



Carnegie Mellon University  
Master of  
Software Engineering

### 17-615: Data Structures and Algorithms

MW 1:30 -2:50pm, Remote (recorded)

F 8:00 – 9:00am, Remote (live)

[A1, Fall 2020, 6 Units]

**Last Update: 08/27/21**

#### Instructor

Prof. Matthew Bass

#### Email

[mbass@andrew.cmu.edu](mailto:mbass@andrew.cmu.edu)

#### Office Location & Hours

SCR 267 (currently remote)

Zoom ID: 3609899473

By appointment

#### Teaching Assistants

Ed Tsoi

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**Course Description.** The primary objective of the course is to provide students a solid background in the key principles of data structures and algorithms and introduce algorithmic thinking. This course is designed to complement the experience that students may already have with formal, yet practical underpinnings in computer science. Students will be better equipped for job interviews and more capable practicing software engineers. Specific learning objectives include:

- provide students with an thorough understanding of basic static and dynamic data structures and the relevant algorithms for operating on them
- provide students with a framework to analyze and characterize those factors influencing algorithmic performance and memory utilization
- develop the student’s ability to recognize and analyze critical computational problems, recognize alternative algorithms and data structures to solve the problems, and apply critical judgement to select among them
- improve the student’s ability to performed detailed, code-level design and document the design in an understandable way
- provide students with a hands on working knowledge of fundamental machine learning and data science concepts
- provide immediate competency enabling students to directly apply course material in real world situations
- provide hands-on opportunities to write software and repair debug programs to practice with data structures and algorithms

**Prior Knowledge.** Students are expected to be familiar with programming in at least one programming language. Formal programming language training is not required. Students may not have any formal background in algorithms, data structures, analysis, or detailed design techniques and methods.

Previous coursework in computer science (such as data structures or algorithms) is not necessary. However, students should have some experience writing small programs or software applications. Students in doubt regarding their experience should obtain instructor's permission.

**Learning Objectives.** After completing this course, you will be able to:

- Understand the basic static and dynamic data structures and the relevant algorithms for operating on them
- Analyze and characterize those factors influencing algorithmic performance and memory utilization
- Recognize and analyze critical computational problems, recognize alternative algorithms and data structures to solve the problems, and apply critical judgement to select among them
- Perform detailed, code-level design and document the design in an understandable way
- provide students with a hands on working knowledge of fundamental machine learning and data science concepts

**Learning Resources.** The course and all course materials will be distributed via Canvas.

**Assessments.** Students learn more by applying and explaining ideas to others, thus, the course requires the following activities:

- **Lecture and Reading Assessments:** These are short online questions derived from the readings and lectures
- **In-class Exercises:** Exercises students will do in pairs or small groups to practice applying the concepts learned in the course
- **Individual Homework Assignments:** These will be primarily programming assignments based on the concepts learned throughout the course
- **Final Exam**

Assessment	Final Grade %
Lecture & Reading Activities	20%
Individual Homework's	30%
Final Exam	30%
Class participation	20%

### Course and Grading Policies

- **Late-work policy:** All work is expected to be handed in at the indicated due date and time. For fairness to the whole class, no late submissions or makeups will be accepted for the Lecture & Reading Activities. We will, however, drop the lowest grade. The penalty for turning in Individual Homeworks late is 10%/day. In the first week of classes, you should receive a course schedule for each course; please use them to plan ahead. If you have any questions you should raise them immediately rather than waiting for conflicts to arise.
- **Participation policy.** Class participation will be graded by in-class engagement, including asking relevant questions based on a critical review of required readings and lectures, preparation for any in-class exercises, and responses on the class discussion board. The lack of attendance and participation, will count against your participation grade.

This semester involves regular use of technology. Research has shown that divided attention is detrimental to learning; I encourage you to close any windows not directly related to what we are doing while you are in class. Please turn off your phone notifications and limit other likely sources of technology disruption, so that you can fully engage with the material, each other, and me. This will create a better learning environment for everyone.

**Attendance.** In order to attend class in person, I expect that you will abide by all behaviors indicated in [A Tartan's Responsibility](#), including any timely updates based on the current conditions.

**Facial coverings.** If you do not wear a facial covering to class, I will ask you to put one on (and if you don't have one with you, I will direct you to a distribution location on campus). If you do not comply, please remember that you will be subject to student conduct proceedings, up to and including removal from CMU. Accordingly, I will be obliged to take other measures for the safety of the whole class.

**Recording of Class Sessions.** All synchronous classes will be recorded via Zoom so that students in this course (and only students in the course) can watch or re-watch past class sessions.

Please note that breakout rooms will not be recorded. I will make recordings available on Canvas as soon as possible after each class session (usually within 3 hours of the class meeting). Please note that you are not allowed to share these recordings. This is to protect your FERPA rights and those of your fellow students.

**Transferring to Fully Remote During the Semester.** If the class needs to go fully remote, you will receive an email from me and an announcement will be published on our course website on Canvas.

At any point during the semester, you may choose to participate in the class remotely. If you decide to switch to remote for one or more classes, please try to let me know by email **[insert email]** at least 24 hours in advance so I can prepare the breakout rooms and in-class sessions appropriately. In addition, if you are able, let me know the expected length of your remote engagement (e.g., number of classes or for an extended period of time).

**Course Schedule,** The following schedule provides a general overview of topics and assignments. Please refer to the syllabus online in Canvas for specific lecture topics, reading assignments and due dates.

Class	Lectures (questions due at 1:30 EST pm on date listed)	Assignments
8/30	- Course Introduction - Interview Strategies	
9/1	- Good Coding Practices - Measurement & Analysis of Algorithms	
9/6	No Class (Labor Day)	
9/8	- Recursion	A1 due
9/13	- Arrays & Lists	
9/15	- Searching and Sorting	A2 due
9/20	- Stacks & Queues	
9/22	- Trees	A3 due
9/27	- Heaps	
9/29	- Hash Maps	A4 due
10/4	- Graphs	
10/6	- Searching and Sorting Revisited	A5 due
10/11	- Final Review	
10/13	Final	A6 due

**Accommodations for Students Disabilities.** If you have a disability and have an accommodations letter form the Disability Resources office, I encourage you to discuss your accommodations and needs with me as early in the semester as possible. I will work with you to ensure that accommodations are provided as appropriate. If you suspect that you may have a disability and would benefit from accommodations but are not yet registered with the Office of Disability Resources, I encourage you to contact them at [access@andrew.cmu.edu](mailto:access@andrew.cmu.edu).

**Academic Integrity.** Honesty and transparency are important to good scholarship. Plagiarism and cheating, however, are serious academic offenses with serious consequences. If you are discovered engaging in either behavior in this course, you will earn a failing grade on the assignment in question, and further disciplinary action may be taken.

For a clear description of what counts as plagiarism, cheating, and/or the use of unauthorized sources, please see the [University's Policy on Academic Integrity](#).

If you have any questions regarding plagiarism or cheating, please ask me as soon as possible to avoid any misunderstandings. For more information about Carnegie Mellon's standards with respect to academic integrity, you can also check out the [Office of Community Standards & Integrity](#) website.

**Student Wellness.** As a student, you may experience a range of challenges that can interfere with learning, such as strained relationships, increased anxiety, substance use, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may diminish your academic performance and/or reduce your ability to participate in daily activities. CMU services are available, and treatment does work. You can learn more about confidential mental health services available on campus at the [Counseling and Psychological Services](#) website. Support is always available (24/7) from Counseling and Psychological Services: 412-268-2922.

**We must treat every individual with respect.** We are diverse in many ways, and this diversity is fundamental to building and maintaining an equitable and inclusive campus community. Diversity can refer to multiple ways that we identify ourselves, including but not limited to race, color, national origin, language, sex, disability, age, sexual orientation, gender identity, religion, creed, ancestry, belief, veteran status, or genetic information. Each of these diverse identities, along with many others not mentioned here, shape the perspectives our students, faculty, and staff bring to our campus. We, at CMU, will work to promote diversity, equity and inclusion not only because diversity fuels excellence and innovation, but because we want to pursue justice. We acknowledge our imperfections while we also fully commit to the work, inside and outside of our classrooms, of building and sustaining a campus community that increasingly embraces these core values.

Each of us is responsible for creating a safer, more inclusive environment.

Unfortunately, incidents of bias or discrimination do occur, whether intentional or unintentional. They contribute to creating an unwelcoming environment for individuals and groups at the

university. Therefore, the university encourages anyone who experiences or observes unfair or hostile treatment on the basis of identity to speak out for justice and support, within the moment of the incident or after the incident has passed. Anyone can share these experiences using the following resources:

- **Center for Student Diversity and Inclusion:** [csdi@andrew.cmu.edu](mailto:csdi@andrew.cmu.edu), (412) 268-2150
- **Report-It online anonymous reporting platform:** [reportit.net](https://reportit.net) username: *tartans*  
password: *plaid*

All reports will be documented and deliberated to determine if there should be any following actions. Regardless of incident type, the university will use all shared experiences to transform our campus climate to be more equitable and just.