



Syllabus for CS340

Algorithms and Data Structures, Fall 2023

Department of Computer Science

Class meets 9:30am-10:45am or 11am-12:15am Tuesdays/Thursdays EB0140

About the Instructor

Name: Dr. John Matta (jmatta@siue.edu) EB2053

Phone: 618-650-3344 (Not a good way to reach me. Email or Discord is better.)

Discord: <https://discord.gg/VEHaGPgcNQ> you are invited to join the cs340 channel on my Discord Server (DrJohnMatta). I will attempt to keep up with this and answer questions quickly. I go to bed around 9pm, so don't expect any communication after that.

Office Hours: 10am-11am Mondays and 12:30pm-1:30pm Tuesdays. Please let me know if you are coming.

Better than Office Hours: I try to answer emails and Discord messages quickly!

Welcome

Welcome to Algorithms and Data Structures. I'm always pleased to teach this class and bring students from introductory programming into more advanced topics in computer science. I've taught this class many times, going back to 2015. Our textbook is the top selling book in the field of computer science, and one way of recognizing a CS Bachelor of Science is by knowledge of the topics contained within. It's a big book, so we'll explore some topics in more depth than others, but always with the goal of making you a competent (end employable) computer scientist.

Bio

I worked in software development for 6 years, then as an entrepreneur for 20 years. I sold my business, went back to school and am now a professor. My research interests are in analysis of social and biological networks, algorithms, computer science education, and use of computer science to solve social and public health problems. I like to involve students in research – if you have an interest in research, talk to me.

Teaching Philosophy

I have a strong interest in the Peer Instruction teaching method. I want the class to be a discussion, where students learn not only from me, but from each other. In this particular class, the focus is on problem solving. We will try to learn different methods for solving problems and to practice what we learn by applying it in a variety of ways. It is hoped that the skills developed will be useful in job interviews and other real-life situations.

About the Course

Course description

Considers appropriate choice of data structures, comparisons of algorithms, recursive algorithms, time complexity, graph algorithms, and an introduction to dynamic programming, NP-completeness, and approximation algorithms.

3 credit hours.

Prerequisite knowledge

The course presumes knowledge of a linked list, an array-based stack, and an array-based queue. Knowledge of the growth of functions from MATH224, and the ability to translate pseudocode into real life code in a language like C++ or Java is also assumed. Prerequisites are Undergraduate level CS 150 Minimum Grade of C and Undergraduate level MATH

224 Minimum Grade of C and (Undergraduate level MATH 130 Minimum Grade of C or Undergraduate level MATH 150 Minimum Grade of C).

Course goals and objectives

This class covers the basics of creation and analysis of CS algorithms and will help students excel at coding interviews. Students who complete the course will have demonstrated the ability to do the following:

- Argue the correctness of algorithms.
- Analyze worst-case running times of algorithms using asymptotic analysis. Compare the asymptotic behaviors of algorithms, and describe the relative merits of worst-, average-, and best-case analysis.
- Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it. Recite algorithms that employ this paradigm. Derive and solve recurrences describing the performance of divide-and-conquer algorithms.
- Describe the dynamic-programming paradigm and when it is used. Recite and apply algorithms that employ this paradigm.
- Describe the greedy paradigm and explain when it is appropriately used. Recite algorithms that employ this paradigm. Analyze greedy algorithms.
- Explain the major algorithms for sorting. Recite the analyses of these algorithms and the design strategies that the algorithms embody.
- Explain the major elementary data structures for implementing dynamic sets and the analyses of operations performed on them. Recite algorithms that employ data structures and how their performance depends on the choice of data structure. Synthesize new data structures by augmenting existing data structures. Synthesize algorithms that employ data structures as key components.
- Explain the major graph algorithms and their analyses. Employ graphs to model engineering problems, when appropriate. Synthesize new graph algorithms and algorithms that employ graph computations as key components, and analyze them.

Course textbook

Introduction to Algorithms by Cormen, Leiserson, Rivest, and Stein

Undergraduate students can rent textbooks from SIUE. The textbook should have been included as part of your rentals. Please visit the [Textbook Service website](#) for more information.

Other course materials

Website/Moodle: <http://classes.cs.siu.edu/>

Course requirements

Course activities/assessments

Grade breakdown:		Grading:	
Quizzes:	100	900 to 1000	A
Homeworks:	100	800 to 899	B
Programming Assignments:	500	700 to 799	C
Exam 1:	150	600 to 699	D
Exam 2:	150	559 down	F
Total:	1000		

Live Meetings The class will meet live on Tuesdays and Thursdays as listed above. The Tuesday class will consist mainly of problem solving, while the Thursday class will be more of a lecture. If you are unable to attend the lecture, you should prepare for the problem-solving session by watching the videos listed in the schedule below. Quizzes will be part of the Thursday class.

Submitting work

Reports should be submitted on Moodle as **PDF files**. If code is also required, that should be submitted separately in a zip file. Most assignments will be due within one week. An assignment can be submitted up to two days after it is due for a 20% penalty (except for the last week).

Online discussions

It is appreciated if general questions are posted on the Discord channel, so that other students can benefit from the answers. Posting on Discord is not required as a part of the class, but it's an effective way to communicate.

Online Class behavior

In general, questions and participation are welcomed and encouraged. Following are suggestions given for online participation. The same general ideas apply in a live class. Please take the following suggestions to heart as you participate:

- **Reflect** before you post an emotional response and reread what you have written to be sure it is professional. Communicate as if your comments are printed in a newspaper.
- **Communicate** effectively.
 - Do not use all caps or multiple punctuation marks (!!!, ???, etc.).
 - Be sure to define or explain acronyms, jargon or uncommon terms so everyone can understand and participate in the discussion.
- **Sign your name.** Take responsibility for your comments in order to build a strong classroom community.
- **Foster community.** Share your ideas and contribute to ongoing discussions. Make comments that add to, not detract from, a positive learning environment for the course.
- **Be constructive.** Challenge ideas and the course content, but do so in positive ways. It's fine to disagree, but when done politely you stimulate and encourage helpful discussion, and you maintain positive relationships with fellow students.
- **Keep the conversation on topic.** Online dialogue is like conversation. If there is a particular dialogue going on, please add to it, but if you have something new to say, start a new thread.

Course and University policies

Academic Integrity: For school policies and procedures, you may refer here: <http://www.siu.edu/policies/3c2.shtml>. In this course we have group projects and *encourage* students to work together. So what constitutes academic misconduct?

It is **not** considered academic misconduct if you:

- Work together on homework assignments, as long as each pair works out and submits their own final answers. Here “final answers” includes such things as derivations, plots (where appropriate), written explanations, and source code (for computational exercises), etc.
- Get help from other professors, tutors, etc. on the homework assignments *provided* it is clear that you are the author of your own answers, and you understand what you’ve written down.

An instance of academic dishonesty, or cheating, will result in receiving an F in the class. Some things that count as cheating are:

1. Discussing quiz questions with a friend while you take a quiz.
2. Telling a friend the questions that were on the quiz before they take it.
3. Copying answers from an online tutor or homework website.
4. Obtaining a copy of a quiz before taking the quiz.
5. Having someone else take a quiz for you.
6. Taking a quiz for someone else.
7. Working in pairs/groups where only one person does all the work.
8. Copying parts of a project from a website.
9. Copying code or results or reports from a friend or website.
10. Letting a friend copy your code or results or report.
11. Paying someone to write your code or report for you.
12. Lying to an instructor about how much work you put into a project.
13. Lying to an instructor to obtain more time to work on a project.
14. Helping others cheat.

The above lists are intended as examples and are not exhaustive. If in doubt, please ask.

Recordings of Class Content

The recording, as well as replicating or sharing of any course content and/or course materials without the express permission of the instructor of record, is not permitted, and may be considered a violation of the University’s Student Conduct Code (3C1), linked here: <https://www.siu.edu/policies/3c1.shtml>.

Diversity and Inclusion

SIUE is committed to respecting everyone’s dignity at all times. In order to learn, exchange ideas, and support one another, our virtual and physical classrooms must be places where students and teachers feel safe and supported. Systems of oppression permeate our institutions and our classrooms. All students and faculty have the responsibility to co-create a classroom that affirms inclusion, equity, and social justice, where racism, sexism, classism, ableism, heterosexism, xenophobia, and other social pathologies are not tolerated. Violations of this policy will be enforced in line with the SIUE Student Conduct Code.

The [Inclusive Excellence, Education, and Development Hub](#) is an excellent resource for students for support and community. Any person who believes they have experienced or witnessed discrimination or harassment can contact Lindy Wagner, Assistant Vice Chancellor for Inclusive Excellence, Education and Development at (618) 650-3179 or linwagn@siue.edu.

Pregnancy and Newly Parenting Policy

This policy and procedure are established to ensure the protection and equal treatment of pregnant students, students with pregnancy-related medical conditions including as a result of the termination of pregnancy, and students who become new parents including parents adopting or fostering to adopt for the first 12 weeks a child is in the home, in accordance with Federal and State guidelines and regulations. "New Parents" refers to a parent who has recently welcomed a newborn or adopted a child or is fostering to adopt a child and needs support to mitigate the disruption in academic progress within the first 12 weeks of parenting or a parent that needs support due to medical necessity attributed to pregnancy or delivery of a child; care of newborn; or lactation within the first year of child's life or legal adoption/fostering. Visit [Policies & Procedures - Student Rights and Conduct - Newly Parenting Policy - 3C15](#) to view the full policy and learn how to request accommodations through the Office of Equal Opportunity, Access, and Title IX Coordination (EOA).

Additional Support

Services for Students Needing Accommodations

Students needing accommodations because of medical diagnosis or major life impairment will need to register with Accessible Campus Community & Equitable Student Support (ACCESS) and complete an intake process before accommodations will be given. Students who believe they have a diagnosis, but do not have documentation, should contact ACCESS for assistance and/or appropriate referral. The ACCESS office is located in the Student Success Center, Room 1203. You can also reach the office by emailing us at myaccess@siue.edu or by calling [618-650-3726](tel:618-650-3726).

If you feel you would need additional help in the event of an emergency situation, please notify your instructor to be shown the evacuation route and discuss specific needs for assistance.

Cougar Care

Dealing with the fast-paced life of a college student can be challenging, and I always support a student's decisions to prioritize mental health. Students have access to counseling services on campus (Student Success Center, 0222). Make an appointment by visiting cougarcare.siue.edu or by calling [618-650-2842](tel:618-650-2842).

Subject to change notice

All material, assignments, and deadlines are subject to change with prior notice. It is your responsibility to stay in touch with your instructor, review the course site regularly, or communicate with other students, to adjust as needed if assignments or due dates change.

Course Schedule:

Dates and topics covered may change. Tuesdays are problem solving sessions and Thursdays are lectures. Videos reflecting the content of the Thursday lectures are provided for convenience.

Wk	Tuesday	Thursday	Assignments Due
1 8/22 8/24	01Insertion Sort (ch2) 02LoopInvariantProof (ch2)	03The Growth of Functions (ch3) 04Mergesort (ch2)	
2 8/29 8/31	05Problem Solving Session 1	06Heaps (ch6) 07Heapsort and Priority Qs (ch6)	Quiz1 (10 pts) Homework1 (25 pts)
3 9/05 9/07	08Problem Solving Session 2	09RecursionAndRecurrences (ch4) 10Quicksort (ch7)	Quiz2 (10 pts) Project1 (100 pts)
4 9/12 9/14	11Problem Solving Session 3	12Counting Sort 13Radix Sort 14Medians and Order (ch9)	Quiz3 (10 pts)
5 9/19 9/21	15BSTs (ch12) 16Red-Black trees (ch13)	17B-trees (ch18) Catch Up	Quiz4 (10 pts) Homework2 (25 pts)
6 9/26 9/28	18Problem Solving Session 4	19Hash Tables and Chaining (ch11) 20Hash Tables and Open Access (ch11)	Quiz5 (10 pts) Project2 (75 pts)
7 10/03 10/05	JOB FAIR-NO CLASS 22Introduction to Graphs (ch22)	JOB FAIR-NO CLASS 23BFS and DFS (ch22) 24Topological Sort (ch22)	Homework3 (25pts)
8 10/10 10/12	21Problem Solving Session 5	Exam 1	Exam1 (150 pts)
9 10/17 10/19	25Problem Solving Session 6	26Disjoint Sets (ch21) 27Minimum Spanning Trees – Kruskal (ch23)	Quiz6 (10 pts) Project3 (75 points)

10 10/24 10/26	28Problem Solving Session 7	29Minimum Spanning Trees – Prim (ch23) 30Shortest Paths - Dijkstra (ch24)	Quiz7 (10 pts) Homework4 (25 pts)
11 10/31 11/02	31Problem Solving Session 8	32Shortest Paths - Bellman Ford & DAGs (ch24) 33Shortest Paths – Floyd Warshall (ch 25)	Project4 (75 pts)
12 11/07 11/09	34Problem Solving Session 9	35Rod Cutting (ch15) 36Subset Sum / Knapsack 37Sequence Alignment (ch15)	Quiz8 (10pts)
13 11/14 11/16	38Problem Solving Session 10	39Intractable Problems (ch34) 43Approximations	Project5 (75 points) Quiz9 (10pts)
14 11/21	Thanksgiving Break!		
15 11/28 11/30	NO CLASS. Watch Search Tree Videos.	NO CLASS. Watch Search Tree Videos: 44SearchTreeMethodsBacktracking 45SearchTreeMethodsBranchAndBound	Quiz10 Backtracking (10pts) Take this quiz sometime during the day Friday, Dec. 1.
16 12/05 12/07	46Live Problem Solving Session 12	Exam 2	Project6 (100 points)
17	FINALS WEEK	No Final	