Final Review

Topics

Convex Hulls

- Jarvis March, Graham Scan
- Chan's Alg - Output sensitive $O(n \log h)$

(Linear) Algebraic Decision Tree Model

- Element Uniqueness $\Omega(n \log n)$

Linear Programming

Network Flow

- $O(|V||E|)$ Orlin
- Bipartite matching
- Pennant Race
- Open pit mining

Linear Programming Duality

- Zero sum games

Dynamic programming

- Longest common subsequent
- Longest increasing subsequence
- Edit distance $O(nm)$

NP-completeness

- NP, NP-hard, NP-complete
- Clique, Vertex Cover, 3SAT
- Independent Set
- Partition
- Hamiltonian Cycle
- TSP
- Knapsack

Approxmation Algorithms

- List Scheduling (Greedy)
- Vertex Cover (MVC)
- Christofides Algorithm for $\triangle$TSP, metric-TSP

Hardness of Approximations

- General-TSP is NP-hard to approximate.
- Chromatic Number is NP-hard to additively approximate.

Online Algorithms

- Paging
- k-server
- (online coloring, not on exam)

Examples of competitive analysis, compete to something stronger and then show how closely you are. Can't differentiate using standard analysis. Close to optimal for all inputs.

- Randomized Marking Mouse $O(\log m)$-competitive

Hashing

- Universal set of hash functions
- Cuckoo Hashing
- Analysing properties of Cuckoo graphs