CPE593
Data Structures and Algorithms

Instructor: Dr. Aftab Ahmad
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Prerequisites: Recommended: CPE552, CPE553 or solid ability to program in C++. Do not take this course if you are learning to program!

Teaching Assistant:
Efraim Dov Neimand

Grading questions? ***email the TA first at kayakdov@gmail.com.***

Schedule: Monday 6:30 – 9:30 PM
Office Hours: Monday 4:00 – 6:00 PM
Course Information:
References:
Prerequisites: Recommended: EE-552 or EE-553 or good command of C++
Cross-listed with: NIS-593

Overview

Data Structures and algorithms is an intensive introduction to brilliant solutions to classical problems with wide application across computer programming. We cover

Course Objectives

By the end of this course, students will:

- Know the role of algorithms in computing
- Understand how to analyze algorithms
- Understand the asymptotic behavior of the performance of algorithms
- Understand and use of divide-and conquer
- Understand and apply probabilistic analysis of algorithms
- Know and use heapsort, quicksort, radix sort, bucket sort
- Understand and analyze sorting in linear time, medians and order statistics
- Understand and design elementary data structures
- Use and analyze Hash tables, binary search trees, red-black trees
- Understand and apply augmented data structures

FORMAT AND STRUCTURE

- This course is comprised of weekly lectures, group project, and two exams.

Course Readings:

Required Text(s): Cormen, Leiserson, Rivest and Stein 3rd Ed.
Required Readings: Articles distributed by the instructor
Reference Readings: Any book on advanced level of analysis of algorithms, such as *An Introduction to the Analysis of Algorithms* by Sedgewick and Flajolet, The Art of Computer Programming by Knuth.

Topics by Week

*All the material that is due on a week is due before the class time of that week. F*or example, Homework Assignment 1 is due before 6:30 PM on Monday of week 3, which is February 10, 2020.

Week 1
Background, and introduction to the algorithms in computing – Chapter 1
Homework Assignment 1 given

Week 2
Analyzing and designing algorithms, insertion sort – Chapter 2

Week 3
Asymptotic notations and growth of functions – Chapter 3
Homework Assignment 1 due
Homework Assignment 2 given
Project proposal and literature due

Week 4
Maximum sub-array problem, Strassen's algorithm, substitution method, recursion-tree method, the master method – Chapter 4

Week 5
The hiring problem, indicator random variables, randomized algorithms, probabilistic algorithms – Chapter 5
Homework Assignment 2 due
Homework Assignment 3 given

Week 6
Heap, building a heap, heapsort algorithm, priority queues – Chapter 6

Week 7
Quicksort, Randomized quicksort, analysis of quicksort – Chapter 7
Homework Assignment 3 due
Homework Assignment 4 given

Project Midterm report due

Week 8
Lower bounds for sorting, counting sort, radix sort, bucket sort – Chapter 8
Midterm Examination in Class

Week 9
Minimum and maximum, selection in expected linear time and worst-case linear time – Chapter 9

Week 10
Stacks, queues, linked lists, pointers and objects, rooted trees – Chapter 10
Homework Assignment 4 due
Homework Assignment 5 given

Week 11
Direct-address tables, hash tables, hash functions, open addressing, perfect hashing – Chapter 11

Week 12
Binary search tree, querying BST, insertion, deletion, randomly built BST – Chapter 12
Homework Assignment 5 due
Homework Assignment 6 given

Week 13
Red-black trees, rotation, insertion, deletion, dynamic programming – Chapters 13, 15

Week 14
Greedy algorithms, B-trees, Minimum spanning trees, NP-completeness (Parts of Chapters 16, 18, 23, 34)
Homework Assignment 6 due
Project Final Report due

Week 15
Final Exam / Final Project Presentations

Assessment

Homework assignments: 300 points (6 assignments x 50 points) on Programming and performance analysis
Midterm Exam: 200 points During Week 8 on topics through week 7
Final Exam: 300 points (on topics from week 8 through week 14)
Team project: 200 points
Total points: 1000

Project

A separate description for the term project will be distributed by the instructor. The project can be done in teams of up to three. It will provide an opportunity for students to understand the application of the concepts from the course in real life problem solving and system design.

Project requirements

The project has three parts: Proposal (50 points), mid-term report (50 points), Final report and Presentation (50 + 50 points).
See project description for requirements for each part and grade rubrics.

Programming Assignments Rubric

Every programming assignment (i) must run and produce the expected results, and (ii) must be accompanied with performance graph and a performance bound. Here is how the assignment points are given:

25 points for the correctly running code producing the desired results. A deduction of 10 points if the TA can easily fix the problem due to which it does not run. It is up to the TA to decide this.

10 points for documentation (comments at the beginning describing the purpose of the assignment, and, where applicable, purpose and logic of functions, objects and important data types).

10 points for performance graph measuring run time.

5 points if a performance bound is asked showing theoretical run time

Late submission

For assignment and project late submissions, a 10% credit is taken off every day after the deadline.

Letter Grade Scale

A	900 – 1000
B	800 – 899
C	700 – 799
F	0 – 699

ACADEMIC INTEGRITY

Graduate Student Code of Academic Integrity

All Stevens graduate students promise to be fully truthful and avoid dishonesty, fraud, misrepresentation, and deceit of any type in relation to their academic work. A student’s submission of work for academic

credit indicates that the work is the student's own. All outside assistance must be acknowledged. Any student who violates this code or who knowingly assists another student in violating this code shall be subject to discipline. All graduate students are bound to the Graduate Student Code of Academic Integrity by enrollment in graduate coursework at Stevens. It is the responsibility of each graduate student to understand and adhere to the Graduate Student Code of Academic Integrity. More information including types of violations, the process for handling perceived violations, and types of sanctions can be found at www.stevens.edu/provost/graduate-academics.

EXAM ROOM CONDITIONS

The following procedures apply to quizzes and exams for this course. As the instructor, I reserve the right to modify any conditions set forth below by printing revised Exam Room Conditions on the quiz or exam.

1. Students may use only laptop devices during lectures, quizzes and exams.

2. Students may use the following materials during quizzes and exams. Any materials that are not mentioned in the list below are not permitted.

Material	Allowed/Not allowed
Handwritten Notes	Not allowed
Typed Notes	Both sides of a Letter/A4 size sheet allowed
Textbooks	Allowed

3. Students are not allowed to work with or talk to other students during quizzes and/or exams. During lectures, do not distract other students. If you have a question raise your hand and ask instructor.

LEARNING ACCOMMODATIONS

Stevens Institute of Technology is dedicated to providing appropriate accommodations to students with documented disabilities. The Office of Disability Services (ODS) works with undergraduate and graduate students with learning disabilities, attention deficit-hyperactivity disorders, physical disabilities, sensory impairments, psychiatric disorders, and other such disabilities in order to help students achieve their academic and personal potential. They facilitate equal access to the educational programs and opportunities offered at Stevens and coordinate reasonable accommodations for eligible students. These 3services are designed to encourage independence and self-advocacy with support from the ODS staff. The ODS staff will facilitate the provision of accommodations on a case-by-case basis.

Disability Services Confidentiality Policy

Student Disability Files are kept separate from academic files and are stored in a secure location within the Office of Disability Services. The Family Educational Rights Privacy Act (FERPA, 20 U.S.C. 1232g; 34CFR, Part 99) regulates disclosure of disability documentation and records maintained by Stevens Disability Services. According to this act, prior written consent by the student is required before our Disability Services office may release disability documentation or records to anyone. An exception is made in unusual circumstances, such as the case of health and safety emergencies.

For more information about Disability Services and the process to receive accommodations, visit https://www.stevens.edu/office-disability-services. If you have any questions please contact: Phillip Gehman, the Director of Disability Services Coordinator at Stevens Institute of Technology at pgehman@stevens.edu or by phone (201) 216-3748.

INCLUSIVITY

Name and Pronoun Usage

As this course includes group work and in-class discussion, it is vitally important for us to create an educational environment of inclusion and mutual respect. This includes the ability for all students to have their chosen gender pronoun(s) and chosen name affirmed. If the class roster does not align with your name and/or pronouns, please inform the instructor of the necessary changes.

Inclusion Statement

Stevens Institute of Technology believes that diversity and inclusiveness are essential to excellence in academic discourse and innovation. In this class, the perspective of people of all races, ethnicities, gender expressions and gender identities, religions, sexual orientations, disabilities, socioeconomic backgrounds, and nationalities will be respected and viewed as a resource and benefit throughout the semester.

Suggestions to further diversify class materials and assignments are encouraged. If any course meetings conflict with your religious events, please do not hesitate to reach out to your instructor to make alternative arrangements. You are expected to treat your instructor and all other participants in the course with courtesy and respect. Disrespectful conduct and harassing statements will not be tolerated and may result in disciplinary actions.