Arizona State University Spring C 2025, revised 1/8/25

SER222: Design & Analysis: Data Structures and Algorithms Syllabus

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Catalog Description

Data structures and related algorithms for their specification, complexity analysis, implementation and application. Sorting and searching. Professional responsibilities that are part of program development, documentation and testing.

General Information:

Instructor	Ruben Acuña, racuna1@asu.edu, (480) 727-1580 (email preferred)
Office Hours	Online only (Zoom): https://zoom.us/my/acuna. Use https://calendly.com/racuna1 to make an appointment. 18 hour advance notice required.
Class Meeting Time	MW 10:30 AM - 11:45 AM
Schedule Line Number	13579
Class Website	Canvas, GitHub, YouTube
Communication	Slack: See myASU. (Synchronous hours same as office hours.)
Final Exam Date	Wednesday, May 7th at 9:50 AM - 11:40 AM

Course Coordinator	Ruben Acuña, racuna1@asu.edu, (480) 727-1580 (email preferred)
Office Hours	Ground: Peralta Hall 230Q, online: https://zoom.us/my/acuna.
	All questions regarding course material and grading must be directed to the instructor for your section of the course.

Enrollment Requirements:

Prerequisites:

- CSE205: Object-Oriented Programming and Data Structures (C or better)
- MAT243: Discrete Math Structures (with C or better)

It is your responsibility to know the background material defined by the outcomes of these courses. If you did not take these courses recently (as defined by the SE major map), or you did not do well when you took them, you will need to spend time to review the material. You are welcome to discuss prereq materials with the staff, especially during the first week, just be aware that new topics will be introduced.

Course Objectives:

The outcomes of this course are the following:

	Course Outcome	SER Outcomes	EM@FSE

CO-1	Students can understand and apply big-O analyses of algorithms. Students can analyze existing algorithms and use these techniques in designing algorithms.	PO1, PO6	
CO-2	To gain experience in the object-oriented programming paradigm. Students understand elementary data structures as objects and as being composed of objects. Students can design objects using elementary data structures.	PO-SER1	G
CO-3	To learn and to be able to judge the appropriateness of alternate implementations of elementary data structures. Students understand advantages and disadvantages of sequential implementation vs. linked implementation.	PO1, PO-SER1	Q
CO-4	To learn specification and application of elementary data structures. Students know commonly used specifications for arrays, stacks, queues, strings, sets, sequential lists, binary search trees and hashed storage.	PO-SER1	J, K

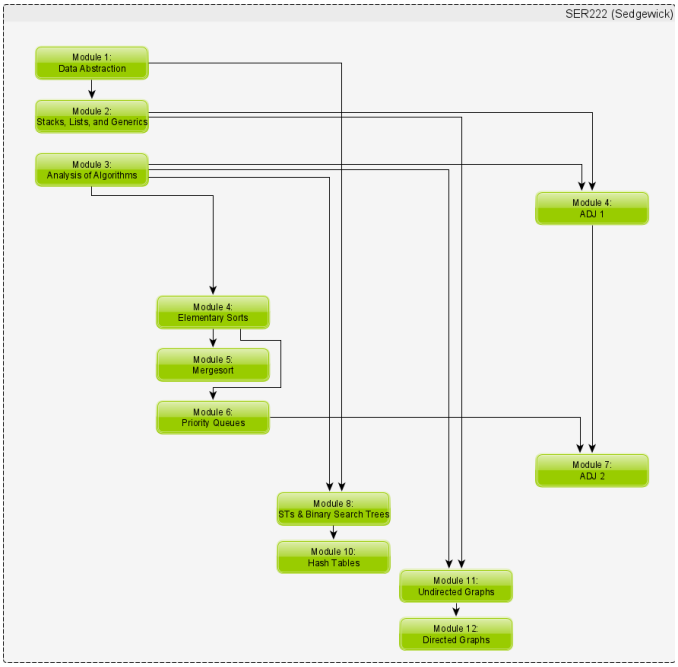
Entrepreneurial Mindset: This course is part of ASU's Entrepreneurial Mindset at Fulton Schools of Engineering (EM@FSE) initiative. This course contains assignments that, in addition to practicing technical skills, ask you to consider how the solutions you develop fit into the larger picture. The core aspects of the entrepreneurial mindset are the 3Cs: Curiosity, Connections, and Creating Value. The goal is to help you develop an entrepreneurial view of your engineering skills, to solve problems that generate value. FSE@EM goes beyond the traditional view of entrepreneurship in computing (e.g., start-ups): it's about asking questions that lead you to new places and making connections across ideas and situations.

In support of developing an entrepreneurship mindset, EM@FSE identifies 17 indicators. As you continue your degree at ASU, you will take courses that support these indicators. In this course, we focus on four of them: g) Applies technical skills/knowledge to the development of a technology/product. j) Describes how a discovery could be scaled and/or sustained, using elements such as revenue streams, key partners, costs, and key resources. k) Defines a market and market opportunities. q) Integrates/synthesizes different kinds of knowledge.

Course Structure:

The material in this course is separated into modules. Most modules correspond to one section from the textbook. Each week typically covers one or two modules. Each module is comprised of instruction (lectures or videos), followed by a cairn (to cement the basics), and a homework assignment (to really practice). The assignments have three forms: short answer, programming, and ADJs (sometimes you may only have one or two). **You are expected to engage with course using the following flow: Instruction →Cairn →Homework.**

Time to complete a module varies, but it is typically nine hours to complete instruction, cairn, and homework. Modules without a programming assignment will take considerably less time because programming is intensive. You are encouraged to do load balancing between the modules that require lots of time, and those that require less.



Course Materials:

Readings: The required text is: R. Sedgewick, and K. Wayne, *Algorithms*, 4th edition, Addison-Wesley Professional, 2011. If you're interested in other books on algorithms, the instructor can make recommendations. A used copy of the text is acceptable.

Other:

Communication: This class uses a communication tool called Slack to manage course communications. Please make Slack the first place you look for new information regarding the course. It is expected you will check Slack at least once every day, as will the instructional staff each evening. Do not expect that we will be on Slack at other times, though we may occasionally pop-in to provide help and see how you are doing. Staff will be accessible synchronously on Slack as stated on the Contact Information page in Canvas. For email and Slack messages, please allow 24 to 48 business hours for a response.

- **Canvas Note: do not use the comment feature on any submission (e.g., short answer or programming), we do not use it because Canvas does not have a way to track what has been answered.** Use Slack or email if you have questions.
- **Do not share any answers (even if partial) to graded assignments on Slack until after the due date.** For example, do not post a code snippet of your homework that you have questions on. If we see this, we will delete your post and contact you personally. Instead, you should 1) Post your question without code (e.g., "I get a null pointer exception when displaying the list, any ideas?"), or 2) Reach out to the instructional staff who can privately provide input on your work.

Academic Calendar: Please review ASU's Academic Calendar (https://students.asu.edu/academic-calendar) for important Registrar dates such as: adding/ dropping/ withdrawing from courses, etc.

Late Homework Policy: All homework is due at 11:59:00pm (Arizona Time). ***Late submissions are not accepted, except as defined under Late Pass below.*** Students choosing to submit on the final day of the deadline are responsible for any personal technical issues (including but not limited to:

computer, internet, Canvas) that occur. Students are encouraged to submit homework several days in advance of any deadline. It is also highly suggested that students double check that they have submitted the correct files - students will receive a grade based on what they submitted. Extensions are permitted only when there is a significant, and documented, event (e.g., illness or personal emergency) that prevents the student from completing the assignment. A notice must be submitted to the instructor before the due date or as soon as circumstances allow.

Late Pass: A late pass grants an extension of exactly 24 hours to a module's homework. You have TWO (2) late passes that you may use during the semester. To use a late pass, contact a member of the instructional staff via email within 12 hours of the original deadline. **(This means you have until noon the day after the original deadline to make the request.)** They will update Canvas to reflect your personal extension. Due to logistics, the late pass may NOT be applied to homework for Module 12. Multiple late passes may not be applied to the same assignment.

Supplemental Instruction: This course was selected to participate in ASU's Supplemental Instruction (SI) program. SI sessions are group study opportunities, scheduled 2-3 times per week. These sessions are facilitated by your SI Leader, who is attending class and preparing SI sessions based on the course content. Students should attend SI sessions to ask questions about course content, work collaboratively with other students, and to develop learning/study strategies. Students who participate in SI sessions typically earn higher final course grades and exam grades than students who do not participate in SI. SI attendance is voluntary, and it is not a substitute for class attendance. For information about the days, times, and Zoom links for SI sessions, refer to the SI website: https://tutoring.asu.edu/content/supplemental-instruction-si-schedule.

Grading:

Performance will be assessed by homework, cairns, and three exams. Their weights are:

Category		Category Total	Individual Weight
Homework		507 + 6 (EC)	
	M1: Short Answer, Programming		32 + 14
	M2: Programming		32
	M3: Short Answer, Programming (w/ written)		18 +26 + 6
	M4: ADJ		30
	M5: Short Answer, Programming (w/ written)		14 + 24 + 12
	M6: Programming (w/ written)		32 + 4
	M7: Short Answer		14
	M8: ADJ		40
	M9: Programming		40
	M10: Short Answer, Programming		10 + 40 + 6 (EC)
	M11: Short Answer, ADJ		14 + 25
	M12: Programming, Market Analysis		60 + 20
Cairns		88 + 5 (EC)	
Exam 1		135	
Exam 2		135	
Exam 3		135	
Total		**1000 + 11 (EC)**	

EC indicates extra credit. The final letter grade will be determined according to the points obtained as follows:

E	D	C	C+	B-	B	B+	A-	A	A+
0-599	600-699	700-769	770-799	800-829	830-869	870-899	900-929	930-969	970-1000

Homework Drops: No homework will be dropped.

Cairn Policies: *Cairn (noun): a stack of stones made to mark a path in the wilderness.*
Cairns should be completed as you finish the instruction in the course. They are meant to keep you on track, to enable you to check your understanding as you proceed, and to emphasize the relationship between topics in the course. They have a relatively low weight, simpler questions than the main homework, and allow two attempts so that they can be used to develop your skills without worrying as much about your grade. Treat them an opportunity to try applying concepts before doing heavily weighted homework, and receive feedback in terms of a solution. After completing the instructional materials, cairns should not take more than 20-30 minutes to complete (depending on number of attempts). **No cairn questions require a compiler or doing online research** - in fact, doing either of those things may hinder your learning experiences. Remember that as a learner, your goal is to learn the material well, not simply to maximize your points.

- Although cairns are associated with a particular module, they will contain two questions from the previous module as well. One question will be based purely on the previous module, and one will combine application of the current and previous module's topics. The remaining questions will focus on the current module.
- You will be allowed **two attempts** on each cairn. The same questions will be shown both times, and you will be able to see the points you have earn on each question (but not the complete solution). **The final attempt will be used for grading purposes.**
- Cairns will be released on the day of lecture that we finish the topics that it covers. It will then be due at 11:59pm that day.
- The cairn solutions will be released after the due date.

Short Answer Homework Policies: You may submit any number of times before the deadline, **but we grade only the latest version.**

Programming Homework Policies: Read the assignment PDF for specifics on what your programming submissions should look like. In addition:

- Most assignments will be graded using the Gradescope platform. Gradescope enables cloud-based assessment of your programming assignments. Our implementation of Gradescope works by downloading your assignment to a virtual machine in the cloud, running a suite of test cases, and then computing a tentative grade for your assignment.
- You are allowed unlimited submissions, only the newest submission will be graded.
- **Programming submissions that do not compile will receive a score of zero unless otherwise mentioned in the assignment PDF.**

Grade Appeals:

Students may appeal a scored assessment within one week of grades being released. Appeals are in written form only (including email) and must point to specific evidence of why the grade should be revised. The instructor reserves the right to assign a lower score on appeal. For additional information on ASU's grade appeal policy, see https://catalog.asu.edu/appeal.

Absence Polices:

Students unable to attend class, take exams, or complete assignments due to a medical condition must present a doctor's signed excuse and notify the instructor as soon as the condition affects the student's work.

Excused absences for classes will be given without penalty to the grade in the case of (1) a university-sanctioned event [ACD 304-02]; (2) religious holidays [ACD 304-04]; a list of religious holidays can be found here https://eoss.asu.edu/cora/holidays]; (3) work performed in the line-of-duty according [SSM 201-18]. Students who request an excused absences must follow the policy/procedure guidelines. Excused absences do not relieve students of responsibility for any part of the course work required during the period of absence.

Per SSM 201-02, an instructor may drop a face to face student for nonattendance during the first week of the semester.

Student Behavior

Students in this class are expected to acknowledge and embrace the FSE student professionalism expectation located at: https://engineering.asu.edu/professionalism/

Students are expected to participate in the educational process and not be a disruptive element with regard to the learning of others. Safety, self-discipline and respect for others are necessary elements in the educational processes employed in this course. All students should be familiar with the Student Code of Conduct, which can be found at http://www.asu.edu/studentlife/judicial/ .

Generative AI

Generative AI is a technology that can often be useful in helping students learn the theories and concepts in this course. However, **unless explicitly allowed by your instructor, the use of generative AI tools to complete any portion of a course assignment or exam will be considered academic dishonesty and a violation of the** ASU Academic Integrity Policy. Students confirmed to be engaging in non-allowable use of generative AI will be sanctioned according to the academic integrity policy and FSE sanctioning guidelines.

Academic Integrity:

All engineering students are expected to adhere to the ASU Student Honor Code and the ASU academic integrity policy, which can be found at https://provost.asu.edu/academic-integrity/policy). Students are responsible for reviewing this policy and understanding each of the areas in which academic dishonesty can occur. If you have taken this course before, you may not reuse or submit any part of your previous assignments without the express written permission from the instructor.

All student academic integrity violations are reported to the Fulton Schools of Engineering Academic Integrity Office (AIO). Withdrawing from this course will not absolve you of responsibility for an academic integrity violation and any sanctions that are applied. The AIO maintains a record of all violations and has access to academic integrity violations committed in all other ASU college/schools.

Specific academic integrity rules for this class are: The Student Academic Integrity Policy of Arizona State University requires each student to act with honesty and integrity and to respect the rights of others in carrying out all academic assignments. There are a number of actions that constitute a violation of the policy. These actions in this course include, but are not limited to:

1) practicing any form of academic deceit;

2) referring to materials or sources or employing devices (e.g., audio recorders, crib sheets, calculators, solution manuals, or commercial research services) not specifically authorized by the instructor for use during tests, quizzes, homework, and class activities;

3) acting as a substitute for another person in any academic evaluation or using a substitute in any academic evaluation;

4) possessing, buying, selling, or otherwise obtaining or using, without appropriate authorization, a copy of any materials intended to be used for academic evaluation in advance of its administration;

5) depending on the aid of others to the extent that the work is not representat that this aid is not authorized by the instructor;

6) providing inappropriate aid to another person, knowing or having good reason to believe the aid is not authorized by the instructor;

7) submitting the ideas or work of another person or persons without customary and proper acknowledgment of sources (i.e., engaging in plagiarism);

8) permitting one's own ideas or work to be submitted by another person any academic evaluation or record for reasons having no relevance to class achievement.

9) turning in work/code done by someone else or another pair/group

10) copying work/code done by someone else or another pair/group

11) writing code together with someone else or with another pair/group (unless expressly allowed by the instructor)

A common question in programming courses is the use of code that is "googled" or found on popular sites such as StackOverflow. Items 5 and 7 pertain to this situation. Most programmers use reference examples, found in print or online. This is fine as a practice but is not acceptable in situations where you are using code to proxy your understanding of the coding concepts applied in that assessment (i.e. lab or in-class activity). First, if you are uncertain if it is allowable or not, verify directly with the instructor before submitting the assignment. Second, if it is allowable, you are still required to a) adhere to all originating author's constraints on the use and licensing of the code, and b) provide proper attribution (full URL to the code snippet or bibliographic reference to a print item). Failure to do so constitutes a violation of this Academic Integrity Policy.

Students may be allowed to work in small teams on lab and in-class assessments. You are to work with your partners and only your partners as directed by the instructor; receiving assistance from anyone else other than your partners, the graders, teaching assistants, approved tutors or the instructor is considered a violation of this Academic Integrity Policy. Further, on any paired/group assessments you remain individually responsible be no differentiated grades awarded between the individuals in the pair/group. From an ethics standpoint, you have a professional responsibility to your partner to give your best effort on each programming assignment. Failure to do so will be considered an ethics violation.

The penalty for an Academic Integrity Violation (cheating) on an in-class assessment or lab will be a reduction of a course letter grade for the first offense, and failure of the course for a second offense. The penalty for an Academic Integrity Violation (cheating) on an exam is immediate failure of the course. The penalty for an ethics violation will be a zero for the in-class assessment or lab. All violations will be referred to the Dean's Office of the Ira A. Fulton Schools of Engineering.

Students should not release (to GitHub, friends, etc.) any of their completed assignments, in order to ensure that they do not cause an AIP violation during a future semester. If a student in a later class submits your work, you and they will be held accountable.

Copyright:

You must refrain from uploading to any course shell, discussion board, or website used by the course instructor or other course forum, material that is not the student's original work, unless the student first

complies with all applicable copyright laws. Course instructors reserve the right to delete materials from the course shell on the grounds of suspected copyright infringement.

The contents of this course, including lectures and other instructional materials, are copyrighted materials. Students may not share outside the class, including uploading, selling or distributing course content or notes taken during the conduct of the course. Any recording of class sessions by students is prohibited, except as part of an accommodation approved by the Disability Resource Center. (see ACD 304–06, "Commercial Note Taking Services" and ABOR Policy 5-308 F.14 for more information).

You may not post any course material (including but not limited to slides, cairns, and assignments), even excerpts, to an external site without the instructor's written permission. If this occurs, you may be penalized for Academic Dishonesty or IP infringement.

Policy against threatening behavior, per the Student Services Manual, SSM

Students in this class are expected to acknowledge and embrace the FSE student professionalism expectation located at: https://engineering.asu.edu/professionalism/

Students, faculty, staff, and other individuals do not have an unqualified right of access to university grounds, property, or services (see SSM 104-02). Interfering with the peaceful conduct of university-related business or activities or remaining on campus grounds after a request to leave may be considered a crime. All incidents and allegations of violent or threatening conduct by an ASU student (whether on- or off-campus) must be reported to the ASU Police Department (ASU PD) and the Office of the Dean of Students.

Disability Accommodations:

Suitable accommodations will be made for students having disabilities. Students needing accommodations must register with the ASU Student Accessibility and Inclusive Learning Services office and provide documentation of that registration to the instructor. Students should communicate the need for an accommodation in sufficient time for it to be properly arranged. See ACD 304-08 Classroom and Testing Accommodations for Students with Disabilities.

Harassment and Sexual Discrimination:

Arizona State University is committed to providing an environment free of discrimination, harassment, or retaliation for the entire university community, including all students, faculty members, staff employees, and guests. ASU expressly prohibits discrimination, harassment, and retaliation by employees, students, contractors, or agents of the university based on any protected status: race, color, religion, sex, national origin, age, disability, veteran status, sexual orientation, gender identity, and genetic information.

Title IX is a federal law that provides that no person be excluded on the basis of sex from participation in, be denied benefits of, or be subjected to discrimination under any education program or activity. Both Title IX and university policy make clear that sexual violence and harassment based on sex is prohibited. An individual who believes they have been subjected to sexual violence or harassed on the basis of sex can seek support, including counseling and academic support, from the university. If you or someone you know has been harassed on the basis of sex or sexually assaulted, you can find information and resources at https://sexualviolenceprevention.asu.edu/faqs.

As a mandated reporter, I am obligated to report any information I become aware of regarding alleged acts of sexual discrimination, including sexual violence and dating violence. ASU Counseling Services,

https://eoss.asu.edu/counseling is available if you wish to discuss any concerns confidentially and privately. ASU online students may access 360 Life Services, https://goto.asuonline.asu.edu/success/online-resources.html.

Photo Requirement:

Arizona State University requires each enrolled student and university employee to have on file with ASU a current photo that meets ASU's requirements (your "Photo"). ASU uses your Photo to identify you, as necessary, to provide you educational and related services as an enrolled student at ASU. If you do not have an acceptable Photo on file with ASU, or if you do not consent to the use of your photo, access to ASU resources, including access to course material or grades (online or in person) may be negatively affected, withheld or denied.

Change Notice:

Any information in this syllabus may be subject to change with reasonable advance notice.

Schedule

In this course, we will be covering approximately twelve sections from Sedgewick (skipping a few subsections here and there). **Keep in mind that this is not a fixed schedule and topics/assignments may change.**

Week	Monday	Wednesday
1/13 (1)	**Topics:** • Syllabus • M1: Data Abstraction	**Topics:** • M1: Data Abstraction
1/20 (2)	*No class - MLK holiday observed!*	**Topics:** • M2: Stacks, Lists, and Generics
1/27 (3)	**Topics:** • M2: Stacks, Lists, and Generics	**Topics:** • M3: Analysis of Algorithms
2/3 (4)	**Topics:** • M3: Analysis of Algorithms	**Topics:** • M3: Analysis of Algorithms
2/10 (5)	**Topics:** • M4: Analysis, Design, and Justification I	**Topics:** • M4: Analysis, Design, and Justification I
2/17 (6)	***Exam 1 (tentative)***	**Topics:** • M5: Elementary Sorts
2/24 (7)	**Topics:** • M5: Elementary Sorts	**Topics:** • M6: Mergesort
3/3 (8)	**Topics:** • M6: Mergesort	**Topics:** • M7: Priority Queues
3/10 (9)	*No class - spring break!*	*No class - spring break!*
3/17 (10)	**Topics:** • M7: Priority Queues	**Topics:** • M8: Analysis, Design, and Justification II
3/24 (11)	**Topics:** • M8: Analysis, Design, and Justification II	**Topics:** • M9: STs & Binary Search Trees
3/31 (12)	***Exam 2***	**Topics:** • M9: STs & Binary Search Trees
4/7 (13)	**Topics:** • M10: Hash Tables	**Topics:** • M10: Hash Tables
4/14 (14)	**Topics:** • M11: Undirected Graphs	**Topics:** • M11: Undirected Graphs
4/21 (15)	**Topics:** • M11: Undirected Graphs	**Topics:** • M12: Directed Graphs
4/28 (16)	**Topics:** • M12: Directed Graphs	Buffer
5/5 (17)	*No class - study for final!*	***Exam 3***