

CSC 223 (D01A)
Data Structures and Analysis of Algorithms
Course Syllabus

Instructor	Jeffrey Elkner
Session	Spring 2025
Meeting Days	A Day
Time	8:00 - 9:24 am
Location	Arlington Career Center Room 512
Contact	jde232@email.vccs.edu

Course Description

Explores and contrasts data structures, algorithms for manipulating data structures, and their use and appropriateness in writing efficient real-world programming applications. Investigates implementations of different data structures for efficient searching, sorting, and other transformer operations. Third course in a three-course sequence. (CSC 221-222-223). 4 Credits.

General Course Purpose

CSC 221, CSC 222, and CSC 223 comprise the standard sequence of minimal programming content for Computer Science majors. The course sequence will teach the students to use high-level languages and their applications to problem solve by using algorithms within procedural and object-oriented languages, while ensuring data adheres to a structured model. JAVA or C++ is the preferred language for this course, institutions may offer using a different language to align with primary 4-year partner requirements.

Course Prerequisites/Co-Requisites

Corequisite: CSC 208 or equivalent

Prerequisite: CSC 222 or by departmental consent

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Course Objectives

Civic Engagement

- Engage and build technology that responds to human needs and helps people navigate institutional systems.

Critical Thinking

- Assess why certain solutions might not work to save time in coming up with more efficient approaches.

Professional Readiness

- Work well with others and display situationally and culturally appropriate demeanor and behavior.

Quantitative Literacy

- Perform accurate calculations, interpret quantitative information, apply and analyze relevant numerical data, and use results to support conclusions.

Scientific Literacy

- Represent real-world objects and processes virtually by identifying properties, behavior, and operations relevant to solving problems on a computer.

Written Communication

- Develop, convey, and exchange ideas in writing, as appropriate to a given context and audience.

Review of Object- Oriented Principles

- Compare and contrast procedural versus object-oriented programming.
- Design class hierarchies using inheritance and interfaces.
- Implement in code OOP constructs including encapsulation, inheritance, and polymorphism.
- Review the design, implementation, and efficiency of recursive algorithms.
- Review of arrays and exception handling.

Analysis of Algorithms

- Discuss the differences between iterative vs. recursive algorithms.
- Demonstrate worst-case complexity function.
- Define other complexity functions such as best case, average case, and amortized.

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Data Structures

- Describe and explain abstract data types including stacks, queues, singly and doubly linked list, sets, maps and graphs.
- Compare and contrast contiguous and linked structures.
- Explain the purpose and use of iterators.
- Implement in code the various data structures using both contiguous and linked applications where applicable.
- Analyze the time and space efficiency of data structures and algorithms and apply this analysis to select the best tools for solving problems.
- Explain how generics and parameterized types implement dynamic binding with polymorphism.

Searching and Sorting Algorithms

- Analyze a variety of algorithms for searching and sorting.
- Classify the various sorting algorithms in terms of their Big-O analysis.
- Implement both recursive and non-recursive algorithms for searches.

Additional Data Structures

- Demonstrate the appropriate use of trees, graphs, sets, heaps, hash tables, and maps to computational problems.
- Describe techniques to generate keys for hashed structures.
- Discuss collision handling for hashing analysis.
- Demonstrate the use of binary search trees.
- Identify other types of tree data structures and their applications.

Real-World Applications

- Create a solution to real-world computing problems by applying appropriate data structures.
- Employ best practices to design, document and implement the solution to a real-world application.
- Make efficient use of formal testing and debugging.
- Apply the use of a version control system or a sandbox environment in team or multiple revision scenarios.
- Demonstrate proficiency in the use of programming languages to solve complex problems in a secure and robust manner.
- Discuss ethical aspects of programming and data handling.

Major Topics to be Included

- Review of Object- Oriented Principles
- Analysis of Algorithms
- Data Structures
- Searching and Sorting Algorithms
- Additional Data Structures
- Real-World Applications

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Required Instructional Materials:

- [A C++ Book for Undergraduate Computer Science Majors](#). by Jeffrey Elkner
- Other freely available resources as provided by instructor

Course Credit: 4 Credits

Policies

I. Expectations

- A. Introduction to Computer Science is a rigorous, college level course that will require sustained and consistent engagement from students.
- B. An average of 90 minutes of homework will be assigned for each 90 minutes in class. We will be utilizing a flipped classroom learning environment, where the lecture portion of the course material will be viewed individually at home *before* class meets, and class time will be used for collaborative engagement and discussion.
- C. Frequent "mini quizzes" at the beginning of class will be used to be sure homework readings and practice have been completed. To be successful in this class, students will be expected to be prepared for these quizzes when they arrive in class.

II. Grading Policies

- A. Grading Scale: A= 100 - 90 B= 89 - 80 C= 79 - 70 D=69 - 60 F= 59 and below
- B. Students will receive a weekly cumulative letter grade that will incorporate daily quizzes, tests, projects, and presentations. These weekly evaluations can be challenged by the student, *but only during the week immediately following when the evaluation is given*.
- C. The average of the weekly evaluations will make up 70% of the final grade, with the course final exam making up 30%.
- D. In cases where district grading policies conflict with college grading policies, the high school and college grades may differ; this may include assignment/test retakes, extended assignment due dates, capped minimum grade allowed, among other such district policies.
- E. It is important that students check their final NOVA grades in SIS as soon as their course is completed.
- F. Course Grade Appeals
 - i. Students who think that a semester grade is in error should contact the instructor immediately to present their concerns. Students who wish to appeal their grade or otherwise report a grievance will need to submit Form 125-021 within 20 days of the end of the semester. The original grade will stand if the student delays in submitting their appeal.
 - ii. NOVA's Student Grievance policy can be found here:
<https://www.nvcc.edu/policies/files/608-Student-Grievances.pdf>
 - iii. Form 125-021 can be found here: <https://www.nvcc.edu/forms/>

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III. Course Policies

A. Student Rights and Responsibilities

- i. Students should be familiar with the college's specific expectations concerning the conduct of its students. These expectations apply to all students, including Dual Enrollment students.
- ii. Student Rights and Responsibilities are outlined in the Student Code of Conduct, found here: <https://www.nvcc.edu/students/handbook/conduct.html>

B. Academic Integrity

- i. Academic integrity requires that you recognize and acknowledge information derived from others and take credit only for ideas and work that are yours. It should be the guiding principle for all that you do, from taking assessments and making presentations to writing papers. More about academic integrity at NOVA can be reviewed on the Student Conduct and Integrity page on the NOVA website: <https://www.nvcc.edu/students/handbook/conduct.html>.
- ii. Violating the Academic Integrity Policy will incur consequences. Your instructor may give you a failing grade for the assignment or for the course. Further, you may be referred to NOVA Cares, reported to an academic dean, or even referred to the Dean of Students for disciplinary action depending on how serious an infraction was committed.
- iii. Please review NOVA's Academic Integrity Policy here: <https://www.nvcc.edu/policies/files/224-Academic-Integrity.pdf>.

C. Accommodations and Accessibility Services

- i. NOVA is committed to ensuring all students have an opportunity to pursue a college education regardless of the presence or absence of a disability. Information on NOVA's Accommodations and Accessibility Services, including how to reach a Accommodations and Accessibility Services counselor, can be found here: <https://www.nvcc.edu/accommodations>.
- ii. Students must reach out to contact NOVA's Accommodations and Accessibility Services to apply for accommodations. A student with a 504 plan or IEP at their high school will still need to apply with NOVA's Accommodations and Accessibility Services – those plans do not automatically carry over to your Dual Enrollment course. If accommodations are agreed upon, students will receive a Memorandum of Accommodation (MOA) by AAS. All information is kept confidential and may increase your chances of success in the academic setting.

D. Advocacy and Privacy of Student Records

- i. Students are expected to reach out to their instructor if they do not understand content or expectations.
- ii. You, as a NOVA student, have a right to review your NOVA grades and other records. Your high school may share grades and other records with NOVA, and NOVA will share your post-secondary (college) grades with your high school. The grades you earn at NOVA are part of a permanent transcript, and you will be required to include your NOVA transcript as part of any future college or graduate school application. NOVA instructors and other college personnel generally may not release a student's educational records without written consent of the student. For dual enrolled students under 18, parents or guardians may generally access records and grades which are created by or shared with a student's high school. For the purposes of these privacy rules, your Dual Enrollment instructor is considered a NOVA employee.

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- iii. To grant parents or guardians direct access to NOVA records, students will be required to submit a notarized copy of NOVA Form 125-356, found here:
<https://www.nvcc.edu/forms/pdf/125-356.pdf>.
 - iv. For more information about student privacy, parent limitations of access to students' educational records, and other restrictions on sharing students' personally identifiable information, please review NOVA Policy 613 (FERPA):
https://www.nvcc.edu/policies/_files/613-FERPA.pdf.
- E. Campus Services
 - i. Dual enrolled students have access to full NOVA campus services to include tutoring, library, and counseling services; student resources are found here:
<http://www.nvcc.edu/students/index.html>.
- F. Office of Wellness and Mental Health
 - i. During your time at NOVA, you may experience challenges including struggles with academics, finances, or your personal well-being. NOVA has support resources available. If you are seeking resources and support or if you are worried about a friend or classmate:
<https://www.nvcc.edu/wellness/index.html>.
- G. Course Drop and Withdrawal Policy
 - i. Please note two important dates related to your enrollment in a course:
 - a. The "Drop" date (also known as census date) for a course is the last day to drop a course. Dropping a course before the drop date will not appear on your NOVA transcript.
 - b. The "Withdrawal" date is the last day to withdraw without a grade penalty. Dropping a course after the drop date and before the withdrawal date will result in a 'W' grade appearing on your transcript.
 - c. To identify these dates for your dual enrollment course, please see below on the 'Course Schedule' chart or log into your myNOVA account and SIS.
 - ii. Withdrawal Process
 - a. Dual enrolled students are responsible for requesting to drop or withdraw from their DE classes, using Form 125-03, found at the following link:
<https://dashboard.nvcc.edu/Forms/125-03>
 - b. Dual enrolled students will use their myNOVA credentials to access the withdrawal form and will select one or more enrolled DE classes to withdraw.
 - c. The withdrawal form is then routed to the assigned DE instructor and the Office of Dual Enrollment for review and approval.
 - d. Check your VCCS email for the status of your request.
- H. Communication
 - i. Students are required to use their VCCS email accounts (____@email.vccs.edu) to communicate with college personnel and should check their email accounts regularly. Students may access their VCCS email accounts through myNOVA.
- I. Title IX
 - i. Title IX is a civil rights law that prohibits discrimination on the basis of sex in educational programs, activities, admission and employment. Complaints of sex-based discrimination, sexual violence, domestic violence, and sexual or gender-based harassment are governed by the Title IX Policy. For more information about Title IX or to make a report:
<https://www.nvcc.edu/titleix/index.html>.

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IV. Additional Course Information

- A. DE students are expected to engage in college level course contents and discussions appropriate for adult learners. Mature topics may be discussed.

V. Course Schedule

A. Critical Course Dates

Course Start Date	Monday, February 3, 2025
Course Drop Date	Monday, February 24, 2025
Course Withdrawal Date	Friday, April 25, 2025
Final Exam Date	Wednesday, June 11, 2025
Course End Date	Wednesday, June 11, 2025

- B. Final Exam Date:** *The final project will be due at the end of the last day of class, Wednesday, June 11.*