

Southern Methodist University
CS 5/7350 & EMIS 7350 - Algorithm Engineering
Wednesdays 6:30-9:20p

Dr. Lee D. McFearin

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Office Hours: After Class (9:30 Wednesdays) and By Appointment

Textbook:

Introduction to Algorithms, Third Edition by Cormen, Leiserson, Rivest, & Stein
McGraw-Hill, 2009. – Required

Grading:

Homework 25%

Project 20%

2 Tests – 30% (15% Each)

Test 3 – 25%

“In Class” Practice Assignments

- “In Class” Practice for distance students will be due one week after they are distributed in class.
- “In Class” Practice for on-campus students will be due the day it is given.
- “In Class” Practice will provide up to +5% Extra Credit on **Final Test** for 5350 Students.
- “In Class” Practice will count toward a completion grade for all students. The cumulative completion grade for the “In Class” Practice Assignments will be counted as an extra Homework Assignment.

Purpose:

This course investigates numeric representation, data structure implementation and various algorithm design paradigms along with methods for evaluating algorithm efficiency and implementation efficiency. The course also studies fundamental algorithm case studies in sorting and searching, dynamic programming, compression algorithms, computer arithmetic and graphs and networks. The course provides an introduction to problem complexity, certificates and verification, definition of NP-complete problems, an introduction to quantum computing and an introduction to cryptographic algorithms with a study of modular fields. The course finally includes a reduction to practice term project to design, test and validate, illustrate, display results, and measure efficiency of an algorithm implementation.

Course Work:

Homework: Each homework assignment will consist of short answer problems and or some small implementations. Please turn in each assignment as a single file. Ensure your name and ID are on the first page of the file.

pdf

Project: A course project will be required. It will be a more substantial implementation with an associated report. The topic will be announced in February. The project will be completed in phases with a final report due near the end of the semester. This project will have more required work for 7000 level students which will be extra credit for 5000 level students

Final Exam: The final exam for the course will be cumulative. The **Tests** will mostly cover the topics since the previous test.

Policies:

Late Work: Work will be accepted with a 30% penalty up to 5 days past the due date and due time. Any work turned in late (without an extension) will have 2 points per 5 minutes up to a maximum of 30 points deducted from the final score.

Extensions: Any extensions for homework or other grades required by a student must have an acceptable reason and must be discussed in advance when physically possible. Extensions may allow work to be turned in without the late penalty and may allow work to be turned in past the 5-day limit. Generally, extensions are easy to get. Please let me know if you need one.

Resubmissions: My goal is for students to learn the material. I also do not want to penalize students who turned in their assignments on time and did poorly because they mis-understood some of the topics. Therefore, all students may resubmit up to two different homework assignments one time each up to 5 days after the due date / due time with the late penalty of 30 points. Resubmissions will not lower your original grade.

Academic Honesty: Each topic discussed will have associated quizzes and homework. Unless stated otherwise, students may discuss problems and approaches with each other for the homework assignments, but must write up their solutions and run their programs independently. At no time should a solution (or partial solution) to a homework problem or a programming assignment be copied from another student. Generally Quizzes and Tests will be individual assignments.

The internet is a valuable research tool and a wealth of information; however, the internet should be treated as any other reference source. That is, any information taken from the internet and used on any assignment must be referenced. Indicating the Title, Author, and URL is sufficient.

Anytime a full sentence is taken from a reference source and used on an assignment, it must be placed in quotation marks and referenced. If only 2 or 3 words have changed in the sentence, still place it in quotation marks, and indicate the changes with brackets: []. Any fact taken from a reference source (other than class notes and the text book) must also be referenced.

Disability Accommodations, Religious Observance and Excused Absences for University Extracurricular Activities will all be handled according to university policies. I will work with you as needed for the best solution!

Course Topics

Subject
Course Introduction & Algorithm Introduction
<i>Algorithm Analysis:</i> Problem, Algorithm, Implementation, Instance Best, Average, Worst Case Upper Bounds, Lower Bounds, Tight Bounds
<i>Data Structures</i> Hardware, Language, Simple, Abstract, Trees, Hashes, Heaps
<i>Sorting</i> n-squared, Log-n, linear
<i>Graph Theory:</i> Terminology Special graphs (Cycles, Cliques, Bipartite, Trees) Coloring, Covering, Smallest Last Ordering, Hamiltonian Cycle
<i>Greedy Algorithms</i> Find Min/Max, Prim & Kruskal MST, Compression (Huffman), Dijkstra's Shortest Path, Bellman-Ford Shortest Path, Ford-Fulkerson Max Flow, Maximal Matching, USA Coin Change, Euler Tour
<i>Divide and Conquer</i> Sorts, Binary Search, Median

<i>Number Theory</i> nCr , nPr , 2^n Counting, Fibonacci numbers, GCD, LCM, Modular Arithmetic, Modular Fields, Prime Numbers, Euler Phi Function, RSA Public Key Crypto, Diffie-Hellman Key Exchanges
<i>Dynamic Programming</i> Pascal's Triangle, Fibonacci Number Calculation, Dice Rolling, 0-1 Knapsack, Longest Common Subsequence, Longest Increasing Subsequence, Levenstein Edit Distance
<i>Quantum Computing</i> General Background, BB84 Transmission Channel
<i>Computer Arithmetic.</i> Number Bases, Redundant and Alternate Digit Sets Number System Conversions Carry-Save Addition
<i>Complexity Theory</i> Problem Complexity: P and NP
<i>Administrative:</i> Project Discussions Exams and Reviews