1 Course Content:

This is an 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.

2 Course Objectives:

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, Knapsack, Shortest Paths (single source, and all pairs), Minimum Spanning Tree (Prim’s and Kruskal’s), 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.

3 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

4 Textbook:


Course Materials:

Additional course materials if needed will be available electronically through Canvas. Also, changes, if any, will be announced by e-mail.
5 Tentative Schedule:

Introduction, Review of techniques for proof, Algorithm Analysis
Algorithm Analysis (continued), Sorting (Heap sort, Quicksort, Linear time Sorting)
Red-Black Trees and other Data Structures;
Dynamic Programming (Matrix Chain Multiplication, Longest Common Subsequence)
Review and Midterm (on everything up to greedy algorithms)
(Greedy Algorithms (Huffman codes, Task Scheduling)
Graph Theory (Review of BFS, DFS, Minimum Spanning Trees)
Graph Theory (Single Source Shortest Paths, All Pair Shortest Paths)
Graph Theory (Maximum Flow)
NP Completeness and Reducibility
Approximation Algorithms for NP complete Problems

6 Covid Policy and Guidance:

Students are expected to attend class meetings regularly and to abide by the attendance policy established for the course. It is important that you communicate with the professor and the instructional team prior to being absent, so you, the professor, and the instructional team can discuss and mitigate the impact of the absence on your attainment of course learning goals. Please inform the professor and instructional team if you are unable to attend class meetings because you are ill, in mindfulness of the health and safety of everyone in our community.

If you are experiencing any symptoms of COVID-19
please seek medical attention from the Student Health and Wellness Center (940-565-2333 or askSHWC@unt.edu)
or your health care provider PRIOR to coming to campus.

UNT also requires you to contact the UNT COVID Team at COVID@unt.edu for guidance on actions to take due to symptoms, pending or positive test results, or potential exposure.

7 Tentative Office Hours:

- TuTh 11:30PM – 1:00PM, F203
- Zoom link: https://unt.zoom.us/j/9547135706
- By appointment (please send your inquiry through canvas mail box), or post your questions in the forum provided for this purpose on Convas.

GTA Information:
Teaching Assistant/ Grader: Check Canvas for TA/Grader information

8 Evaluation:

The various components of your grade are weighted as follows:

<table>
<thead>
<tr>
<th>Items</th>
<th>Total Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exam1</td>
<td>25%</td>
</tr>
<tr>
<td>Exam2</td>
<td>25%</td>
</tr>
<tr>
<td>Group Exercises</td>
<td>40%</td>
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<tr>
<td>Quiz and Class attendance</td>
<td>10%</td>
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</tbody>
</table>
9 Grading Policy:

Your average numeric score is then converted to a letter grade according to the following rubric:
(Numerical Score & Grade): [\geq 85 : A], [\geq 75 : B], [\geq 68 : C], [\geq 58 : D], [otherwise F]

These percentages and cutoffs are tentative and may be changed based on the distribution of scores and the degree of difficulty of the assignments and exams. Students are expected to keep track of their performance throughout the semester and seek guidance from available sources (including the instructor) if their performance drops below satisfactory levels.

10 Prerequisites:

All students are expected to have passed the courses Intermediate Programming, Calculus I, and Problem Solving in Engineering or an equivalent before attending this course.

11 Assignments and Grading:

11.1 Homework Assignments:

There will be 5 homework assignments in group and individual quiz. Each group member assignments. Late assignments will be penalized.

11.2 Exams:

All 2 exams in the course are closed book and be hold online with Lock-Down Browser, closed notes. As in the case of homework extensions, make-up exams will only be given in extreme situations. If for any such reason you can not attend an exam, inform the instructor as early as possible.

Absence from exams may be excused, with appropriate documentation, for illness, critical family emergencies, military service obligations, observance of major religious holidays, and certain university service commitments. Requests for excused absence, and documentation for such absences, must be provided as soon as possible. If the exam is disrupted due to a service outage screenshots/photographic evidence must be provided ASAP. In case or excused absence or outage, a makeup exam will be setup and conducted by the instructor. Even if the reason for an absence/non-attendance is valid, a request for an excused absence/re-attempt will be respected if provided later than the day of the exam. The dates for all the exams are subject to change. Any changes will be announced in class at least a week in advance. Students are expected to be available till the last day of finals week. No accommodations will be made if the student will miss an exam due to being unavailable before the last day of finals week.

11.3 Late submission policy:

The points each assignment graded out of will be provided as part of its description. Assignments submitted late will be automatically penalized, at a rate of 10% of max points per day late. Note that for some assignments, Late submissions may not be accepted (will be announced in class). The submission due time (and the time the link will be available till) will be shown in canvas. Exceptions will only be made for documented emergencies, in strict adherence to UNT policy. Computer/Network crashes, Submission of Incomplete files, Submission of Incorrect files, Submitting at Incorrect Link are NOT acceptable excuses for late submissions. No exceptions will be made. To avoid problems with such crashes and last-minute problems, students are encouraged to submit as early as possible. They are also advised to ensure that their file was uploaded correctly before submitting it. You can always revise your submission till the deadline. If you are unable to work on/submit an assignment due to a valid documented reason (illness, critical family emergencies, military service obligations, observance of major religious holidays, and certain university service commitments) one makeup assignment may be provided that will be due during finals week.

11.4 Attendance:

Students are expected to attend either online (if available) or in-person lectures. Attendance in the lectures will be part of your final grade. Any material that the student missed will not be covered again in class.
12 Academic Integrity and Collaboration:

UNT policy 06.003 defines the following breaches of academic integrity:

- **Cheating.** The use of unauthorized assistance in an academic exercise, including but not limited to:
  - use of any unauthorized assistance to take exams, tests, quizzes or other assessments;
  - usage of sources beyond those authorized by the instructor in writing papers, preparing reports, solving problems, or carrying out other assignments; usage without permission of tests, notes, or other academic materials belonging to instructors, staff members, or other students of the university;
  - dual submission of a paper or project, or resubmission of a paper or project to a different class without express permission from the instructor;
  - any act designed to give a student an unfair advantage on an academic assignment.

- **Plagiarism.** Use of another’s thoughts or words without proper attribution in any academic exercise, regardless of the student’s intent, including but not limited to:
  - the knowing or negligent use by paraphrase or direct quotation of the published or unpublished work of another person without full and clear acknowledgement or citation.
  - the knowing or negligent unacknowledged use of materials prepared by another person or by an agency engaged in selling term papers or other academic materials.

- **Forgery.** Altering a score, grade or official academic university record; or forging the signature of an instructor or other student.

- **Fabrication.** Falsifying or inventing any information, data or research as part of an academic exercise.

- **Facilitating Academic Dishonesty.** Helping or assisting another in the commission of academic dishonesty.

- **Sabotage.** Acting to prevent others from completing their work or willfully disrupting the academic work of others.

Cheating of any sort will not be tolerated in this course. All submissions must be your own original work. Taking information or code from the internet or other students is considered a breach of academic integrity. Failure to adhere to these strict standards will be cause for disciplinary action that could be as severe as expulsion from the university. If it is determined a student cheated on any assignment in this course they will receive an F for their final course grade and an academic integrity report will be filed with the Office of Academic Integrity. Further, UNT is now maintaining a database recording any acts of academic dishonesty that is available to employers. Additionally, because these are group projects, if one group member is caught cheating the consequences of their actions will extend to the group as a whole. It is the responsibility of all group members to ensure that when they put their names on their submission as a whole and submit it, the submission does not contain any instances of cheating. Failure to report known instances of cheating within a group will be deemed facilitation of academic dishonesty and reported as such. For more information see the UNT Student Academic Integrity Policy.

**Collaboration Policy:**
For each project submission, all work is expected to be your own. While you should be working with your group members, you are not to collaborate with other groups for projects, provide solutions to other groups, search for solutions on the internet, or purchase solutions. Doing so will be deemed a breach of academic integrity. However, for any non-graded, practice assignments students are encouraged to work together to solve problems.

**ODA:**
The University of North Texas makes reasonable academic accommodation for students with disabilities. Students seeking reasonable accommodation must first register with the Office of Disability Accommodation (ODA) to verify their eligibility. If a disability is verified, the ODA will provide you with a reasonable accommodation letter to be delivered to faculty to begin a private discussion regarding your specific needs in a course. You may request reasonable accommodations at any time, however, ODA notices of reasonable accommodation should be provided as early as possible in the semester to avoid any delay in implementation. Note that students must obtain a new letter of reasonable accommodation for every semester and must meet with each faculty member prior to implementation in each class. Students are strongly encouraged to deliver letters of reasonable accommodation during faculty office
hours or by appointment. Faculty members have the authority to ask students to discuss such letters during their designated office hours to protect the privacy of the student. For additional information see the Office of Disability Accommodation website at http://www.unt.edu/oda. You may also contact them by phone at 940.565.4323.

**Syllabus Revisions:**
This syllabus may be modified as the course progresses should the instructor deem it necessary. Notice of changes to the syllabus shall be made through Canvas and/or in-class announcements.