CSCE 4110 Algorithms

1. **Class Hours:** Tuesday and Thursday (11:30-12:50)
   Room: NTDP B140

2. *Course Content:* This is a first undergraduate course in the design and analysis of algorithms. The course will focus on the design strategies, on the mathematical analysis of the algorithms, and on the correctness proofs.
3. *Course Objectives:*
   - Be able to analyze the time and space complexity of a nontrivial algorithm, using mathematical tools, and prove/justify the correctness.
   - Understand the Divide and Conquer, Greedy, and Dynamic Programming strategies for algorithmic design.
   - Be familiar with the algorithms for Matrix Multiplication (Strassens), Activity Selection, Knapsack, Shortest Paths (single source, and all pairs), Minimum Spanning Tree (Prims and Kruskals), Matrix Chain, and Longest Common Subsequence problems.
   - Be exposed to approximation algorithms for solving NP-hard problems.
   - Be able to determine and measure the efficiency of a given algorithm, in practice, through different possible implementations, and by testing on suitable data sets.
   - Be able to communicate clearly and precisely in writing about the theoretical analysis of an algorithm and its efficiency in practice.
4. *Prerequisites:* Students planning to enroll in this course should have taken course numbers 3110, 2100, 2110. They should have been exposed to the following:
   - Time and space analysis; asymptotic notation
   - Basic sorting algorithms: insertion, merge and heap sort
   - Data structures including trees, heaps, BSTs, union/find data, and graphs
   - Recurrence Relations and Proof techniques
   - Graphs: BFS, DFS, MST (Prims and Kruskals algorithms)
   - Mathematical structures: Sets, relations
   - Important mathematical manipulations: Sums, combinatorics
5. *Course Information and Policy:*
   - Course Announcements and Assignments will be emailed and posted on Blackboard.
   - Evaluation: There will be a quiz every week on Thursday, starting from Week 2. There will be 10 such quizzes each worth 3%, **30**%. There will be 4 assignments worth 10%, total of **40**%. There will be 2 exams (Midterm and Final) each worth 15%, total **30%**
   - Academic Integrity Standards in this course are consistent with UNT policy: STUDENT STANDARDS OF ACADEMIC INTEGRITY (18.1.16), or other related/existing UNT polices. The work that you turn in to be graded, including any underlying ideas, must be your own individual work. Usage of unauthorized material and sources, or depending on any unauthorized assistance, to answer homework problems, tests questions, writing reports, or carrying any type of assignment, etc., without the permission of the instructor, or without complete and accurate and complete attribution/citation of the source, when applicable, is viewed as an academic misconduct.

- Students can take the make-up for **at most** three quizzes if they miss the quiz on the original date.
- Five points will be deducted for each day (weekends included) of late submission of the homework.
- The passing marks in this class is 55 or lower. Anyone getting lower than 55 will get an F

6. Topics: (1 week= Two classes of 80 minutes each)
   (a) Week 1 Introduction, Review of techniques for proof, Algorithm Analysis
   (b) Week 2 Algorithm Analysis (continued), Sorting (Heap sort, Quicksort) (**Homework 1 Assigned**)
   (c) Week 3 Sorting (Sorting in Linear Time), Hash Tables
   (d) Week 4 Binary Trees, Red-Black Trees (**Homework 2 Assigned**)
   (e) Week 5 Dynamic Programming (Matrix Chain Multiplication, Longest Common Subsequence)
   (f) Week 6 Greedy Algorithms (Huffman codes, Task Scheduling)
   (g) Week 7 Review and **Midterm**
   (h) Week 8 Graph Theory (Review of BFS, DFS, Minimum Spanning Trees)
   (i) Week 9 Graph Theory (Single Source Shortest Paths, All Pair Shortest Paths) (**Homework 3 Assigned**)
   (j) Week 10 Graph Theory (Maximum Flow)
   (k) Week 11 Selected Topics: Matrix Operations (**Homework 4 Assigned**)
   (l) Week 12 NP Completeness and Reducibility
   (m) Week 13 Approximation Algorithms for NP complete Problems
   (n) Week 14 Review
7. *TextBook:* Introduction to Algorithms, by Thomas H. Cormen, Charles E. Leiserson, and Ronald L. Rivest.
8. Instructor: Sanjukta Bhowmick
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   Email: sbhowmick@unomaha.edu **Use this email for fastest response**
   Office Hours: Tuesdays and Thursdays 3-4 pm