

Exam 1 Announcement

When: Thursday, February 15, 2007, 8:15 P.M.10:15 P.M. Please show up a few minutes early so that you can take advantage of the full time available.

Where: Room 113 IST (the same building as our offices).

Crib sheet: The exam is *closed book*. You may, however, bring one *handwritten* crib sheet on an $8\frac{1}{2} \times 11$ or A4 *colored* sheet of paper. The color of the paper has to be significantly different from white. Preparing a crib sheet can be a useful study aid, so take time in selecting material for it. You may use both sides of the paper and write as small as you like, but you are allowed only one sheet and it must be handwritten. Calculators and programmable devices are not allowed for this exam.

Material covered: You are responsible for all material covered in the lectures, reading assignments, and homework through the lecture on Monday, February 12. The course home pages has a record of the material covered in lectures and reading assignments.

Exam review: Lecture held on Monday, February 12 will be devoted to review for the exam. Please come prepared with questions.

Practicing for the exam: In addition to the practice exam (Handout 9), if you need more problems to practice on, please look at the problems and exercises in the chapters we covered.

Exam conflict: If you are unable to attend the exam at the scheduled time, please talk to us as soon as possible.

List of topics:

- Asymptotic notation ($O, \Omega, \Theta, o, \omega$).
- Correctness proofs using loop invariants.
- Sorting algorithms: Insertion Sort, Merge Sort, Quicksort, Randomized Quicksort. You should know how each algorithm works, its running time, and whether or not it is in place. You should be aware of input arrays which cause the algorithm to perform especially well or especially poorly.
- Recurrences: recursion trees, substitution, Master Theorem (know by case number).
- Randomized algorithms: what are they? What sort of analyses are meaningful? Randomized Quicksort and Randomized Selection.
- Median and order statistics. How long does it take to find the i th smallest element (element of rank i) in the array? Randomized Selection and how it works.

- Divide and conquer: Merge Sort, binary search, integer multiplication, exponentiation, Quicksort, polynomial multiplication, median of two sorted arrays, stock price problem from homework 3, Groundhogs and Holes. For each of these problems, you should be able to come up with the recurrence that the running time satisfies, and know how to solve it. Most importantly, you should be able to use divide and conquer to **design new algorithms**.
- You should understand pseudocode used in CLRS and be able to describe your algorithms both in English and using pseudocode (your pseudocode does not have to be the same as in the book).
- You should understand and be able to adapt subroutines we developed while building up the algorithms above (e.g. merging sorted arrays, partitioning a sorted array around a pivot).
- Some questions will require you to be comfortable with material covered in the mathematical prerequisites. For example: arithmetic and geometric sums, logarithms and exponents, elementary probability. Appendices A, B and C of CLRS are a good place to review this material.