

## CSCE 4110: Algorithms

1. **Class Hours:**

**Section 2:** Monday and Wednesday 2:30-3:50

**Section 1:** Monday and Wednesday Friday 10:30-11:20

2. *Course Content:* This is a first undergraduate course on analysis of algorithms. Course will focus on the design strategies, the mathematical analysis of the algorithms, and their proofs of correctness.

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 (Strassen's), Activity Selection, Knapsack, Shortest Paths (single source, and all pairs), Minimum Spanning Tree (Prim's and Kruskal's), 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 (Prim's and Kruskal's algorithms)
- Mathematical structures: Sets, relations
- Important mathematical manipulations: Sums, combinatorics

5. Tentative Schedule:

- Week 1 Introduction, Algorithm Analysis
- Week 2 Sorting (Heap sort, Quicksort, Linear time Sorting)
- Week 3 Red-Black Trees and other Data Structures;
- Week 4 Dynamic Programming (Matrix Chain Multiplication, Longest Common Subsequence)
- Week 5 Review and Midterm (on everything upto greedy algorithms)
- Week 6 Greedy Algorithms (Huffman codes, Task Scheduling)
- Week 7 Graph Theory (Review of BFS, DFS, Minimum Spanning Trees)
- Week 8 Graph Theory (Single Source Shortest Paths, All Pair Shortest Paths)
- Week 9 Graph Theory (Maximum Flow, Strongly Connected Components, Biconnected Graphs)

- (j) Week 10 NP Completeness and Reducibility
  - (k) Week 11 Approximation Algorithms for NP complete Problems
6. *Suggested TextBook*: Introduction to Algorithms, by Thomas H. Cormen, Charles E. Leiserson, and Ronald L. Rivest.
  7. Instructor: Sanjukta Bhowmick  
Office: F291  
Email: sanjukta.bhowmick@unt.edu Office Hours:  
Monday 12:30 to 13:30  
Wednesday 13:00 to 14:00
  8. TAs:  
Saatvik Gannarapu  
Email: SaatvikGannarapu@my.unt.edu  
Office Hours: 14:00-15:00 Tuesday. F232  
  
Phuc Nguyen  
Email: phucnguyen2@my.unt.edu  
Office Hours: 11:00-12:00 Thursday. F232
  9. Course Announcements and Assignments will be announced via Canvas.
  10. **Evaluation:**  
There will be **5 assignments** on the following topics; (i) Algorithm Analysis; (ii) Sorting and Searching; (iii) Dynamic Programming; (iv) Greedy Algorithms; (v) Graph Theory.  
Each assignment will be worth 10 points, making a total of  $5 \times 10 = \mathbf{50\%}$ . The grading pattern will be as follows; You will have to submit a code, experimental results and a report on how you solved the problem. This will constitute 5 points. The remaining 5 points will be based on an in-class quiz, which will require you to run the code.  
Assignments can be done in groups of at most 4. I strongly recommend that you form the groups because I will design the assignments assuming that there are 3 to 4 students per group.  
There will be 2 exams (Midterm and Final) each worth 25%, total **50%**.
  11. Academic Integrity Standards in this course are consistent with UNT policy: STUDENT STANDARDS OF ACADEMIC INTEGRITY (18.1.16), or other related/existing UNT policies. 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.
  12. Two points will be deducted for each day (weekends included) of late submission of the homework.
  13. The passing marks in this class is 55 or more. Anyone getting lower than 55 will get an F