

CMPS 201 Midterm Topics, Fall 2004

The midterm will be held in class on Thursday November 4.

The midterm will be closed book, but you may have one 3×5 card of personal notes (both sides) written in your own hand. Calculators will not be allowed. A list of study problems will be posted later today.

The midterm will have several problems on the topics below similar to the questions on the take-home pre-exam. In addition, there will be a few questions requiring proofs. Good topics for the longer questions are: induction, lower bounds, and amortized analysis, and they are likely to be similar to something from the homework, lectures, or study problems.

For the algorithm's listed you should also generally know the worst-case resource requirements and proof of correctness.

1. Algorithms, RAM model, resources, unit cost and log cost (see AHU '74)
2. Worst case, best case, average case over input, average case over algorithm's randomization, and amortized resource usages.
3. Resource requirements as a function of problem size and asymptotic notation (O , o , Ω , ω , and Θ , both the books definitions and the "limit" definitions)
4. Proving that a asymptotic relationship holds (or does not hold) between a pair of functions
5. Asymptotically incomparable functions
6. Recurrences, recurrence relations, and boundary conditions
7. Asymptotic solutions to recurrences by master theorem
8. Solving and bounding recurrences by induction
9. Induction, especially over structures like trees and graphs
10. Strassen's matrix multiplication algorithm
11. Heaps and heap sort
12. Merge sort
13. Quicksort and partition
14. Indicator variables and the average case analysis of Quicksort
15. Information theoretic (decision tree) lower bounds and the $\Omega(n \log n)$ lower bound for sorting.
16. Radix sort and its relation to the decision tree lower bounds
17. Adversary arguments (see Baase's book)
18. Finding both max and min
19. Median of medians linear time selection
20. Hashing, collisions, chaining, rehashing
21. Binary search trees
22. Red-black trees
23. Amortized analysis

24. Doubling trick of hash tables
25. Union-find (or merge-find, or disjoint sets) and its analysis

This includes the material in chapters 1–13, 17, and 21 of the text, as well as most of the appendices.