Foundations of Computer Science - CS506

Syllabus FALL 2025

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Office Hours: Zoom on Wed 11:30-1:30

*I will respond to all emails/Inbox messages within 24 hours. Quizzes and assignments will be graded weekly."

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General Course Information

Course Description

The course assumes basic knowledge of a higher-level programming language. Introduction to the concepts of iteration, asymptotic performance analysis of algorithms, recursion, recurrence relations, graphs, automata and logic, and also surveys the main data models used in computer science including trees, lists, sets, and relations. Programming assignments are given.

Course Learning Outcomes (CLOs)

You will notice throughout the course that many pages are marked with "CLOs". These refer to the Course Learning Outcomes. These markers are in place to help you clearly identify the relationship between learning outcomes (what you should be able to do at the end of the course) and the learning materials and activities.

By the end of the course, students will be able to:

1. Apply set algebra and propositional logic to solve problems involving sets, logical statements, and their relationships.
2. Use basic mathematical tools and terminology such as sets, sequences, arrays, and relations to model and solve problems in computer science.
3. Perform mathematical induction to prove the correctness of recursive algorithms and data structures.
4. Utilize mathematical tools used to analyze the efficiency of algorithms and implement simple programs to measure their time complexity.
5. Implement and analyze fundamental algorithms and complex structures including iteration, recursion, functions, recursive relations, binary trees, and graphs.
6. Design, implement, and test programs in a high-level programming language (C++) to apply concepts such as data structures, algorithms, and recursion.
7. Discuss topics related to mathematical and computer science concepts, including algorithms, data structures, recursion, and their applications in problem-solving.

Required Materials

1. R. Johnsonbaugh, "*Discrete Mathematics*," Pearson, 8th Ed.
2. Goodrich, Tamassia, Mount: *"Data Structures and Algorithms in C++"*, Wiley, 2nd Ed.

Recommended

1. M. Weiss, "*Data Structures and Algorithm Analysis in C++*," Pearson, 4th Ed.

Course Modality

This is an online course, which will be conducted fully online, asynchronously via Canvas. For more information on using Canvas and other supported learning tools, visit the IST Service Desk Knowledgebase.

Course Work

Weekly Expectations

Course Workload: This course values your time and effort and aims to provide a rewarding learning experience. You can expect to dedicate approximately 7.5 hours to the course per week.

This course is organized by weekly modules. Each week, students must watch a lecture video, complete a reading assignment, and participate in a class discussion forum. Homework will be assigned weekly.

Learning Activities and Assessments

Final grades will be based on the following percentages:

Category	Percent of Final Grade
Quizzes	25%
Assignments/Projects	10%
Exams Midterm = 30% Final = 35%	65%

Quizzes: (25% of grade) There will be several quizzes throughout the course. They are meant to help you practice course concepts and prepare for the tests. These quizzes will mostly consist of short answer questions based on the weekly assignments.

Discussion Forums: You are expected to participate in discussion forums in Canvas. When all students participate in a discussion, it creates an active learning environment that will help you better understand the materials and be more successful in the class

Assignments: (15% of grade) Assignments will be given weekly to give you an opportunity to apply course concepts for that week. Similar to quizzes, these activities are designed to help you practice and prepare for the tests. Assignments will be posted on Canvas. The problem sets may be either typed or handwritten (neatly) and uploaded in **PDF** format only. The programming assignments must be implemented and run, producing the desired results. The submission format of these assignments will be detailed for each assignment. Assignments must be done by you individually (teamwork not allowed.)

Exams: (**60% of grade**) There will be 2 tests based on the lectures and assignments. Quizzes will also help prepare for the tests.

Grading Policy

NJIT Graduate Grades

Letter to Number Grade Conversions

Grades will be rounded to the nearest whole number before being assigned according to the following scales.

The following grades are used for graduate courses:

- **A**: 90-100
- **B+**: 85-89
- **B**: 80-84
- **C+**: 75-79
- **C**: 70-74
- **F**: Below 70

Note: There is no D grade for graduate courses.

Exam Information

There will be **No make-up EXAMS** during the semester. In the event the Final Exam is not taken, under rare circumstances where the student has a legitimate reason for missing the final exam, a makeup exam will be administered later. In any case the student must notify the instructor that the exam will be missed and present written verifiable proof of the reason for missing the exam, e.g., a doctor's note, police report, court notice.

Respondus LockDown Browser

This course will be utilizing:

- LockDown Browser: A locked browser used to prevent students from printing, copying, going to another URL, or accessing other applications during an assessment in Canvas.
- Monitor: Used in conjunction with LockDown Browser, Monitor is the usage of a webcam to record a user during the exam session.

If virtual machine software is detected on your device, you won't be able to run LockDown Browser, and you'll receive a warning, "The browser can't be used in virtual machine software such as Virtual PC, VMWare, and Parallels." You can find examples of VM software and troubleshooting steps on Respondus's FAQ page for this topic.

For information about Repondus's privacy policies, please visit their Privacy Center.

In using LockDown Browser, students need:

- High-speed internet connection
- Windows or Apple Operating System

In using Monitor, students need:

- Webcam (internal or external)
- Microphone and Audio (internal or external)
- NJIT ID or Photo-Issued ID
- To perform an environment check

Helpful Resources:

- Introduction to Respondus LockDown Browser for Students Video
- Respondus Monitor Resources
- Respondus Computer Requirements
- Questions or Problems? Contact:
    - Respondus Live Chat
    - IST Service Desk: 973-596-2900 or Help.njit.edu

Late Work Policy

No late assignment or quiz will be allowed. However, the lowest grade for both assignments or quizzes will be dropped. Please note, if you miss an assignment or quiz for a legitimate medical reason or other emergency, this must be documented with the Dean of Students (dos@njit.edu). Once documented, you will be excused from the missed assignment (it will have no weight on your grade). Please be proactive in communicating such situations with your instructor.

University Policies and Resources

Academic Integrity

"Academic Integrity is the cornerstone of higher education and is central to the ideals of this course and the university. Cheating is strictly prohibited and devalues the degree that you are working on. As a member of the NJIT community, it is your responsibility to protect your educational investment by knowing and following the NJIT academic code of integrity policy.

Please note that it is my professional obligation and responsibility to report any academic misconduct to the Dean of Students Office. Any student found in violation of the code by cheating, plagiarizing or using any online software inappropriately will result in disciplinary action. This may include a failing grade of F, and/or suspension or dismissal from the university. If you have any questions about the code of Academic Integrity, please contact the Dean of Students Office at dos@njit.edu"

Generative AI

As an institution, NJIT fully embraces the transformative potential of artificial intelligence (AI) to enhance learning, creativity, and problem-solving across all disciplines. Drawing from the AI-U student guidelines for AI, created by the American Association for Colleges and Universities (AAC&U) and Elon University, we are committed to fostering the responsible and ethical use of AI in our academic community. While we encourage students to explore AI technologies to support their studies, it is crucial to maintain academic integrity and ensure AI tools are used transparently and appropriately.

Netiquette:

Throughout this course, you are expected to be courteous and respectful to classmates by being a polite and active participant. Please respect opinions, even those that differ from

your own, and avoid using profanity or offensive language. For discussion forum assignments, respond promptly to give others time to reply.

Accessibility

This course is offered through an accessible learning management system. For more information, please refer to Canvas's Accessibility Statement.

Requesting Accommodations

The Office of Accessibility Resources and Services collaborates with administrators, faculty, and staff to offer reasonable accommodations and support for students with disabilities. To receive services, students must provide medical documentation.

If you are in need of accommodations due to a disability, please contact the Office of Accessibility Resources and Services to discuss your specific needs.

Resources for NJIT Online Students

NJIT is dedicated to your success. Various academic support centers and services are available to help you excel in your course and program. For more information, visit the "Student Services" page in Canvas, which also includes technical support details.

Course Schedule

Note: All due dates are in Eastern Standard Time (EST/EDT).

Change your Canvas settings to show due dates in your local time zone.

Please note the following abbreviations regarding the textbooks below:

J=R. Johnsonbaugh, "*Discrete Mathematics*,"

GTM=Goodrich, Tamassia, Mount: *"Data Structures and Algorithms in C++"*

Module	Topic(s)	Activities and Due Dates
1	**Sets and Logic**: Sets, Propositional Logic, Quantifiers, Mathematical Review	1. **Reading:** Chapters 1 (J) 2. **Discussion**-Introduce Yourself 3. **Practice Assignment** - Sets and Logic
2	**Proofs**: Direct Proofs, Proofs by Contradiction, Induction	1. Chapter 2 (J) 2. **Assignment** - Proofs and Induction
3	**Programming Overview**: Fundamental Types, Pointers, Arrays, Structures, Expressions, Control Flow	1. Chapter 1 (GTM) 2. **Discussion** - Impression of C++-Initial 3. **Programming Project** 4. **Quiz 1** - Proofs
4	**Functions and Relations:** Functions and Relations,	1. Chapter 3 (J) **2. Assignment** - Relations

Module	Topic(s)	Activities and Due Dates
	Intro to Relational Databases	
5	**Functions and Parameters:** Functions, Argument/Parameter Passing	1. Chapters 1,2 (GTM) 2. **Programming Project** - Functions and Parameters – Sunday 3. **Quiz 2 -** Relations
6	**Algorithms:** Algorithms, Analysis of Algorithms, Intro to RSA Public-Key Cryptosystem	1. Chapters 4,5 (J) 2. **Assignment** - Algorithms - Sunday
7	**Algorithms:** Running-Time Calculations, Worst-Case Analysis	1. Chapter 4 (GTM) 2. Review for the Midterm and Practice Test
8	Midterm	**PRACTICE TEST and MIDTERM**
9	**Recurrence Relations:** Introduction to Recursive Algorithms, Linear and Binary Recurrences, Recursion Analysis	1. Chapter 7 (J) 2. Chapters 3,4,5,11 (GTM) 3. **Programming Project** - Recursive Algorithms
10	**Counting:** Multiplication and Addition Principles, Combinatorics, Probability, Pigeonhole Principle (PHP)	1. Chapter 6 (J) 2. **Assignment** - Multiplication Principle, PHP
11	**Graph Theory:** Paths and Cycles, Euclidian and Hamiltonian Cycles, Shortest-Path Algorithms, Isomorphisms of Graphs	1. Chapter 8 (J) 2. **Assignment** - Graphs 3. **Quiz 3** - Counting
12	**Graph Theory**: Shortest-Path Algorithms, Dijkstra's Algorithm	1. Chapter 13 (GTM) 2. Project Due Sunday at Midnight
13	**Trees:** Rooted Trees, Binary trees, Tree Traversals, Minimum Spanning Trees (MST, Isomorphism of Trees	1. Chapter 9 (J) 2. Chapters 7,10 (GTM) 3. Homework Due Sunday at Midnight 4. **Quiz 4** – Graphs (Trees)
14	**Intro to P, NP, NP-Completeness:** Deterministic vs.	

Module	Topic(s)	Activities and Due Dates
	Nondeterministic, Easy vs. Hard	
15	Review	**PRACTICE TEST and FINAL EXAM**