University of North Texas
Department of Computer Science and Engineering

CSCE 4110 – Algorithms

Session: Fall/2022

Classes:

4110-001 (3096) - TuTh 1:00 PM - 2:20 PM- NTDP K120
4110-002 (7969) - TuTh 2:30 PM - 3:50 PM- NTDP K110

Instructor:
Dr. Moawia Eldow
Office: E250E
Email: moawia.eldow@unt.edu
Office hours: TuTh 12-01 PM

TAs/Graders:

4110-001 (3096):

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4110-002 (7969):

Name: Deeksha Thandra
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Office & hours: TBA

Description:

This is a first undergraduate course on the analysis of algorithms, focusing on the design strategies, the mathematical analysis of the algorithms, and their proofs of correctness. Topics include reviewing of some sorting and searching algorithms, advanced techniques of algorithm design (divide-and-conquer, the greedy method, dynamic programming, graph algorithms), NP-Completeness theory, and approximation algorithms.

Course Objectives:

By the end of this course, students will:

1) Be able to analyze the time and space complexity of a nontrivial algorithm, using mathematical, tools, and prove/justify the correctness.
2) Understand the Divide and Conquer, Greedy, and Dynamic Programming strategies for algorithmic design.
3) Be familiar with the algorithms for Matrix Multiplication (Strassen's), Activity Selection, Shortest Paths (single source, and all pairs), Minimum Spanning Tree, Matrix Chain, and Longest Common Subsequence problems.
4) Be exposed to approximation algorithms for solving NP-hard problems.
5) 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.
6) Be able to communicate clearly and precisely in writing about the theoretical analysis of an algorithm and its efficiency in practice.

Prerequisites:

Students planning to enroll in this course should have taken course numbers 3110, 2100, 2110. They should have been exposed to the following:

1. Time and space analysis; asymptotic notation
2. Basic sorting algorithms: insertion, merge and heap sort
3. Data structures including trees, heaps, BSTs, union/find data structures, and graphs
4. Recurrence Relations and Proof techniques
5. Graphs: BFS, DFS, MST (Prim's and Kruskal's algorithms)
6. Mathematical structures: Sets, relations
7. Important mathematical manipulations: Sums, combinatorics
8. Programming with one of the high-level languages such as Python, C++, or Java

Textbook:

Introduction to Algorithms, by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stien, MIT Press, **Third Edition**.

Grades and grading policy:

Participation	**5%**
Homework Assignments	**35%**
Programming Assignments	**20%**
Midterm Exam	**20%**
Final Exam	**20%**

The letter grade will be assigned based on the following scale:

Grade	5150
A	90 and Above
B	[80-90)
C	[70-80)
D	[60-70)
F	Below 60

Homework Assignments:

Written individual homework assignments/exercises ***will be due at 11:59 p.m. on Fridays.*** Assignments must be turned in using the dropbox on canvas.

Programming Assignments:

Programs may be written in any language as long as the TA/Grader and the instructor are able to build and execute from source code, and ***will be due at 11:59 p.m. on Fridays***. If in doubt, contact the instructor to verify that the programming environment is acceptable. Instructions will be provided in Canvas. Programs must be turned in using the dropbox on canvas.

Exams:

There will be one midterm exam (***The First Exam***) during the semester at the normal lecture time, which will cover ***the first half*** of the class topics. There will also be a final exam (***The Second Exam***) during finals week, which will cover ***the second half*** of the class topics.

Late Submission Policy:

Assignments may be turned in late, but not more than two weeks. All the late submissions **may lose a percentage of their graded point values** according to the following schedule:

On time : **0%**
1-3 days : **10%**
4-7 days : **20%**
8-14 days : **40%**
> 14 days : **100%**

Announcements

Stay tuned and make sure to check Canvas frequently. Important announcements will be posted there.

Academic Policies

No cheating or plagiarism is allowed in assignments and exams. Academic dishonesty will result in a final course *grade of "F"*. "Sharing/reuse" of solutions to assignment problems is strictly prohibited. All work turned in with your name on it must be your own work.

Other Policies:
Students should refer to any other polices from university, college and department.

CSCE 4110 - Course Outline (*Tentative Schedule*):

Week	**Classes, Reading chapters and Topics**	**Homework (HW) & Programing Assignments (PA) – (due date)**
Aug 29-Sep 2	Overview of Class, Algorithms in Computing (Ch1), and Getting started with Algorithms (Ch2)	
Sep 5-9	Growth of Functions (Ch3) – Review, and Some Sorting Algorithms (Ch6, Ch7) – Review	**HW1 (09/16/2022)**
Sep 12-16	Lower bound of sorting & counting sort (Ch8), and Some Searching Algorithms (Ch12, Ch13) – Review	**HW2 & PA1 (09/23/2022)**
Sep 19-23	Divide and Conquer (Ch4)	
Sep 26-30	Divide and Conquer (cont.)	**HW3 & PA2 (10/07/2022)**
Oct 3-7	Dynamic Programming (Ch15)	
Oct 10-14	Dynamic Programming (cont.), and Review for the mid-term exam	**HW4 & PA3 (10/21/2022)**
Oct 17-21	**Mid-Term Exam** (***Tuesday, 10/18/2022***) Greedy Algorithms (Ch16)	
Oct 24-28	Greedy Algorithms (cont.)	**HW5 PA4 (11/04/2022)**
Oct 31-Nov 4	Graph Algorithms – First part: 1) Elementary Graph Algorithms (Ch22), and 2) Minimum Spanning Trees (Ch23)	
Nov 7-11	Graph Algorithms – Second part: 1) Single-Source Shortest Paths (Ch24), and	**HW6 (11/18/2022)**
Nov 14-18	2) All-Pairs Shortest Paths (Ch25)	
Nov 21-25	Nov 22: NP-Completeness & Approximation Algorithms (Ch 34 & Ch35) Nov 24: ***Thanksgiving – No classes*** (Reading assignment on Ch35 will be provided)	**HW7 (12/02/2022)**
Nov 28-Dec 2	NP-Completeness & Approximation Algorithms (Cont.)	
Dec 5-9	Review for the final	
Dec 12-16	**Final Exam:** **Tuesday, Dec. 13, 2022, available from 1:30 pm to 4:00 pm – 4110-002 (TR: 2:30-3:50PM)** **Thursday, Dec. 15, 2022, available from 10:30 am to 1:00 pm – 4110-001 (TR: 1:00-2:20PM)** **Important note:** Since this time is based on the university registrar schedule for the final on Fall/2022, no excuse will be accepted for any conflict, and if the students have any conflict, they need to contact the other faculty to resolve their conflicts.	