CpSc 8380: Advanced Data Structures (Fall 2021)

Course Objectives:

This is a course on advanced Data structures and their applications in executing algorithms for varied applications. It is suitable for beginning graduate students and/or serious seniors. The objective is to familiarize the audience with the fundamental concepts, techniques and tools of advanced data structures and their use in algorithms. Participation in this course will enable you to harness the power of advanced concepts of data structures & algorithms in your own areas of application as well as will prepare you to take advanced courses and/or do research work in any specific area of specific applications.

Course Outline (Tentative):

**Role of Algorithms in Computing:** Algorithms as a Technology- Insertion Sort, Analyzing Algorithms, Designing Algorithms, Growth of Functions, Asymptotic Notation – Standard Notations and Common Functions, Performance Modeling: Metrics, Speed-up, Efficiency, Scalability, Cost, Isoefficiency, Optimality, Overhead; Recurrence Relations and their solution techniques (e.g., Substitution Method, Recursion-Tree)


**Algorithm Design Techniques:**

**NP Complete and NP Hard:**

- Models for Parallel/Distributed Computing: Taxonomy, PRAM, BSP, Multithreading, Distributed Shared Memory
- Interconnection networks — Static and Dynamic, Embedding and Routing, NOW, SMP
- Basic Computing and Communication Primitives — Broadcast and Multicast, Prefix sum.
- Performance Modeling — Metrics, Speed-up, Efficiency, Scalability, Cost, Iso-efficiency, Optimality, Overhead.
- Resource Allocation, Deadlocks and Recovery
- Concurrency Control in Distributed Systems
- Applications: Sorting and Searching: algorithms for different models and their comparison, Matrix Computations: Dense and Sparse, Combinatorial Optimization: Dynamic Programming, Branch and Bound.

The emphasis will be on understanding the fundamentals of data structures and algorithms that use the data structures to solve problems and performance evaluation. Platform dependent details change quickly; it is the understanding of the fundamentals that helps the individual to keep up with the details; the fundamental principles do not change.

Academic Integrity

- As members of the Clemson University Community, we have inherited Thomas Green Clemson's vision of this institution as a "high seminary of learning". Fundamental to this vision is a mutual commitment to truthfulness, honor, and responsibility, without which we cannot earn the trust and respect of others. Furthermore, we recognize that academic dishonesty detracts from the value of a Clemson degree. Therefore, we shall not tolerate lying, cheating, or stealing in any form. Read the university academic integrity statement and Academic Integrity Policy.

Required Textbook

There is no required textbook.

Reference Books [Update Needed]

Class Attendance Policy

You are responsible for knowing all information covered in online lectures and class notes.

Late Policy

You do NOT get any credit for any late assignment and there'll be no make-up tests or assignments. In case you feel you have a justifiable reason to be late or to miss a test, please contact your instructor prior to the deadline.

Grade Distribution (Tentative)

1. Participation in class discussions 5%
2. Quizzes in Class 10% (In case there is no quiz at the end of the semester, these points will be allocated to Homework Assignments)
3. Homework assignments 15%
4. Term Paper or Project 45%
5. Two Tests 30%

Homework may include programming assignments. We will have extensive reading assignments over the unclear or controversial points. It is imperative you read the appropriate material before coming to the class.

Term Paper/Project

You will either write a term paper or implement a distributed system or some component thereof. The term paper can either make a research contribution or survey one of the topics of interest. You will write a comprehensive report of your project and will review at least two others' work. We will give more detailed information on these topics later in the semester.
Clemson University Student Accessibility Services

“Students with disabilities needing accommodations should contact the Office of Student Accessibility Services in Suite 239, Academic Success Center building 864-656-6848, prior to contacting the instructor.”

Clemson University Title IX (Sexual Harassment) statement

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