ECS 122A
Algorithm Design and Analysis

Instructor: Qirun Zhang

Agenda

- NP-Completeness
  - Subset-sum

Updates

- Final on Friday
  - Similar to the midterm
  - Bring your photoID
  - Closed book & closed notes
  - Coverage: From 8/28 lecture to today's lecture
  - 5 Problems
    - One bonus problem
      - Hard. Unlikely to get partial credit.
- If you want additional help, send me an email *directly*

Fundamentals

- Know how algorithm works
  - All algorithms mentioned in the lecture
- For graph algorithms, you can assume the graph is connected

Lecture 9

- Variants of shortest-path problems
- Bellman-Ford
  - How it works? When it works? Complexity?
- Single-source shortest path in a DAG
  - Basic idea
- Dijikstra's algorithm
  - How? When? Complexity?

Lecture 10

- All-pairs shortest path: Floyd-Warshall
  - How? When? Complexity?
  - Dynamic programming: recursive formulation
- Transitive closure
  - Floyd-Warshall (simple way)
  - A better way
  - How? Complexity?

Lecture 11

- Union-Find
  - Operations
  - Representations
    - Linked list representation
    - Disjoint-set forest
    - Difference?
  - Heuristics for union
    - How? Complexity?

Lecture 12

- Dynamic programming
  - Rod cutting
    - Recursive formulation
    - Algorithm: How? Complexity?
  - Chain matrix multiplication
    - Recursive formulation
    - Algorithm: How? Complexity?

Lecture 13

- Dynamic programming
  - Longest common sequence
    - Recursive formulation: formal proof
    - Algorithm: How? Complexity?
    - Similar problems

Lecture 14

- NP-Completeness
  - Definitions of: P, NP, NPC, NP-Hard
  - Relationship
- Reduction $\leq_p$
  - In poly time
  - Yes in A <=> Yes in B
- NP-Completeness proof
  - Show in NP
  - Show it's NP-Hard
    - Using reduction

Lecture 14

- NP-Complete Problems
  - Directed Hamiltonian cycle
  - Subset-Sum
- Two additional NPC problems
  - Undirected Hamiltonian cycle
  - Set-Partition

The End