Algorithms & Data Structures

CSIS2420 001

Instructor Information

Class Meetings and Modality

Class Meetings: Monday and Wednesday, 10:00 - 11:50 AM, LAC 116..

This course is taught using a flipped classroom model. You'll watch lecture videos before class, so we can use our in-person time to practice and apply the new concepts.

For those unfamiliar with the flipped classroom approach, the following video provides a brief introduction:

Course Description

CSIS-2420 focuses on dynamic data structures including stacks, queues, linked lists, heaps, hash tables, balanced trees, and graphs. It also covers the design and analysis of efficient algorithms, including algorithms for recursion, sorting, searching and traversal operations. CSIS-2420 develops problem-solving skills through the design and implementation of programs that solve substantial programming challenges.

NOTE: You must be prepared to spend a significant amount of time, over and above the scheduled class periods, working on homework assignments and programming projects.

Course Student Learning Outcomes

- Analyze and evaluate the efficiency and scalability of algorithms and determine the performance characteristics of a software program.
- Select the appropriate sorting or searching algorithm given specific quantitative limitations.
- Select the appropriate data structure(s) to solve a problem given a set of programming specifications and performance requirements.
- Understand and use the interfaces and data structure classes of a given API to design and implement programs that solve substantial programming challenges.
- Implement classic algorithms and data structures using generic classes.

Course Prerequisites

CSIS-1410 Object-Oriented Programming

Text | Lecture Videos

CS 2420 is based on the book *Algorithms* by Robert Sedgewick and Kevin Wayne (ISBN 978-0321573513)

Students are asked to purchase a subscription to Prof. Sedgewick's lecture videos, which make the material more accessible and are referenced in the weekly prep assignments.

For more details, please refer to the 'Textbook' tab on the 'Getting Started' page within the Orientation Module.

Communication Plan

The best way to reach me is via **Canvas mail**. I check it daily and respond to questions within 24 hours during the workweek.

For more details, please read the '**Instructor and Student Participation Expectations**' section, which is posted under the 'Welcome' tab on the 'Getting Started' page within the Orientation Module.

Brief Description of Assignments/Exams

Instructions, due dates, and submission procedures for all graded coursework are managed through Canvas.

- **Prep Quizzes** (7%):
  Weekly prep quizzes on Canvas help you assess how well you've understood the material from the video lectures. These quizzes can be taken only once, but the three lowest scores will be dropped from your final grade calculation.

- **Course Exercises** (20%):
  Course exercises (CEs) are crucial to your learning. They serve as a bridge between Professor Sedgewick's video lectures and the assignments. Collaboration and pair programming with classmates are encouraged when working through these exercises.

- **Assignments**(23%):
  Assignments are an essential part of the course, requiring you to apply new concepts independently. Academic integrity is essential; while you may discuss homework concepts with classmates, your implementations must be your own unless instructions explicitly permit a designated assignment partner.

- **Exams** (50%):
  There will be three module tests and one final exam. Upholding academic integrity during exams is paramount. If an exceptional situation prevents you from taking an exam at the scheduled time, please contact me at least 24 hours in advance.

Grading Scale

Grading Scale	A 94% - 100%	A- 90% - 93%
B+ 87% - 89%	B 84% - 86%	B- 80% - 83%
C+ 77% - 79%	C 74% - 76%	C- 70% - 73%
D+ 67% - 69%	D 64% - 66%	D- 60% - 63%
E 59% and below		

Keys for Success (how to succeed in the course)

Stay Engaged and Keep Up with the Course Pace
Attend class regularly, and complete the prep assignments before each session. This will help you get the most out of the class exercises and stay on track with the course material.

Get the Help You Need—and Support Others
If you need help with your code, reach out to our free Java tutors. Use the small-group activities to get your questions answered and to assist your classmates.

Reach Out to Me Whenever You Need Additional Support
The best way to reach me is after class or via Canvas mail, which I check daily during the workweek. Don’t hesitate to contact me if you have any course-related questions or need additional support. I’m here to ensure you have the resources you need to succeed.

Additional Policies

Late Policy:

Submitting work on time is crucial for success in this course, as there is a strong correlation between punctual submissions and course completion.

However, I understand that unexpected difficulties can arise. You may submit your work until the posted "until-date," after which submissions close. Please note that Canvas deducts 1% per day after the due date, so catching up quickly is important.

If you face an unforeseeable situation that disrupts your ability to submit coursework, please contact me as soon as possible. Early communication allows us to explore ways I

can support you during challenging times.

Academic Integrity and AI:

Students are expected to adhere to the Code of Student Rights and Responsibilities.

Generative artificial intelligence (AI) is a rapidly emerging tool that can be useful in your learning process. In this course, you are permitted to use generative AI to enhance your understanding while watching videos and working on prep quizzes. You may also use AI to assist with Class Exercises, such as asking for explanations or help in troubleshooting a tricky bug. However, you must instruct the AI to act as a tutor, not to provide code solutions.

Please note that the use of generative AI is strictly prohibited for coursework in the Assignments and Exams categories.

Student Academic Calendar

As students you should be aware of all important dates in the semester, such as the day that courses begin and end, as well as the drop date and the last day to withdraw. To learn more about those dates, navigate to the Student Academic Calendar below:

SLCC Student Academic Calendar

Learning Support and Tutoring Services

We are pleased to offer a range of tutoring and learning support services to help you achieve your academic goals. Whether you need assistance with a specific subject or want to improve your study skills, you have many options for tutoring or other support.

To learn more about the services we offer and how to access them, please visit the Institutional Syllabus under the Tutoring and Learning Support tab: https://slcc.instructure.com/courses/530981/pages/institutional-syllabus. We encourage you to take advantage of these resources to help you succeed in your studies. If you have any questions or would like to schedule a tutoring session, please don't hesitate to reach out to us. We are here to support you in any way we can.

Advising and Counseling Support Services

At our institution, we are committed to supporting your academic and personal growth. That's why we offer a range of advising and counseling services to help you navigate the challenges of college life. To learn more about the resources available to you and how to access them, please visit the Institutional Syllabus under the Advising and Counseling Support Services tab: https://slcc.instructure.com/courses/530981/pages/institutional-syllabus. Our advising team and the support centers across campus are here to support you in achieving your goals and overcoming any obstacles you may face.

Institutional Policies

As members of our academic community, we would like to invite you to review the Institutional Syllabus which covers important policies and procedures. This document contains important links for students on the code of student rights and responsibilities, academic integrity, and grading policies, Title IX and other important acknowledgements. By familiarizing yourself with this information, you can help us create a safe and respectful environment for everyone.

You can access the document by clicking on the following link: https://slcc.instructure.com/courses/530981/pages/institutional-syllabus

Weekly Schedule

This course incorporates two evidence-based learning strategies: interleaving and spaced repetition. As a result, you will encounter various topics across multiple weeks. The schedule below provides an overview of the topics covered throughout the course. For specific dates, please refer to the calendar or module section.

Date	**Topic**
Week 1	Welcome Course Overview
Week 2	Debugging Intro to Data Structures | Linked List
Week 3	Intro to Algorithms

	Analysis of Algorithms
Week 4	Stacks, Queue Recursion
Week 5	Iterator Elementary Sorting Algorithms
Week 6	Module1 Exam Merge Sort | Stability | Comparator
Week 7	Quick Sort Priority Queue, Heap
Week 8	HeapSort Elementary Symbol Table
Week 9	Module 2 Exam Binary Search Tree | Tree Traversal
Week 10	Balanced Binary Search Trees
Week 11	Hash Tables
Week 12	Module3 Test Undirected Graphs
Week 13	Directed Graphs Symbol Graphs
Week 14	Minimum Spanning Trees 1
Week 15	Minimum Spanning Trees 2
Week 16	Shortest Path Jamboree
Week 17	Final Exam

How to Navigate to Canvas

Assignment Schedule

Due Date	Assignment Name	Assignment Type	Points

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	1410 Lab - Doc Comments | JAR	Assignment	0
	1410 Lab - jUnit	Assignment	0
	1410 Lab - KeyValuePair	Assignment	0
	Big O - Part 1	Quiz	0
	Big O - Part 2	Quiz	0
	PRACTICE Memory	Quiz	0
	Quiz Generic Methods and Types | Review	Quiz	0
	REVIEW Analysis of Algorithms	Quiz	0
	REVIEW Balanced BSTs	Quiz	0
	REVIEW Heap	Quiz	0
	REVIEW: Elementary Sorts	Quiz	0
	Roll Call Attendance	Assignment	0
	Video & Quiz - Java Doc #1	Quiz	0
	Video & Quiz - Java Doc #2	Quiz	0
	Video & Quiz - jUnit #1	Quiz	0
	Video & Quiz - jUnit #2	Quiz	0

Due Date	Assignment Name	Assignment Type	Points
	Video & Quiz - Runnable JAR	Quiz	0
	Water Cooler	Discussion	0
8/24	Academic Honesty	Quiz	5
8/24	CE Getting Started	Assignment	5
8/24	Discussion - This Is Me	Discussion	8
8/24	Programming Survey	Study Group	Quiz	3
8/24	Quiz Orientation	Quiz	8
8/26	Quiz Array vs Linked List	Quiz	4
8/26	Quiz Intro to Linked List	Quiz	6
8/28	Quiz Union Find - Dynamic Connectivity	Quiz	3
8/28	Quiz Union Find - Improvements	Quiz	2
8/28	Quiz Union Find - Quick Union	Quiz	4
8/28	Quiz Union Find - QuickFind	Quiz	3
9/2	CE - Debugging	Assignment	10
9/4	Quiz Analysis of Algorithms - Mathematical Models	Quiz	4

Due Date	Assignment Name	Assignment Type	Points
9/4	Quiz Analysis of Algorithms - Memory	Quiz	6
9/4	Quiz Analysis of Algorithms - Observations | Percolation	Quiz	2
9/4	Quiz Analysis of Algorithms - Order of Growth	Quiz	8
9/4	CE Intro to Data Structures CODE	Assignment	10
9/7	CE Fluency: Analysis of Algorithms	Quiz	10
9/9	Quiz Stacks and Queues - Iterators | Bag	Quiz	5
9/9	Quiz Stacks and Queues - Queues	Quiz	4
9/9	Quiz Stacks and Queues - Resizing arrays	Quiz	6
9/9	Quiz Stacks and Queues - Stacks	Quiz	9
9/9	CE Intro to Algorithms CODE	Assignment	10
9/11	Quiz Recursion	Quiz	4
9/11	Quiz Stacks and Queues - Applications	Quiz	2

Due Date	Assignment Name	Assignment Type	Points
9/14	A01 Stack | Queue | Linked Structure	Assignment	40
9/16	Quiz Elementary Sorts - Insertion Sort	Quiz	4
9/16	Quiz Elementary Sorts - Rules | Comparable	Quiz	5
9/16	Quiz Elementary Sorts - Selection Sort	Quiz	4
9/16	CE Stack | Queue	Assignment	10
9/18	CE ArrayList | LinkedList	Assignment	10
9/21	A02 - Recursion	Assignment	30
9/21	CE Iterator | Recursion	Assignment	10
9/23	Module1 Test CODE	Quiz	35
9/23	CE Fluency: Elementary Sorts	Quiz	10
9/23	Module1 Test	Quiz	35
9/25	Quiz Mergesort - bottom up	Quiz	1
9/25	Quiz Mergesort - Comparator	Quiz	3
9/25	Quiz Mergesort - Introduction	Quiz	11
9/25	Quiz Mergesort - Sorting Complexity	Quiz	5

Due Date	Assignment Name	Assignment Type	Points
9/25	Quiz Mergesort - Stability	Quiz	4
9/28	Quiz Quicksort - Introduction	Quiz	8
9/28	Quiz Quicksort - Selection	Quiz	4
10/2	Quiz Quicksort - System Sorts	Quiz	5
10/2	Quiz Priority Queue - API and Implementation	Quiz	3
10/2	Quiz Priority Queue - Binary Heap	Quiz	10
10/2	Quiz Quicksort - Duplicate Keys	Quiz	3
10/2	CE Merge CODE_PLO-CS-6	Assignment	10
10/5	A03 - Sorting Methods	Assignment	30
10/5	Quiz Priority Queue - Heap Sort	Quiz	4
10/7	CE Stable CODE	Assignment	10
10/9	Quiz Elementary ST - API	Quiz	6
10/9	Quiz Elementary ST - Implementations	Quiz	3
10/9	Quiz Elementary ST - ordered operations	Quiz	2

Due Date	Assignment Name	Assignment Type	Points
10/9	CE Quicksort CODE	Assignment	10
10/12	CE Elementary ST CODE	Assignment	10
10/12	Discussion: Impact of Deep Fakes and Election Misinformation	Discussion	25
10/12	Pair Up - A04 Symbol Table	Assignment	2
10/12	CE HeapSort CODE	Assignment	10
10/13	CE Fluency: Heap	Quiz	10
10/14	Module2 Test	Quiz	50
10/14	Module2 Test CODE	Quiz	50
10/16	CE Fluency: Tree Traversals	Quiz	8
10/16	Quiz BST	Quiz	7
10/16	Quiz BST - Delete	Quiz	4
10/16	Quiz BST - Ordered Operations	Quiz	4
10/23	CE BST CODE	Assignment	10
10/23	Quiz Balanced Search Trees - BTrees	Quiz	3
10/23	Quiz Balanced Search Trees - red black BSTs	Quiz	13

Due Date	Assignment Name	Assignment Type	Points
10/23	Quiz Balanced Trees - 2-3 trees	Quiz	6
10/26	A04 Symbol Table	Assignment	40
10/26	Quiz Hash Table - Separate Chaining	Quiz	4
10/26	Quiz Hash Tables - Context	Quiz	4
10/26	Quiz Hash Tables - Hash Functions	Quiz	8
10/26	Quiz Hash Tables - Linear Probing	Quiz	4
10/30	Quiz Undirected Graphs - API	Quiz	7
10/30	Quiz Undirected Graphs - depth first	Quiz	5
10/30	Quiz Undirected Graphs - intro	Quiz	3
11/2	CE Hash CODE	Assignment	10
11/2	Pair Up - Team Project	Assignment	2
11/2	Quiz Symbol Table Applications - Dictionary Client	Quiz	2
11/2	Quiz Symbol Table Applications - Indexing Clients	Quiz	1
11/2	Quiz Symbol Table Applications - Sets	Quiz	6

Due Date	Assignment Name	Assignment Type	Points
11/2	Quiz Symbol Table Applications - Sparse Vectors	Quiz	2
11/4	Module3 Test	Quiz	46
11/4	Module3 Test CODE	Quiz	46
11/6	CE Fluency: Balanced BSTs	Quiz	10
11/6	CE Undirected Graphs CODE	Assignment	10
11/6	Quiz Undirected Graph - challenges	Quiz	1
11/6	Quiz Undirected Graphs - breadth first search	Quiz	3
11/6	Quiz Undirected Graphs - Connected Components	Quiz	5
11/9	CE DFS vs BFS CODE	Assignment	10
11/9	CE Symbol Graph CODE	Assignment	10
11/9	Quiz Directed Graphs - intro	Quiz	2
11/9	Quiz Directed Graphs - Digraph API	Quiz	3
11/9	Quiz Directed Graphs - digraph search	Quiz	6

Due Date	Assignment Name	Assignment Type	Points
11/9	Quiz Directed Graphs - topological sort | strong component	Quiz	6
11/13	CE Directed Graphs	Assignment	10
11/13	Quiz Minimum Spanning Tree - Prim's Algorithm	Quiz	8
11/13	Quiz Minimum Spanning Trees - edge-weighted graph API	Quiz	4
11/13	Quiz Minimum Spanning Trees - Greedy Algorithms	Quiz	5
11/13	Quiz Minimum Spanning Trees - Intro	Quiz	2
11/13	Quiz Minimum Spanning Trees - Kruskals Algorithm	Quiz	3
11/16	Team Assignment - Design_PLO-CS-4	Assignment	20
11/20	CE Internet_CODE	Assignment	10
11/20	Quiz Minimum Spanning Trees - Context	Quiz	3
11/20	Quiz Shortest Paths - API	Quiz	6
11/20	Quiz Shortest Paths - Dijkstra's algorithm	Quiz	7

Due Date	Assignment Name	Assignment Type	Points
11/20	Quiz Shortest Paths - properties	Quiz	4
11/23	Team Assignment - Significant Progress	Assignment	25
11/26	CE Shortest Paths CODE	Assignment	10
12/1	Team Assignment - Project_PLO-CS-1	Assignment	50
12/4	Vote and Reflection - Team Assignment	Quiz	16
12/5	Jamboree 8 XC	Assignment	0
12/7	Bonus Points	Assignment	0
12/11	Final	Quiz	50
12/11	Final CODE	Quiz	50