ECE 345 -Algorithms and Data Structures
Winter 2013

Advances over the past 50-60 years have sparked the technological age, and at the center of this revolution is the study of algorithms and data structures. They are behind web searching, the human genome project, efficient circuit designs, video games, cell phones, assembly lines, operating room scheduling, and so on. Indeed, nearly every facet of our daily lives is touched by them...but what are they really? Throughout this course you will be introduced to basic data structures (i.e., constructs for data storage), some of their algorithms (i.e., to search for and update data records stored in a specific data structure) and methods of analysis and correctness (i.e., proving an algorithm is correct, and how fast/slow it is).

Staff

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Lecture and Tutorial Schedule

- Lectures: MWF 10:00-11:00am in BA1210.

- Tutorials: W 3:00-5:00pm in GB412.

- All students **must** be registered and able to attend the tutorial as the midterm will be held during this time.

- Tutorials will answer questions about the lecture material, address homework material, solve sample problems from the textbook and generally get more exposure to course topics.

Textbook

The required textbook for this course is

- T. Cormen, C. Leiserson, R. Rivest, C. Stein (CLRS), *Introduction to Algorithms*, McGraw Hill 2009 (3rd Edition).

CLRS is a well-written comprehensive textbook used by most major universities. No other text is required and no lecture notes will be distributed. However, if you would like supplementary textbook suggestions, consider (not available in book store):

- S. Skiena, *The Algorithm Design Manual*, McGraw Hill 2011 (2nd Edition).

- R. Sedgewick, P. Flajolet, *An Introduction to the Analysis of Algorithms*, 2013 Addison-Wesley Professional (2nd Edition). * will be available Jan 25th 2013.

Course Contents

In this class we will cover the following material:

- Background: asymptotics, recurrences, combinatorics, randomization, graphs and trees (Chapters 1...5, Appendices A, B and C)

- Sorting: quicksort and analysis, heapsort and analysis, other sorting methods, lower bounds in sorting and selection in linear time (Chapters 6...9)

- Binary Search trees, Red-Back trees, Amortized Analysis, Splay trees, Hashing (Chapters 10...13, 17)

- Dynamic Programming and Greedy Algorithms (Chapters 15 and 16)

- Basic graph algorithms (breadth-first search, depth-first search) (Chapter 22)

- Minimum Spanning Trees and Single Source Shortest Paths (Chapters 23 and 24)

- Introduction to theory of computation and NP-Completeness (Chapter 34)

Course Requirements and Grading Scheme

The final grade for this class has three components:

28% **Assignments:** There will be four assignments, which you may do in groups of 2-3 students. You can switch groups between assignments but you will receive the group grade each time. Deadlines for assignments are final! *Absolutely no late assignments will be accepted.* Assignments will be handed in at the start of the respective tutorial.

Assignments must be legible and well organized. Illegible and organized work will NOT be graded. You must also include a stapled and signed cover sheet with your assignment or it will not be graded. All members of the group must sign the sheet, without exception.

30% **Midterm:** There will be one midterm of two hours, open CLRS book, absolutely NO electronic aids of any kind. HELD DURING TUTORIAL TIME. Date TBD (approximately 7 weeks into the course).

42% **Final:** 2.5 hours open CLRS book, absolutely NO electronic aids of any kind. Exam dates and rooms will be announced at a later time.

When you don't know: It may happen that you are unable to solve a problem from the homework, midterm or final no matter how hard you try. This is OK...you still have the opportunity to gain up to 80% of the marks for that question - depending on your effort and how close you were to solving the problem. How is this possible? You must **clearly and exactly** indicate:

- What issues did you encounter with understanding the question? What parts were confusing, and what questions did you ask the instructor or teaching assistants to overcome these issues (be specific in your question and the answer!)? If you consulted other textbooks, indicate which ones and why they were not helpful.

- If you understood the question but were still unable to arrive at a solution then indicate what difficulties you encountered when attempting to solve the problem? What ideas did you try, and why did they fail? Did you consult the instructor/TAs, other textbooks, etc?

Remarking: You have exactly *seven* working days to submit your work (homework or midterm) for remarking from the time we release it to you (in tutorial). *There are NO exceptions to this rule and no late homework will be remarked.* For remarking the midterm, you will need to clearly indicate on a separate piece of paper the reason you believe you were marked unfairly. *Staple* (do not glue, etc!) this paper to your work and submit it to the instructor or the head TA.

If there is a legitimate reason for a late assignment or exam absence (illness, etc), discuss the matter with the instructor. Keep in mind that official documentation must always be provided (i.e. doctor letter etc).

How to Get the Most out of this Course

- **Attend** all lectures and tutorials.

- Carefully **read** all relevant textbook chapters.

- If you do not understand something 100%, then **ASK QUESTIONS**!

- **Practice, practice and more practice**. The textbook has a number of great questions, and more are available in other books and the web.

- Do not procrastinate or be lazy! **Keep up with readings and start assignments early**.

- **Think, don't memorize!** Simple memorization doesn't get you very far in this course, you must learn to be clever in how you approach solving problems.

If you do the above, hand in all homework and understand their solutions, then you will probably do well on the exams and thus achieve a good course mark. Your life will beautiful and fulfilled, you'll be forever happy and there will be peace on Earth :)

Webpage and Bulletin Board

All official announcements will be posted on the course Portal. *It is your own responsibility to check it at regular intervals, i.e. once per day.* Questions on the material (i.e. lectures, exams, labs etc.) will be welcomed on the board. **No solutions to problems should be posted by students on the board.** Only the instructor and TAs may post solutions. Please do not use the board for any posts other than those relating to the course.

Cheating Policy

Cheating is against "fair–play" and will not be tolerated under any circumstances. While the pressures of many classes, homeworks, work and/or extracurricular activities can be great, this is *never* an excuse for copying solutions from others. **The University holds among its highest principles the notion of academic freedom and integrity. Cheaters will face the University's disciplinary committee as well as receive a failing grade in this course.** If you think that there is an issue that influences your performance in the class then talk to the instructor.