

Final Review Session

Graphs

Concepts

Dijkstra's, Bellman-Ford, Floyd-Warshall (how it works, proof of correctness, runtime)

What graphs does Dijkstra's work on? When does it produce incorrect answers with negative edge weights?

Skills

How to convert a problem to a graph to run Dijkstra's, BF, FW on (HW 4 P1).

Dynamic Programming

Concepts

Bottom-up vs. top-down

Optimal substructure and overlapping subproblems

Skills

Write DP recurrences (T6 P2/P3)

Design a DP algorithm (T6 DP2, T7 P3/P4)

Determine runtime of DP algorithms

Greedy

Concepts

How greedy relates to DP and divide and conquer

Properties of MST's

Prim's, Kruskal's

Skills

Design a greedy algorithm (HW 5 P1/P2; P6 Greedy 1; T7 P1)

Prove properties about MST's (HW 5 E1)

Run through Prim's, Kruskal's (T7 P2)

Use greedy stays ahead and greedy exchange argument to prove correctness (HW 5 P2, T7 P5)

Analyzing optimality of approximation algorithm (HW 5 P3)

Advanced

Concepts

What is a decision problem?

P vs NP vs NP-complete vs NP-hard

Pseudo-polynomial, fixed-parameter tractable

FPTAS

TSP, vertex cover, set cover

Karger's algorithm

Ford-Fulkerson algorithm

Skills

Recognize when an algorithm is pseudo-polynomial, fixed-parameter tractable, FPTAS

Follow the steps of TSP, vertex cover, set cover

Follow the steps of Karger's, Ford Fulkerson