Fall 2024

CS 610-001: Data Structures and Algorithms

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NJIT

Department of Computer Science

CS 610-001: Data Structures & Algorithms-Fall 2024

Class Location: WEST LECT 1	**Class Time:** Wed 11:30 AM - 2:20 PM

Instructor: Marzieh Eskandari

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Zoom: https://njit-edu.zoom.us/my/meskandari

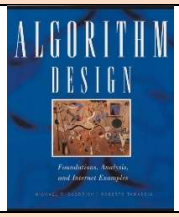
Office: GITC 4313	**Office Hours:** Wed 9:30 AM- 11:15 AM

Prerequisites:

1. Undergrad course on Data Structures & Algorithms (CS 505 or equivalent);
2. Discrete Math (CS 506 or CS 241 or equivalent);
3. Programming Maturity.

Textbook:

Michael Goodrich and Roberto Tamassia,
Algorithm Design: Foundations, Analysis, and Internet Examples,
Wiley, 2002. ISBN: 0-471-38365-1. (Available at NJIT bookstore)



Evaluation:

Assignments: 15%
Attendance: +5% (Extra)
Class Activity: +5% (Extra)
Midterm Exam 1 (**Oct 9th**): 25%
Midterm Exam 2(**Nov 6th**): 25%
Final Exam (**Dec**): 35%

Note 1: NJIT Picture ID required for all exams. All exams are closed books and closed notes.

Course Description:

This is a graduate-level course on data-structures and algorithms, with an emphasis on algorithm design techniques and analysis of algorithms. Topics include analysis techniques, worst-case and average-case analysis, recursion, recurrence relations, priority queues, hash tables, binary-search trees, balanced search trees (AVL trees, red-black trees), sorting algorithms; divide-and-conquer design technique and other design techniques such as greedy-method and dynamic-programming, graph algorithms.

Course Objectives (what you are expected to get out of this course):

1. Learn basic analysis techniques
2. Learn basic design techniques
3. Learn recurrence equations and how they are used in analysis of algorithms
4. Learn advanced data structures: Priority queues, heaps, hash tables, and search trees
5. Understand sorting algorithms and their complexities
6. Learn basic graph algorithms and their applications

Grading:

The grading scale (out of 100) is: 90–100: **A**, 1st quarter: **B+**, 2nd quarter: **B**, 3rd quarter: **C+**, 4th quarter: **C**, <60: **F**.

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 academic code of integrity policy that is found at: http://www5.njit.edu/policies/sites/policies/files/academic-integrity-code.pdf
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

Schedule of Assignments & Due Dates:

Assignment	Subject	Date
Homework 1		Sep 18- Sep 24
Midterm Exam 1	Time complexity, Recursive Algorithms, Linked-Lists, stack, Queue, Trees, Priority Queues, Heaps, Heapsort	Oct 9
Homework 2		Oct 23-Oct 29
Midterm Exam 2	Sorting Algorithms, Dictionaries and Hash Tables, Balanced Search Trees, Graphs	Nov 6
Homework 3		Nov 20- Nov 26
Final Exam	D&C, Greedy, DP	Dec

Course Outline:

Week	Date	Topic
1	Sep 4	Introduction, Analysis Techniques, Complexity definitions: O, Omega, Theta
2	Sep 11	Recursive Algorithms, Recurrence Relations (Review)
3	Sep 18	Stacks, Queues, Linked-Lists, Trees (Review), Trie data Structure
4	Sep 25	Priority Queues, Heaps, Heapsort
5	Oct 2	Sorting: Insertion-Sort, Bubble-Sort, Selection-Sort, Merge-Sort, Quicksort (Review) Integer Sorting: Bucket-Sort, Radix Sort (MSD, ...), Lower-Bound on Sorting by Comparison, Shell Sort, Bitonic Sort and Counting Sort
6	**Oct 9**	**Review/Midterm Exam 1: Weeks 1,2,3,4**
7	Oct 16	Dictionary ADT and Hash Tables
8	Oct 23	Balanced Search Trees: AVL and Red-Black trees, Graphs: Representations and Traversals, Topological Sorting
9	Oct 30	Divide-and-Conquer: Strassen's Matrix Multiplication, Large Integer Multiplication (Karatsuba), Min & Max, FFT, VEB(if time allows)
10	**Nov 6**	**Review/Midterm Exam 2: Weeks 5,7,8**
11	Nov 13	Greedy method (Fractional Knapsack, Task Scheduling, Huffman Coding)
12	Nov 20	Greedy method (MST Algorithms: Prim, Kruskal, Single-Source-Shortest-Paths (Dijkstra)...)
	Nov 27	**Thanksgiving**
13	Dec 4	Dynamic Programming: introduction, Binomial coefficients, All-Pairs-Shortest-Paths (Floyd)
14	Dec 11	Dynamic Programming: Chain Multiplication, Optimal Binary Search Tree Problem Solving Prep: Final Exam Readiness