NJIT

Department of Computer Science

CS 610-102: Data Structures & Algorithms-Spring 2025

Class Location: KUPF 209	**Class Time:** Thu 6:00 PM - 8:50 PM

Instructor: Marzieh Eskandari

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

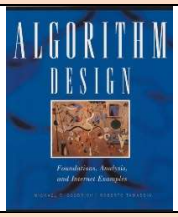
Office: GITC 4313	**Office Hours:** R 4:30 PM- 5:45 PM, MF 1:00 PM-2:20 PM: Online

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: 30%
Quizzes: +5%
Attendance: +5% (Extra)
Class Activity: +5% (Extra)
Midterm Exam (**Mar 13th**): 30%
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 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 is: **A**: 94–100%, **B+**: 85–93%, **B**: 76–84%, **C+**: 67–75%, **C**: 60–66%, **F**: 0–59%.

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	Date	Remarks
Homework 1	Jan 30-Feb 5	
Homework 2	Feb 13- Feb 19	
Homework 3	Feb 27-Mar 5	
Midterm Exam	**Mar 13**	Weeks 1-7
Homework 4	Mar 27-Apr 2	
Homework 5	Apr 10-Apr 16	
Homework 6	Apr 24-May 5	
Final Exam	**May**	Weeks 9-14

Course Outline:

Week	Date	Topic
1	Jan 23	Introduction, Analysis Techniques, Complexity definitions: O, Omega, Theta
2	Jan 30	Algorithm Analysis, Recurrence Relations
3	Feb 6	Recursive Algorithms, Stacks, Queues (Review)
4	Feb 13	Linked-Lists, Trees (Review) Priority Queues, Heaps
5	Feb 20	Heapsort Sorting: Insertion-Sort, Bubble-Sort, Selection-Sort, Merge-Sort, Quicksort (Review) Shell Sort, Bitonic Sort Lower-Bound on Comparison-Based Sorting
6	Feb 27	Integer Sorting: Bucket-Sort, Radix Sort (MSD, ...), Counting Sort Dictionary ADT and Hash Tables
7	Mar 6	Balanced Search Trees: AVL and Red-Black trees, Prefix Trees
8	**Mar 13**	**Midterm Exam: Weeks 1-7**
	Mar 20	**Spring Recess- No classes**
9	Mar 27	Graphs: Representations and Traversals, Topological Sorting Greedy method (Fractional Knapsack, Task Scheduling, Huffman Coding)
	Apr 3	**Wellness day- No classes**
10	Apr 10	Greedy method (MST Algorithms: Prim, Kruskal, Single-Source-Shortest-Paths (Dijkstra)...)
11	Apr 17	Dynamic Programming: introduction, Binomial coefficients, All-Pairs-Shortest-Paths (Floyd)
12	Apr 24	Dynamic Programming: Chain Multiplication, Optimal Binary Search Tree
13	May 1	Divide-and-Conquer: Strassen's Matrix Multiplication, Large Integer Multiplication (Karatsuba), Min & Max, FFT, VEB (if time allows)
14	May 6	Problem Solving Prep: Final Exam Readiness