COMP 550-001 – Algorithms & Analysis

Lectures: MW 9:05 - 10:20 am, in FB 009

Instructor: Sanjoy Baruah (baruah@cs.unc.edu). **Office:** FB-134. **Office Hours:** Immediately after class, or by appointment

Text: There is one **required** textbook for this course:

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

Course web page: Located at http://www.cs.unc.edu/~baruah/Teaching/2016-2Fa/. Students are required to monitor this page frequently for announcements, assignments, lecture notes, etc.

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

Course Description: This class introduces (i) concepts, notation, and terminology for reasoning quantitatively about the efficiency of algorithms; (ii) important data-structures and algorithms; and (iii) fundamental techniques for algorithm design.

Target Audience: A sound knowledge of algorithms and techniques for their analysis is a basic competency in computer science, and a prerequisite to a deeper understanding of most topics in computer science. This course is targeted at students that seek such a deeper understanding. COMP 550 is a required course (a "core requirement") for the BS degree in Computer Science

Course requirements:

- Several homework assignments — approximately one every two weeks — will be made available on sakai and the course web-page. You are encouraged to work on these assignments in groups, but must construct and write up your final solutions independently. Copying homework solutions from another student, the Internet, or other sources is considered cheating and referred to the student attorney general. *You must include a signed honor statement with each submission explicitly listing the people you worked with and stating that you completed the assignment in accordance with these rules.*
  As a courtesy to your grader, homework submissions should be typeset or hand-written neatly. Poorly written homework submissions will not be graded.
  A homework assignment will typically comprise several problems, of which only a few will be graded. It will not be revealed beforehand which problems are being graded.
- Several closed-book exams will be administered in class, testing your knowledge of the material being covered in the lectures and the home-work assignments.
- A comprehensive final exam will be administered during the final exam period. This, too, will be closed-book.
- Although attendance is generally not recorded, it is expected that each student will attend most lectures. The instructor may conduct pop quizzes for extra credit during any lecture, including on days with low attendance.

Grading criteria: The breakup of grades is tentatively set as follows

- Several homework assignments: 20%
- Several in-class exams: 50%
- Final exam: 30%

Class Participation: This class will be far more enjoyable for everyone if all students come to class ready and willing to discuss the material to be covered. I plan to reward those who participate in class by increasing their final grade by up to half a letter grade. I also reserve the right to add a similar negative "reward" to those who do not observe appropriate etiquette in class.

Course Policies:

- **Grading policy:** Tests and homeworks are graded by the TA under the instructor's supervision. If you wish to dispute the score assigned to you, it is your responsibility to initiate negotiation via email on this, within one week of the date that the tests or assignments are returned. No complaints will be considered after this one-week deadline.
- **Class Etiquette:** You are expected to maintain proper etiquette in class. This includes:
  - Not making a habit of arriving late, or leaving in the midst of class. If you must be late once or twice, take an aisle seat quietly; likewise if you must leave early. If this becomes habitual, you should drop the course.
  - Keeping cell-phones, pagers, etc. off during class. Not talking in class. Private discussion between students, even whispers, carry surprisingly well and are a real distraction to those seating near you and to the instructor.
  - Not using your laptop to browse the web

  We will try to be courteous to you and we ask that you be courteous to others as well. Thank you.
- The **course final** is given in compliance with UNC final exam regulations and according to the UNC Final Exam calendar. It will be held during the 8am – 11am time-slot on **Saturday, Dec 10th**.

Honor Code: The Honor Code and the Campus Code are in effect for this course. The following is adapted from a memo from the Chancellor.

> *The Honor Code prohibits lying, cheating, or stealing when these actions involve academic processes or University, students, or academic personnel acting in an official capacity. The Campus Code requires students to conduct themselves so as not to impair signicantly the welfare or the educational opportunities of others in the University community. As a student at UNC-CH, you have accepted a commitment to the Honor Code and the Campus Code, and the principles of academic integrity, personal honesty, and responsibility on which they were founded more than 100 years ago.*
> *Academic dishonesty in any form is unacceptable, because it circumvents the purpose of the University. The instructor and teaching assistant have a responsibility to report any possible Honor Code violations to the Student Attorney General. Please join us in supporting the Honor Code by signing the Honor Pledge on all written work, and consult us if you are uncertain about your responsibilities within this specific course.*

Disclaimer: The professor reserves to right to make changes to the syllabus, including test dates. These changes will be announced as early as possible.

TOPICS TO BE COVERED

- Introduction: techniques and terminology for the analysis of algorithms
  - pseudocode
  - running time analysis – the Random Access Machine (RAM) model
  - asymptotic notation
- Algorithm design technique: Divide and conquer
  - Setting up and solving recurrences
- Probabilistic analysis and Randomized Algorithms
  - Linearity of expectation
  - Average-case analysis
  - Randomization – expected worst-case analysis
- Algorithm design technique: Dynamic Programming
- Algorithm design technique: the Greedy Method
- Applications: Sorting and Searching
  - Sorting algorithms: insertion sort, merge-sort, quick-sort and randomized quick-sort
  - Sorting in place; stable sorts
  - Lower bound on comparison-based sorting
  - Linear-time sorting algorithms
  - Randomized linear-time selection; Deterministic linear-time selection
- Applications: Graph Algorithms
  - Representation and terminology
  - Shortest paths; minimum spanning trees
- Intractability: NP-completeness
- Search structures: red-black trees
- Linear Programming