Algorithms and Data Structures

(ENEE 351)

Spring 2020

Prof. Papamanthou

Course Goals: This course teaches fundamental concepts in computer engineering, including topics in discrete math, data structures and algorithms. The course will also include a hands-on programming component. This course will provide students with the tools to design modular, time and space-efficient algorithms for real-world problems.

Credits: 4.

Course Prerequisites: ENEE 150 and ENEE 244.

Topic Prerequisites: C programming.

Main Textbook: Introduction to Algorithms (third edition), by Cormen, Leiserson, Rivest and Stein.

Tentative Topics:

1. Fundamental Concepts: Mathematical induction; Recursion; Combinatorics (counting); Discrete probability; Recurrence relations; Concepts and tools for analyzing algorithmic performance such as: work-depth, asymptotic notation, worst case, randomized and probabilistic complexity.
2. Core Data Structures: Stacks; Queues; Graphs; Trees; B-trees; Binary-search trees; Hash tables; Dictionaries; Heaps.
3. Sorting Algorithms and their Analysis: Sorting: Insertion sort; Merge sort; Quicksort; Radix sort;
4. Graph algorithms: Depth-first search; Breadth-first search; Shortest path; Minimum spanning tree; Topological sort;Fast Fourier Transform (FFT).
5. Algorithmic approaches: brute-force algorithms; greedy algorithms; divide-and-conquer; dynamic programming.
6. Advanced Topics: Advanced (Tree) Data Structures, Max-flow/Min-cut, NP-Completeness, Parallel Computing

Tentative Programming Projects: Sorting (Radix Sort), Dynamic Programming, Hash tables, Graph algorithms, FFT.

Grading Method: 5 Homeworks 30%; 4 Programming projects 40%; 1 Midterm 10%; 1 Final 20%.

Exams Information:

1. Midterm: Wednesday 03/11 (in class); Final: Tuesday 05/19 (8:00 am to 10:00 am)
2. The exam material will consist of (i) notes to be taken during lectures; (ii) reading material to be published on the webpage; (iii) material covered in discussions and labs.
3. Homework and programming assignments will be published on the webpage, but should be submitted through Canvas. No late submissions will be accepted (except for medical reasons for which documentation must be provided).