Course Syllabus
COMP 550-001: Algorithms and Analysis
Spring 2015

Schedule: MoWeFr 09:05 - 09:55, in FB 009.
Course website: http://www.cs.unc.edu/~zsguo/comp550.html
Piazza: https://piazza.com/unc/spring2015/comp550/home

Instructor: Zhishan Guo
Office: Sitterson 126
Email: zsguo@cs.unc.edu (please include "[comp550]" in your email subject for easy identification)

Office Hours: Mo We 10:00-11:30 in Sitterson 126, or by appointment
Teaching Assistants: No TA for this course -- the instructor is responsible for all questions.

Target Audience: This is a must course for undergraduate students perusing B.S. majoring in computer science at UNC Chapel Hill. Any undergraduate or graduate student with certain background in programming and data structures is welcome to take this core undergraduate-level course in our department. This course is listed in the background requirement for graduate students in the CS department. It also serves as a prerequisite for most graduate-level courses in the theory category. Please look for COMP750 if you have learnt most to-be-covered topics (see below), which is the graduate-level algorithm course.

Prerequisites: COMP 410, and COMP 283 or MATH 381.

Textbook: *Introduction to Algorithms, 3rd Edition, Cormen, Leiserson, Rivest, and Stein, McGraw Hill, 2009.*

Goal of the Course: This is an upper-division undergraduate course on the design and analysis of computer algorithms. This is a course on problem solving instead of programming. We will examine several interesting problems, devise algorithms for solving them, prove their correctness, and characterize their performances. We will study many useful data structures and core algorithms, different methods for designing algorithms to solve problems, various techniques for analyzing them, and applications of the algorithmic on practical problems in the real-world. This course focuses primarily on developing thinking abilities on both formal thinking (proof techniques and algorithm analysis) and problem solving skills (algorithm design and selection). Upon successful completion of the course, you should:

- Be thoroughly familiar with a collection of core algorithms.
- Be fluent in the following algorithm design paradigms: divide and conquer, greedy algorithms, randomization and dynamic programming.
- Be able to analyze the correctness and runtime performance of a given algorithm using the following techniques: asymptotic notion, recurrences, proof by induction, and proof by contradiction.
- Be familiar with the inherent complexity (lower bounds and intractability) of certain problems.
- Be intimately familiar with the following data structures: lists, trees, graphs, heaps, balanced trees and hash tables.
- Be able to apply some of these techniques in real-world problems.

Grading:
Homework (6-8) 25%
Class Participation 5%
Mid-Term Exams (3) 40%
Final Exam 30%
Programming Project (optional) up to 10%

I plan to reward students who actively evolve in discussions (in class or on piazza) by increasing their final grades by up to half a letter grade. I also reserve the right to give negative class participation grades to those who do not observe appropriate etiquette in class, which may result in a half-letter down-grade of

your final scores. You are responsible for defining/proposing the course project. It can be either some implementations of core algorithms we cover or some algorithmic study to any open problem. Group work is allowed though contribution of each member must be clarified in the final report.

Class Etiquette: You are expected to maintain proper etiquette in class, which includes:

- Not making a habit of arriving late, or leaving in the midst of class;
- Not talking (include whispering), sleeping, reading newspapers, etc. in class;
- Keeping cell-phones, pagers, etc. off;
- Do ONLY current-lecture-related actions (if) with your laptop.

Homework Assignments: HWs are due at the beginning of class on the due date given. An assignment is on time only if it is received before the class begins on the due date. No late homework is accepted. The lowest score of all your homework will be dropped when calculating final grade.
Some of the homework assignments may be time-consuming. You are encouraged to discuss the problem sets and study together in group, but when it comes to formulating/writing solutions you must work alone independently.
Homework should be (hand) printed neatly. Poorly written homework sets will not be graded. When writing algorithms, be sure not only that your solution is correct, but also that it is easy for the grader to understand why your solution is correct. Your grade will be based not only on correctness, but also on the clarity, simplicity, and elegance of your solution.

Exams: All three mid-terms will be held in-class, and the final will be held on 8:00-11:00, May 4, 2015. Exams are all close-book ones, but you are allowed to take m (Letter- or A4-size) pages to write whatever you want in the m^{th} exam.

In-class Quizzes: There will also be at least 5 pop quizzes. These help me to see how well the class is learning the material and help you to remember the material better. Some of them may be anonymous; while some will not – those ones are counted into class participation.

Honor Codes: The UNC Honor Code is followed (honor.unc.edu), and suspected violations are reported to the university for investigation. Feel free to ask questions - we typically respond to the entire class.

Topics:

Topics Covered (* = optional = may or may not be covered)
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Chapter 1, 2 -- Introduction
Chapter 3, Appendix A -- Asymptotic Notations, Example
Chapter 2.3, 4 -- Divide and Conquer
Chapter 7 -- Quicksort
Chapter 8 -- Linear Time Sort*
Appendix C, Chapter 5, 7.3 -- Randomized Algorithms
Chapter 9 -- Order Statistics
Chapter 11 -- Hashing
Chapter 12,13 -- Search Trees
Chapter 22 -- Graph Algorithms
Chapter 15 -- Dynamic Programming
Chapter 16, 23, 24 -- Greedy Algorithms
Chapter 29 -- Linear Programming*
Chapter 34, 35 -- NP-Complete*

Disclaimer: *The instructor reserves to right to make changes to the syllabus, including due dates and topics to be covered. Important changes will be announced as early as possible.*