MCS 3312 Analysis of Algorithms – Fall 2017

Instructor: Jeffrey W. Holcomb, Ph.D.

Office Hours: 5:20 to 5:50, M, W, after class
(For an appointment please send email to: jholcomb@udallas.edu)

Contents Description:

1. Introduction
   (Intro, growth of function, recurrences and basic algorithm paradigms)

2. Sorting and Order Statistics
   (Heapsort, Quicksort, and such, sorting in linear time, elementary data structures)

3. Algorithms Involving Sets and Sequences
   (Hash tables, binary Search Trees, Pattern Matching, Union-Find…)

4. Programming designs
   (Dynamic programming, greedy algorithms)

5. Graph Algorithms
   (Graph Search, Minimum-Cost Spanning Trees, Shortest Paths, Network Flows…)

6. Algebraic Algorithms
   (Polynomials, Matrix Multiplication, Fast Fourier Transform…)

7. Linear Programming (Optional)
   (Simplex Method, Duality…)

8. Geometric Algorithms
   (Basic geometric algorithms incl. Convex Hull, Closest Pairs …)

9. NP-Completeness
   (Reducibilities, NP-completeness, Cook's Theorem, NP-complete problems)

Course Description:

A Mathematical study of the complexity of fundamental algorithms in computer science.
Prerequisite: CS 5343 (3-0) S

Course Objectives:

Asymptotic notations, recurrences, algorithm analysis. Divide and conquer algorithms. Greedy algorithms. Dynamic programming algorithms. Graph algorithms. Flow networks. NP-completeness.

Required Textbooks and Materials:

T. Cormen, C. Leiserson, R. Rivest & C. Stein.: "Introduction to Algorithms", MIT Press, (3rd edition) 2009.

Suggested Further Reading Materials:

Skiena, Steven S.: "*The Algorithm Design Manual*"

Turing, Alan: "*On Computable Numbers, with an Application to the Entscheidungsproblem*".

Cantor, G.:"*Ueber eine elementare Frage der Mannigfaltigkeitslehre*".

Chartrand, G., Zhang, P>: "*Introduction to Graph Theory*".

Harary, Frank: "*Graph Theory*" .

Garey, Michael R., Johnson, David S.: "*Computers and Intractability*, *A Guide to the Theory of NP-Completeness*".

Sipser, M.: "Introduction to the Theory of Computation", Thomas Course Technology, 2nd Edition, 2006.

Arora, S & Barak, B.: "Computational Complexity: A Modern Approach", Cambridge University Press, 2009.

Vazirani, V.: "Approximation Algorithms", Springer 2003.

Dates for Academic Calendar for Fall 2017:

- August 23, Wednesday: Fall Classes begin.
- September 4, Monday: Labor Day, no classes.
- October 6, Friday: Fall Reading Day, no classes.
- October 9-13, Monday-Friday: undergraduate mid-semester period; midterm grades due Monday, October 16.
- October 12-15, Thursday-Sunday: Alumni and Family Weekend.
- October 14-20, Saturday-Friday: Charity Week for undergraduates.
- November 20-24, Monday-Friday: Thanksgiving Break for all students, no classes.
- December 6, Wednesday: Last day of classes.

Assignments and Academic Calendar/Grade Scale:

- Homework assignments 10%
  (Late HWs will not be accepted. If you are not able to attend a class, you're responsible for any announcements/handouts.)
- Exam #1 35% during midterms
- Exam #2 35% during finals
- Class project 20%

Course and Instructor Policies:

- Students are encouraged to discuss HW problems. However, your submission must be your own work. Anyone caught cheating on HWs will receive zero credit.

Academic Integrity

The faculty expects from its students a high level of responsibility and academic honesty. Because the value of an academic degree depends upon the absolute integrity of the work done by the student for that degree, it is imperative that a student demonstrate a high standard of individual honor in his scholastic work.

As a general rule, scholastic dishonesty involves one of the following acts: cheating, plagiarism, collusion and /or falsifying academic records.

These descriptions and timelines are subject to change at the discretion of the Professor. All portions of this document are to be considered still in a draft phase.