CS 362, Final Review

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Final

- About 5 main problems
- As usual, the solutions will require lots of thinking, but not much writing.
- I expect a class mean of between 60 :(and 70 :) points

Topics Covered – Pre-Midterm

- Probability and Randomized Algorithms: Linearity of Expectation, Union Bounds, Markov's inequality. Randomized Quicksort, Count-min sketch, Bloom Filters.
- Recurrence Relations and Induction (Chapter 3 and 4): Defns of big-O and friends, recursion trees, Master method, annihilators and change of variables; Proof by induction!
- Dynamic Programming: String Alignment, Matrix Multiplication, Longest Common Subsequence (Chapter 15)

Topics Covered – Post-Midterm

- Greedy Algorithms: Activity selection, fractional knapsack, MST, proof via exchange property (Chapter 16)
- Amortized Analysis: Aggregate Method, Accounting Method, Potential Method, Dynamic Array (Chapter 17)
- Disjoint-Sets: Union by Rank and Path Compression, Amortized Costs (Chapter 21)
- Minimum Spanning Trees: Kruskal's and Prim's Algorithm, Safe Edge Theorem and Corollary
- Shortest Paths: Dijkstra's, Bellman-Ford, Floyd-Warshall (Chapters 22 23,24,25)
- NP-Hard Problems: Definitions of P, NP, co-NP, NP-Hard, and NP-Complete; Reductions (i.e. how to show that a problem is NP-Hard); Classic NP-Hard problems: CIRCUIT-SAT, SAT, 3-SAT, COLORING, CLIQUE, VERTEX COVER, INDEPENDENT SET, HAMILTONIAN CYCLE, TSP. (Chapter 34)
- Approximation Algorithms: Vertex Cover, TSP

Example Problem - Short Answer

Collection of true/false questions, matching and short answer questions. Some examples:

- T/F questions covering all topics
- Multiple Choice e.g. I give you some "real world" problems and ask you which algorithm we've studied in class that you would use to solve each of them; I give you some problems and ask you how fast they can be solved, etc.
- Know the resource bounds for all algorithms covered.

Example Problem - Review

Possibilities:

- Probability
- Recurrence Relations
- Dynamic Programming
- Proof by Induction

Example Problem - Dynamic Programming

- Key focus will be on getting the correct recurrence relation
- Probably related to some problem we did in class and/or homework
- Practice solving a big problem by using solutions to sub-problems

Example Problem - Graph Theory

- Possibility 1: MST and Safe Edge theorem
- Possibility 2: Single Source Shortest Paths (Dijkstra's and Bellman-Ford)
- Possibility 3: All Pairs Shortest Paths

Example Problem - NP-Hardness

- Possibility 1: Something like Radio-Towers or Graph-Isomorphism Problem
- I give you a problem and ask you to prove it's NP-Hard by a reduction from another NP-Hard Problem.
- Might also ask you give an approximation algorithm for it (e.g. a variant of something already seen in class)