

CSE 42 I: Midterm Review

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Complexity, I

Asymptotic Analysis

Best/average/**worst** cases

Upper/Lower Bounds

Big O, Theta, Omega

definitions; intuition

Analysis methods

loops

recurrence relations

common data structures, subroutines

& specialized arguments, e.g. “look at every edge twice”

Graph Algorithms

Graphs

Representation (edge list/adjacency matrix)

Breadth/depth first search

Connected components

Shortest paths/bipartiteness/2-Colorability

DAGS and topological ordering

DFS/articulation points/biconnected components

Design Paradigms

Greedy

emphasis on correctness arguments, e.g. stay ahead, structural characterizations, exchange arguments

Divide & Conquer

recursive solution, superlinear work, balanced subproblems, recurrence relations, solutions, Master Theorem

Dynamic Programming

recursive solution, redundant subproblems, few do all in careful order and tabulate; OPT function (usually far superior to “memoization”)

Examples

Greedy

Interval Scheduling Problems (3)

Huffman Codes

Examples where greedy fails (stamps/change, scheduling, knap, RNA,...)

Examples

Divide & Conquer

Merge sort

Counting Inversions

Closest pair of points

Integer multiplication (Karatsuba)

Matrix multiplication (Strassen)

Powering

Examples

Dynamic programming

Fibonacci

Making change/Stamps, Knapsack

Weighted Interval Scheduling

RNA

String Alignment

OPT function

Midterm Friday, 2/14/2015

Closed book, 1 page of notes

(8.5x 11, 2 sides, handwritten)

(no bluebook needed; scratch paper may be handy; calculators unnecessary)

All up through start of “Dynamic Prog”

assigned reading up through Ch 6.2;

slides

homework & solutions

Some Typical Exam Questions

Give $O(\)$ bound on $17n*(n-3+\log n)$

Give $O(\)$ bound on some code `{for i=1 to n {for j ...}}`

True/False: If X is $O(n^2)$, then it's rarely more than $n^3 + 14$ steps.

Explain why a given greedy alg is/isn't correct

Give a run time recurrence for a recursive alg, or

Solve a simple recurrence

For any of the algs we've studied

- Simulate it on given input

- Explain its runtime analysis or analyze a similar alg

- Explain/give counterexample for failure of a modified version

Give an alg for a new problem/analyze it/argue correctness 9