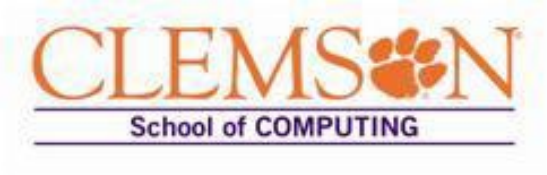

CpSc 8380: Advanced Data Structures (Fall 2022)

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 sequential and parallel 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,

Hierarchical Data Structures: Binary Search Trees: Basics – Querying a Binary search tree – Insertion and Deletion- Red-Black trees: Properties of Red-Black Trees – Rotations – Insertion – Deletion, B-Trees: Basic operations on B-Trees – Deleting a key from a B-Tree, Heaps and Fibonacci Heaps, Merge able heap operations, decreasing a key and deleting a node, bounding the maximum degree. Matrix Computations: Dense and Sparse, Combinatorial Optimization: Dynamic Programming, Branch and Bound.

Elementary Graph Algorithms: Representations of Graphs – Breadth-First Search – Depth-First Search – Topological Sort – Strongly Connected Components- Minimum Spanning Trees: Growing a Minimum Spanning Tree – Kruskal and Prim- Single-Source Shortest Paths: The Bellman-Ford algorithm – Single-Source Shortest paths in Directed Acyclic Graphs – Dijkstra‘s Algorithm; All-Pairs Shortest Paths: Shortest Paths and Matrix Multiplication – The Floyd-Warshall Algorithm;

Algorithm Design Techniques:
Dynamic Programming, Matrix-Chain Multiplication, Elements of Dynamic Programming, Longest Common Subsequence, Longest Increasing subsequence; Greedy Algorithms: An Activity-Selection Problem, Elements of the Greedy Strategy, Huffman Codes.

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

- A. S. Tannenbaum and M van Steen, Distributed Systems: Principles and Paradigms, Prentice-Hall, 2002.
- Joseph Jà Jà, An Introduction to Parallel Algorithms, Addison-Wesley, 1992.
- Advanced Data Structures, PETER BRASSH, Cambridge University Press, 2008.
- Advanced Data Structures: Theory and Applications, Suman Saha, Shailendra Shukla
- D. P. Bertsekas, Parallel and Distributed Computation, Prentice-Hall, 1989.
- T. Leighton, Introduction to Parallel Algorithms and Architectures, Morgan Kaufmann, 1992..
- T. H. Cormen, C. E. Leiserson and R. L. Rivest, Introduction to Algorithms, MIT Press, 2001.
- Vipin Kumar, Ananth Grama, Anshul Gupta and George Karypis, Introduction to Parallel Computing, Addison Wesley, 2003.

Class Attendance Policy

You are responsible for knowing all information covered in 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 40%

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.

Academic Calendar Fall 2022

Aug 22, Mon - Aug 23, Tue Late enrollment
Aug 22, Mon University Convocation
Aug 24, Wed Classes begin
Aug 30, Tue Last day to register or add a class or declare Audit
Sep 6, Tue Last day to drop a class or withdraw from the University without a W grade
Sep 13, Tue Last day to apply for December graduation
Oct 14, Fri Last day for instructors to issue midterm evaluations
Oct 28, Fri Last day to drop a class or withdraw from the University without final grades
Nov 7, Mon - Nov 8, Tue Fall break
Nov 9, Wed Registration for spring term begins
Nov 23, Wed - Nov 25, Fri Thanksgiving holidays
Dec 8, Thu - Dec 9, Fri Classes meet; exams permitted in labs and one-hour courses only
Dec 12, Mon - Dec 16, Fri Examinations
Dec 19, Mon 9:00 A.M.--Deadline to submit candidate grades
Dec 21, Wed 9:00 A.M.--Deadline to submit other grades
Dec 21, Wed Candidates for graduation may access grades
Dec 21, Wed Doctoral Hooding
Dec 22, Thu Graduation

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

Clemson University is committed to a policy of equal opportunity for all persons and does not discriminate on the basis of race, color, religion, sex, sexual orientation, gender, pregnancy, national origin, age, disability, veteran's status, genetic information or protected activity (e.g., opposition to prohibited discrimination or participation in any complaint process, etc.) in employment, educational programs and activities, admissions and financial aid. This includes a prohibition against sexual harassment and sexual violence as mandated by Title IX of the Education Amendments of 1972. This policy is located at http://www.clemson.edu/campus-life/campus-services/access/title-ix/. Mr. Jerry Knighton is the Clemson University Title IX Coordinator. He also is the Director of Access and Equity. His office is located at 111 Holtzendorff Hall, 864.656.3181 (voice) or 864.565.0899 (TDD).

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