NJIT

Department of Computer Science

CS 435-102: Advanced Data Structures and Algorithm Design-Spring 2025

Class Location: ECEC 100 **Recitation:** ECEC 100	**Class Time:** M, 6:00 PM - 8:50 PM **Recitation:** F, 6:00 PM - 7:00 PM

Instructor: Marzieh Eskandari

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

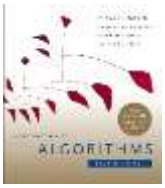
Office: GITC 4313	**Office Hours:** TR 1:00 PM- 2:20 PM, MF 1:00 PM-2:20 PM: Online

Prerequisites:

1. CS 241 (Discrete Math)
2. CS 288 (Intensive Programming)

Textbook:

T.H. Cormen, C. E. Leiserson, R. L. Rivest, and C. Stein,
Introduction to Algorithms,
Third Edition¸ MIT Press, 2009
ISBN-13: 978-026203384-8



Evaluation:

Assignments: 25%
Attendance: +5% (Extra)
Class Activity: +5% (Extra)
Midterm Exam 1 (**Mar 3rd**): 20%
Midterm Exam 2(**Apr 7th**): 20%
Final Exam (**May**): 35%

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

Course Description:

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

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

1. Master basic techniques for analyzing algorithm performance.
2. Explore key algorithm design paradigms, including divide-and-conquer and dynamic programming.
3. Understand recurrence relations and their role in algorithm analysis.
4. Compare and analyze sorting algorithms and their complexities.
5. Learn about search trees, balanced trees, and hashing techniques.
6. Understand fundamental graph algorithms and their applications.
7. Gain an introduction to basic machine learning algorithms and their use cases.

Grading:

The grading scale is: A: 94–100%, B+: 86–93%, B: 78–85%, C+: 70–77%, C: 60–69%, D: 50–59% F: 0–49%.

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

Schedule of Assignments & Due Dates:

Assignment	Subject	Date
Homework 1	Week 1	Feb 3-Feb 9
Homework 2	Weeks 2,3	Feb 17- Feb 23
Midterm Exam 1	**Weeks 1-4**	**Mar 3**
Homework 3	Weeks 5,6	Mar 7- Mar 13
Homework 4	Weeks 7,8	Mar 24-Mar 30
Midterm Exam 2	**Weeks 5-8**	**Apr 7**
Homework 5	Weeks 9-11	Apr 14-Apr 20
Homework 6	Week 12	Apr 25-May 1
Final Exam	**Weeks 8-14**	**May**

Course Outline:

Week	Date	Topic
1	Jan 27	Introduction: Percolation Problem, Algorithm Analysis Techniques, Asymptotic Notation
2	Feb 3	Recursive Algorithms, Recurrence Relations
3	Feb 10	Priority Queues, Heaps
4	Feb 17	Heapsort, Review of Sorting Algorithms: Insertion-Sort, Bubble-Sort, Selection-Sort, Merge-Sort, Quicksort.
5	Feb 24	Integer Sorting: Bucket-Sort, Radix Sort (MSD, ...), Counting Sort Dictionary ADT and Hash Tables
6	**Mar 3**	Trees (Review), Tries, **Midterm Exam 1: Weeks 1-4**
7	Mar 10	Balanced Search Trees: AVL and Red-Black trees Graphs: Representations and Traversals, Topological Sorting,
	Mar 17	**Spring Recess- No class**
8	Mar 24	Divide-and-Conquer: Strassen's Matrix Multiplication, Large Integer Multiplication (Karatsuba), ...
9	Mar 31	Greedy method (Fractional Knapsack, Task Scheduling, Huffman Coding, MST Algorithms: Kruskal)
10	**Apr 7**	**Midterm Exam 2: Weeks 5-8**
11	Apr 14	Greedy method (MST Algorithms: Prim, Single-Source-Shortest-Paths: Dijkstra, ...)
12	Apr 21	Dynamic Programming: Introduction, Binomial coefficients, All-Pairs-Shortest-Paths (Floyd), Matrix Chain Multiplication, Optimal Binary Search Tree, ...
13	Apr 28	Machine Learning Algorithms
14	May 5	Machine Learning Algorithms (cont'd), Review, Problem Solving Prep: Final Exam Readiness