never impact your course grade. You may also share concerns with the Department Head (Randal Burns, `randal@cs.jhu.edu`), the Director of Undergraduate Studies (Joanne Selinski, `joanne@cs.jhu.edu`), the Assistant Dean for Diversity and Inclusion (Darlene Saporu, `dsaporu@jhu.edu`), or the Office of Institutional Equity (`oie@jhu.edu`). In handling reports, people will protect your privacy as much as possible, but faculty and staff are required to officially report information for some cases (e.g. sexual harassment).

Disability Services

Johns Hopkins University values diversity and inclusion. We are committed to providing welcoming, equitable, and accessible educational experiences for all students. Students with disabilities (including those with psychological conditions, medical conditions, and temporary disabilities) can request accommodations for this course by providing an Accommodation Letter issued by Student Disability Services (SDS). Please request accommodations for this course as early as possible to provide time for effective communication and arrangements.

Mental Health Statement

Many students struggle with stress and a variety of other mental health concerns during their academic careers. JHU supports students' mental health and well-being in multiple ways.

Within the Student Health and Well-Being division, Mental Health Services provides many services and resources to students. Undergraduate and graduate students enrolled in degree programs at the Whiting School of Engineering are eligible for services at MHS – Homewood (Counseling Center).

MHS also partners with TimelyCare, which offers on-demand mental health support through TalkNow, as well as up to 12 free counseling appointments with the provider of the student's choice. Psychiatric care is also available through TimelyCare for routine medication management (no stimulants or other controlled substances). https://app.timelycare.com/auth/login.

In addition, The Johns Hopkins University Behavioral Health Crisis Support Team (BHCST) pairs experienced, compassionate crisis clinicians with specially trained public safety officers on every shift on and

around the Homewood campus, seven days a week. The BHCST will provide immediate assistance to those who need it and, just as importantly, link individuals in crisis to ongoing support services in the days and weeks that follow. Call Public Safety, 410-516-5600, and ask for a BHCST clinician.

Specifically for graduate students, the Whiting School of Engineering has a dedicated office with Student Support and Advocacy. Engineering Student Support & Advocacy (ESSA) helps students navigate non-Academic issues including mental or physical health, interpersonal issues, conflict with advisors, financial concerns, time management, leaves of absence, being victimized, and family emergencies. Please find information about this office here: https://engineering.jhu.edu/studentaffairs/navigatingnonacademicissues/.

Eligibility for services for Engineering for Professionals students varies. Visit the EP eligibility page to learn more.

For concerns about a specific student, please contact:

- For emergencies (threat to self or others): 410-516-4600 or 911
- For on-scene mental health support: BHCST at 410-516-4600
- For WSE and KSAS undergraduates: Student Outreach & Support at 410-516-7857 or studentoutreach@jhu.edu (undergraduates)
- For KSAS Graduate Students: Renee Eastwood, Assistant Dean for Graduate and Postdoctoral Academic and Student Affairs
- For WSE Graduate Students: Megan Barrett, Assistant Dean for Engineering Student Affairs