CSCI 230 Data Structures (Fall 2025)

Contents

1 Logistics

1.1 Instructional Staff

Instructor: Michael Levet (He/Him/His); lastnamefirstinitial (at) cofc (dot) edu.

1.2 Key Dates

Last Day to Drop Before Grade of 'W' Is Recorded: Monday, August 25.
Last Day to Drop Before with Grade of 'W': Friday, October 24.
Breaks: October 13-14 (Fall Break); November 26-30 (Thanksgiving Break).

1.3 Course Website

All announcements will be posted to the course website: `https://michaellevet.github.io/F25/CSCI230/index.html`. Students are responsible for checking the course website daily. Assignments and other course materials will be posted to OAKS.

1.4 Lecture

Lectures:

- TR: 9:55-11:10, Harbor Walk East 301.

I will attempt to provide a Zoom (remote synchronous) option for class as well as record lectures via Zoom (to be posted to OAKS), to the extent that technology cooperates. This is provided *as-is*, and students are responsible for the content covered in class regardless of whether technology cooperates. In particular, the instructor is not responsible if technology does not cooperate.

1.5 Office Hours

Office hours will be held on Zoom. The Zoom link and days/times for office hours will be posted to my course homepage. Your success is my top priority- if any of these times don't work, please do not hesitate to email me to schedule an appointment! **If you have COVID or another contagious illness, please do not attend my office hours in-person. I will be happy to facilitate remote participation.**

2 Course Description

2.1 Prerequisites

The course prerequisites involve (i) two semesters of computer programming, with at least one of these emphasizing object-oriented programming in the Java language, as well as (ii) some flavor of Discrete Math. On the programming side, students entering this course should be able to independently design and implement algorithmic solutions in the Java language, debugging their code, writing clean/readable code, and be comfortable consulting the Java documentation regarding built-in libraries. On the Discrete Math side, students should be familiar with first-order logic, evaluating summations (series), manipulating expressions involving exponentials and logarithms, and some proficiency in analyzing algorithms. While students will not be expected to formulate mathematical proofs, this course is mathematical in nature. Comfort with mathematical formalisms will be helpful.

Officially, the course prerequisites are as follows.

- CSCI 221 Computer Programming II (Grade of C- or Better)
- Math 207 Discrete Structures I (Grade of C- or Better)

If you are not comfortable programming in Java, then you should not take CSCI 230 at this time.

2.2 Workload

CSCI 230 is a 3-credit course. Well-prepared students should expect to spend on average 9-12 hours/week outside of class. Students who have significant gaps in their backgrounds may find that they need to carve out additional time to review the prerequisite material.

2.3 Course Content

A *data structure* is a construct that is used to organize data, in such a way that is usable by other software components. The key operations to interact with a data structure are *inserting* new data, *searching* for existing data, *updating* existing data, and *removing* existing data. The way in which the data will be used often influences the design and choice of given data structure. In particular, certain data structures are often useful for certain operations, or special cases theoref (e.g., adding and removing elements to the start or the end of a list).

In this course, we will survey several fundamental data structures including arrays, ArrayLists, Linked Lists, Stacks, Queues, Priority Queues, Binary Search Trees, Heaps, Hash Tables, and Graphs. We will be particularly interested in algorithmic efficiency, and to this end we will discuss techniques to precisely analyze the number of steps that an algorithm takes. Additionally, we will examine several key algorithms related to these data structures, including graph traversals (BFS, DFS, Dijkstra) and spanning tree algorithms (Prim, Kruskal).

There will also be regular smaller programming problems, as well as programming projects throughout the course, in order for students to gain practice both implementing the data structures and developing a larger-scale code base.

If there is time at the end of the course, we will discuss what it means for two graphs to be *the same* and the consequences surrounding implementing a `.equals()` method that is both efficient and correct. This is the Graph Isomorphism problem. We will focus on the *Color Refinement* or *1-dimensional Weisfeiler–Leman* algorithm, including its power and limitations. The Weisfeiler–Leman algorithm itself is both highly accessible and has deep connections to other areas both of theoretical and practical interest, including computational logics (Descriptive Complexity Theory), optimization (Sherali–Adams Hierarchy), combinatorics, and machine learning (Color Refinement has the same distinguishing power as Graph Neural Networks). Our foci, however, will be on understanding how the algorithm works and to gain practice implementing the Color Refinement procedure, rather than exploring the connections to other areas.

My area of research is in Graph Isomorphism. If you are interested in learning more about this area, including in doing research, please don't hesitate to reach out! I enjoy working with students on research projects and supporting their success!

2.4 Learning Objectives

There are several key learning objectives for this course. Students will:

- Implement key data structures from scratch, in Java, such as ArrayLists, LinkedLists, Binary Heaps, Binary Search Trees, and Hash Tables.
- Write non-trivial Java programs.
- Determine the Big-O upper bounds and Big-Theta exact bounds of key functions.
- Determine the exact runtime complexity of algorithms, and then determine asymptotic bounds (Big-O and Big-Theta).
- Trace through operations for key data structures, including ArrayLists, LinkedLists, Binary Heaps, Binary Search Trees, Hash Tables, and Graphs.
- Trace through and reason about: tree traversals, data structures, and graph algorithms.
- Reason about key searching and sorting algorithms.

2.5 Course Text

I will loosely follow OpenDSA: here. This resource is freely available online.

Remark 1. Many of the algorithms we study have minor variations, which may impact the final answer or intermediary steps. The official version of the algorithms will be those presented in class (and not in supplemental texts). You are responsible for using the version of the algorithm presented in class. **Any deviations from OpenDSA will be clearly documented.**

3 Course Structure and Grading

The course will be divided into several units:

- **Lists.** Arrays, ArrayLists, Linked Lists, Stacks, and Queues.
- **Algorithm Analysis.**
- **Hash Tables.**
- **Trees.** Binary Search Trees, Tree Traversals (In-Order, Pre-Order, Post-Order)
- **Graphs.** Graph data structures
- **Graph Algorithms.** BFS/DFS, Dijkstra, Prim, Kruskal
- **Graph Isomorphism.** Color-Refinement

3.1 Generative AI

CSCI 230 is the foundational course for computer scientists. Ultimately, as computer scientists, you will need/should be able to maintain, develop, and improve complex systems. Sometimes that means delving into how things work at a granular level. You should expect to use the content in this course, in the wild.

In the more immediate future, our upper-division classes *assume* that students understand this content and spend little-to-no time reviewing it. This content in this course also commonly serves as the basis for interview questions, for internships and entry-level jobs.

It is thus imperative that you fully absorb this material. Generative AI detracts from this, and is also prone to providing **incorrect answers** in ways that are subtle (read– hard to recognize) to students. For these reasons, **any use of generative AI is strictly prohibited, and may result in an F for the course.**

3.2 Homework

Homework will be assigned regularly, with clearly posted deadlines. You are responsible for being aware of both the **dates** and **times** for these deadlines. Late homework will not be accepted, unless prior arrangements are made or in emergency situations. The instructor reserves the right to determine what constitutes an emergency situation. Please discuss with the instructor as soon as possible if you have a situation that may warrant an extension. Please submit your homework via OAKS.

- There will be a regular written homework. The written homework must be **typed** using LaTeX. Diagrams (e.g., graphs, trees) may be hand-drawn and embedded in the LaTeXdocument as an image and **oriented so that we do not have to rotate our screens to grade your work.** Please note that **handwritten solutions or those prepared without LaTeXwill not be graded.** Similarly, **if we have to rotate our screens to grade your work, then your wil will not be graded.**

  Mathematical equations are not diagrams and must be typed.

- Both your **name** and **student ID** must be included in the appropriate fields. If I am not able to determine who submitted an assignment, then that submission will not be graded.

- The first question on every homework will be an honor code agreement. Failure to indicate that you have upheld the honor code will result in your assignment not being graded.

- For programming assignments, your code must adhere to **clean, readable, and professional** indentation conventions. Submissions deviating significantly from this may receive a 0, and will **not** be eligible for revisions.

- You are welcome to discuss the problems with your classmates, as well as reference outside resources. **Anything you submit must be in your own words and reflect your understanding of the material. You should be able to explain your solutions to the instructor, such as in an interview grading session.** If there are any questions about this, it is your responsibility to contact the instructor reasonably ahead of the submission deadline. **Looking up solutions or copying from other sources (including your classmates) is an honor code violation.** You must **cite** any

resource (other than the course text, instructor) that you use. This includes any classmates with whom you collaborate. Failure to cite your sources will be treated as an **honor code violation.** See Section 3.7.

- Posting to online forums for help (e.g., Chegg, Reddit, StackExchange, etc.) is an **honor code violation.** See Section 3.7.
- Individual assignments may have additional instructions beyond the syllabus. Students are responsible for adhering to those instructions.

Homework will have multiple problems and may span multiple topics. Each problem will be graded on the following scale: Outstanding (T), Demonstrated Proficiency (P), Progress (PR), Significant Errors or Misconceptions (ATT), No Meaningful Attempt (NA). Your grade on an individual homework assignment will be:

$$(\#\text{Proficiency} + \#\text{Outstanding})/(\#\text{Problems}).$$

For each problem where a good faith attempt is made, you will be eligible to revise that problem subject to the following:

- All revisions are due within the clearly posted deadline on the course homepage. This will be reasonably the graded assignment has been returned.
- Any problem that is revised must be accompanied by a reflection. This reflection can take the form of a detailed tutorial on how to solve the problem- this should be written for a CSCI 230 student who is just learning the material. Alternatively, this reflection can be a detailed discussion of your misconceptions when you first attempted the problem and what your understanding is now. **Note:** One-sentence responses of the form "I didn't know then, but I do now.", "I forgot to study.", or similar are **not sufficient**.
- Only one revision is permitted on a given assignment. You may not revise a revision attempt.
- You are welcome and encouraged to discuss problems you don't understand with myself, your peers, and anyone else! The point of the revisions is to help you understand the material. I am here to help you learn the material and succeed!

Fair Warning. Grading first attempts for assignments will in general be my top grading priority, to ensure that I am providing timely feedback on new concepts. As a result, grading for revisions may be considerably slower than for other assignments.

Each HW assignment will be equally weighted, and your HW average will be the average of your scores on each HW assignment.

3.3 Quizzes

There will be regular quizzes throughout the semester. In general, quizzes will be announced clearly in advance, though I reserve the right to give pop quizzes. There will be two types of quizzes: (i) in-class quizzes, which are (unless indicated otherwise) closed book and closed note, and (ii) online quizzes, which will be open-book and open-note. All quizzes will be timed and individual effort.

Online quizzes will always be clearly announced in advance. For online quizzes, a LaTeX template will be provided. Students may either type their work or handwrite their work and embed them as images, **provided their work is legible and I do not have to rotate my screen to grade the work**. In either case, use of the LaTeX template is required. Students will have a total of 45 minutes to submit the quiz **as a PDF** to OAKS. The intent is that 30 minutes (scaled for students with disability accommodations) are spent taking the quiz, and 15 minutes are there to prepare the PDF. In practice, students are welcome to allocate the 45 minutes as they see fit. However, as 15 minutes are allocated to prepare the quizzes for submission, late quizzes will not be accepted.

If your internet goes out, you may take a picture (such as with Cam Scanner) and send a **legible** picture (in JPEG, PNG, or PDF formats) within the 45 minute window to the instructor. **I am unable to accept HEIC files.**

As mentioned above, online quizzes are open-book and open-note, but are individual efforts. Consulting anyone who is not a member of the instructional staff about a quiz, which includes your classmates, tutors, generative AI (including, but not limited to ChatGPT) and posting online (e.g., Chegg, Reddit, Discord, StackExchange, etc.) constitutes an **honor code violation.** Similarly, all answers must be in your own words and reflect your understanding of the material. Copying from any resource is strictly prohibited. See Section 3.7.

You are welcome to email the instructor with clarification questions, with the understanding that doing so counts against your allotted time and that we may not respond to you in time.

In-person quizzes will be timed at 15 minutes (scaled for students with disabilities). Unless otherwise stated, these are closed-book, closed-note and an individual effort. **Students who are out sick, such as with COVID, should contact me for alternative arrangements. Please do not come to class if you are sick.**

Each quiz will contain at least one problem. In order to earn credit for a problem, it is necessary to have earned a Demonstrated Proficiency or Outstanding.

Your quiz score will be:

$$(\#\text{Proficiency} + \#\text{Outstanding}) \,/\, (\text{Total } \# \text{ Quiz Problems}).$$

There will be at least 2 midterms; I reserve the right to give in-person midterms. The midterms will count towards your quiz score, in that each question on a midterm counts as one quiz question. There will be some replacement as follows:

- For the quizzes taken before MT1, if your quiz score is lower than your MT1 score, I will replace that portion of your quiz score with your MT1 score.
- For quizzes taken between MT1 and MT2, I will similarly replace your quiz score with your MT2 score if it is beneficial to you.
- For any quizzes taken between the last midterm and the final, the final will serve to handle grade replacement.

So for instance, if you have only demonstrated proficiency (or earned an Outstanding) on 50% of your quizzes before MT1, but then demonstrate proficiency (or earn an Outstanding) on 70% of the questions on MT1, I will– for the purposes of calculating your final grade– record that you have demonstrated proficiency on 70% of the quizzes before MT1. Note that this is an aggregate replacement– I will not be manually updating individual quiz scores.

3.4 Final

There will be a traditional final exam. Please plan for an in-person final exam. Our scheduled final exam period is **Thursday, December 4 from 10:30 AM-12:30 PM.**

3.5 Cutoffs

Final grades will be issued according to the following cutoffs. Note that you must satisfy **all** of the conditions in each of the columns to receive the given grade. Doing better in one column will not counter-balance lower performance in another.

	Homework	Quizzes	Syllabus Quiz
A	90%	90%	Credit
A-	88%	88%	Credit
B+	86%	86%	Credit
B	83%	83%	Credit
B-	80%	80%	Credit
C+	78%	78%	Credit
C	76%	76%	Credit
C-	71%	71%	No Credit
D+	65%	65%	No Credit
D	60%	60%	No Credit
D-	55%	50%	No Credit

The cutoff for a D- includes a 55% HW average; this is not a typo. Students who do not qualify for a D- will receive an F. Requests for a higher grade that are not consistent with the syllabus will be politely declined.

Students who meet the eligibility for a C+ on all columns may be eligible to have their final grade bumped up at the end of the semester under the following conditions. Let X be exactly Homework or Quizzes. If the letter grade corresponding to category X is lower than the other categories, then your grade will be raised by 1/3 of a letter grade.

- As an example, suppose that your work on the Syllabus Quiz, Homework, and Quizzes all meet the cutoffs for a B, but your Quizzes only meets the cutoff for a C+. Then your final letter grade will be a B-.
- Suppose that your work on the Syllabus Quiz, Homework, and Quizzes all meet the cutoffs for an A-, but your Homework only meets the cutoff for a C+. Then your final grade will be a B-.

Students who violate the Honor Code will not be eligible for this grade bump at the end of the semester.

3.6 Regrade Requests

Students have one week from when a grade was returned to request a regrade. The only regrade requests that will be considered are those where a mistake was made in grading. In particular, all grades are final, unless due to a mistake made by the grader. In order for a grade dispute to be considered, students must submit a written request indicating the problem(s) in question, a clear explanation indicating where a mistake in grading. All regrade requests must be submitted using the Google form on the course homepage.

3.7 Honor Code

I expect students are familiar with policies pertaining to academic integrity, outlined in the Student Handbook. Much of what you will learn about mathematics and theoretical computer science will come from your discussions with your peers. You are welcome and encouraged to discuss the homework problems with each other and with me. It is expected that you work the problems by yourself first, so that you can contribute to the discussion. This policy will be changed, reluctantly, if I find it is being abused. **Your submissions must be written in your own words and reflect your understanding of the material.** Note that you are responsible for citing any resource (including other people) that are not members of the course staff, the course lecture notes, or the lectures. Posting to online forums for help (e.g., Chegg, Reddit, StackExchange, etc.) is an **honor code violation.** Regurgitating solutions from generative AI (including, but not limited to ChatGPT) is an honor code violation. If there are any questions regarding this policy, please ask the instructor.

Any acts of suspected academic dishonesty will be reported to the Office of the Dean of Students and addressed through the conduct process. Students found responsible for honor code violations will be subject to the following minimum penalties:

(a) You will receive a -200% on the given assignment.

(b) You will be reported to the Office of Academic Integrity, which may choose to impose additional penalties.

The usual penalty is an automatic F in the course. **Honor code violations may result in an XXF for the course**, which carries the same weight as an F. The XX modifier denotes that the grade was received for academic integrity violations. **Please do not cheat.** It is not worth it.

3.8 Tutoring

The College of Charleston might offer additional tutoring services. These are offered *as-is*, and I do not coordinate with the tutors. Receiving (or the perception of having received) incorrect information from a tutor is not a valid reason for a regrade request to be considered.

4 Course Policies

4.1 Office Hours: Norms and Expectations

There will be a mix of in-person and online office hours (see the course homepage for the Zoom link). The purpose of office hours is to supplement lecture and the associated readings. In order to get the most out of office hours, we recommend the following.

- Attend the lectures and read through the lecture notes. In particular, work through the provided examples. These materials are there to help you! **If you are out, such as with an illness, I will be happy to accommodate remote participation.**
- Spend some time working the problems first. Try to identify specific approaches you have made, as well as identify where you are stuck. If you are spending more than 30 minutes on a single problem without making much progress, then I strongly encourage you to seek help in office hours!
- If you wish to discuss specific work, please have it typed up so that you can share your screen on Zoom. It is very hard to help you if your work is on paper and you are holding it up to the camera.
- My goal is to provide hints about homework problems, as well as help students obtain momentum to keep working. In particular, I aim to help students arrive at the solutions on their own. It is completely normal to need time to digest a hint, and then come back to office hours with more questions! Learning CS Theory and Math is an iterative process– we encourage students to iterate!
- Please note that I will neither provide entire solutions in office hours nor grade work ahead of the due date.

Office Hours vs. Email: I am generally happy to discuss course logistics via email (e.g., scheduling appointments, etc.). However, email is usually not a conducive medium for tutoring. If you email me with a question about the homework (and you are certainly welcome to do so), I reserve the right to ask you to come to office hours with your question. Note that this does associate some risk with procrastination, in that you may not get your question answered until after the assignment due date (or after the quiz/exam). Similarly, if you email me late at night, I may not see your email until after the assignment is due. Please plan accordingly.

4.2 Late Work

Late work will **not** be accepted, unless prior arrangements have been made or in case of emergency situations. Extensions can be requested using the Google form on the course homepage. I recognize that you all will frequently have competing deadlines, including for your other classes as well as personal obligations. There is not always time to meet all of one's deadlines. The way to handle these situations is to communicate reasonably in advance. For non-emergency situations, please request an extension at least 24 hours in advance. In general, I encourage you to ask for what you need. While I will in general try to be flexible for short-term extensions, do note that that requesting an extension does not guarantee that you will receive one.

In the event of an emergency situation which prohibits you from turning in work before the deadline, I may choose to offer alternative flexibility instead of accepting late work.

For long-term emergencies, please talk to me.

Note that missing the homework or quiz deadlines by a couple minutes is not a valid reason for late work to be accepted. Homework due dates and times will be clearly posted, and students will have 15 minutes to submit their quizzes (on top of 30 minutes to take their quizzes). Please plan accordingly.

4.3 Late Enrollments

Students who enroll in the course after the first day of class are subject to the same deadlines as the rest of the class.

4.4 Attendance

Attendance is not required and will only be taken during the first two weeks, for the purpose of attendance verification as required by CofC. Students who have not engaged with class by attending, completing assignments, or emailing me may be reported as having "never attended." If you are sick, please stay home– let me know if this is in the first two weeks, so that you do not get dropped. In particular, if you have COVID, please quarantine until such time as you are not contagious. I will be happy to facilitate remote participation in these instances. In the event that any member of the class (myself included) contracts COVID, I reserve the right to move the entire class online. For in-person assignments, I reserve the right to provide make-ups, utilize (portions of) an exam, or handle the situation in another way that is in my judgment appropriate. Please contact me within 48 hours– or sooner if at all possible– if you anticipate missing an in-person assignments.

Note that ≥ 0 class sessions will be recorded via both voice and video recording. By attending and remaining in this class, the student consents to being recorded. Recorded class sessions are for instructional use only and may not be shared with anyone who is not enrolled in the class.

4.5 Modifications to the Syllabus

The instructor reserves the right to modify any of the policies in the syllabus at any time, particularly as dictated by the interests of learning and fairness. Students will not be graded any harsher than as outlined in Section 3.5.

4.6 Student Feedback

Student feedback regarding this course is welcome at any time. Those who wish to leave feedback anonymously are welcome to do so using the Google form on the course homepage. Students are also welcome to reach out to the instructor via email or in office hours to discuss their concerns.

5 Required Syllabus Statements

5.1 Religious Holidays

Campus policy regarding religious observances requires that faculty make every effort to deal reasonably and fairly with all students who, because of religious obligations, have conflicts with scheduled exams, assignments or required attendance. In this class, please contact the instructor within the first two weeks to discuss any conflicts with religious events.

5.2 Students with Disabilities

The Center for Disability Services/SNAP is committed to assisting qualified students with disabilities achieve their academic goals by providing reasonable academic accommodations under appropriate circumstances. If you have a disability and anticipate the need for an accommodation in order to participate in this class, please connect with the Center for Disability Services/SNAP. They will assist you in getting the resources you may need to participate fully in this class. You can contact the Center for Disability Services/SNAP office at 843.953.1431 or at snap@cofc.edu. You can find additional information and request academic accommodations at the Center for Disability Services/SNAP website.

If you are not registered with SNAP and believe you may need a disability accommodation, please do not hesitate to contact me.

5.3 Inclement Weather, Pandemic or Substantial Interruption of Instruction

In the event of inclement weather, I will communicate a detailed plan for how class will proceed (if at all). Please prioritize your safety in these situations, including any need to evacuate. If there is a need to evacuate, I will also be prioritizing my own evacuation. The university has allocated make-up days on the weekends to be used if class is canceled for inclement weather. I will communicate in a timely manner for if/how these days will be used.

In the event of a surge in the ongoing COVID pandemic, I reserve the right to make adjustments to the structure of the class. In particular, if there exists at least one member of the class with COVID, I reserve the right to move the course online.