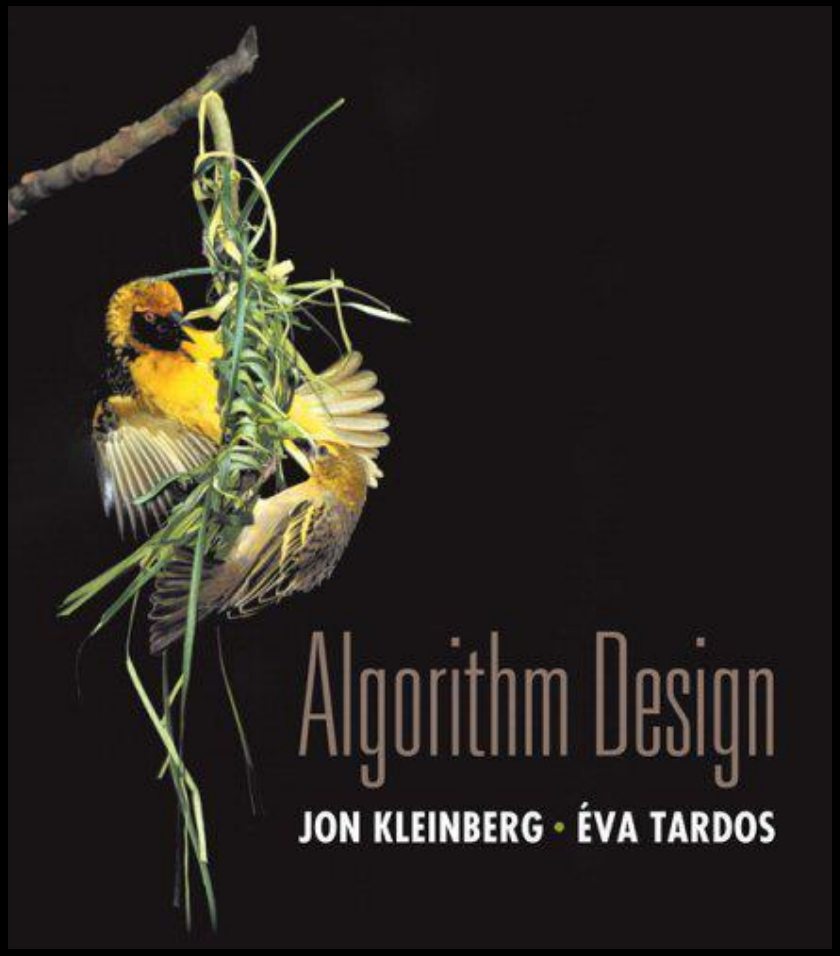


Chapter 1

Introduction: Some Representative Problems

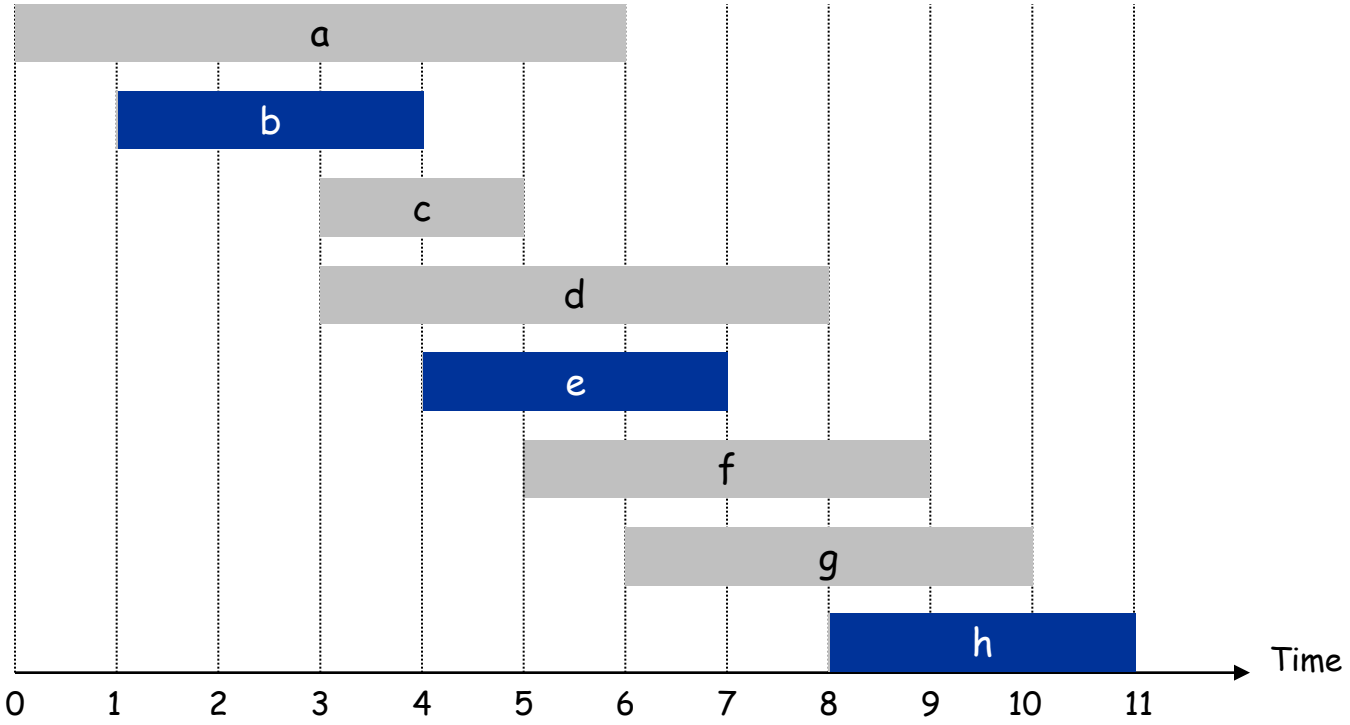
1.2 Five Representative Problems

Interval Scheduling

Input. Set of jobs with start times and finish times.

Goal. Find maximum cardinality subset of mutually compatible jobs.

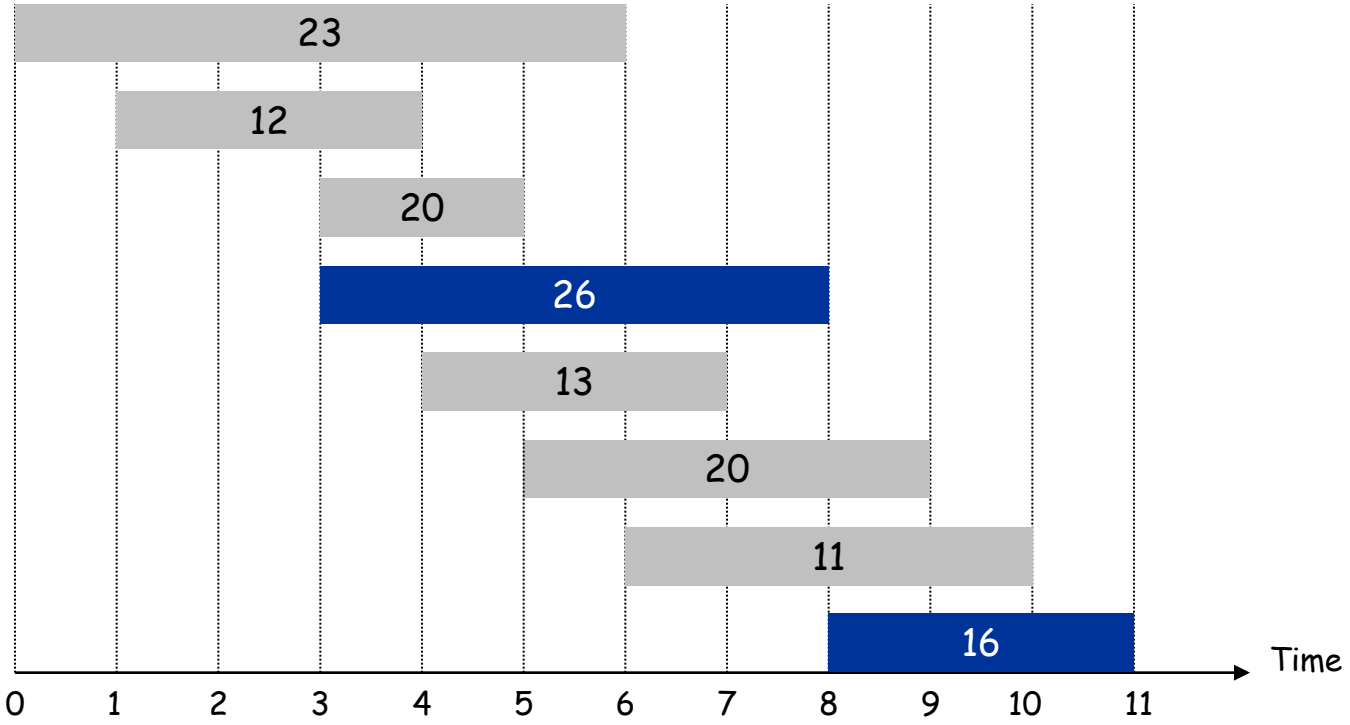
jobs don't overlap



Weighted Interval Scheduling

Input. Set of jobs with start times, finish times, and weights.

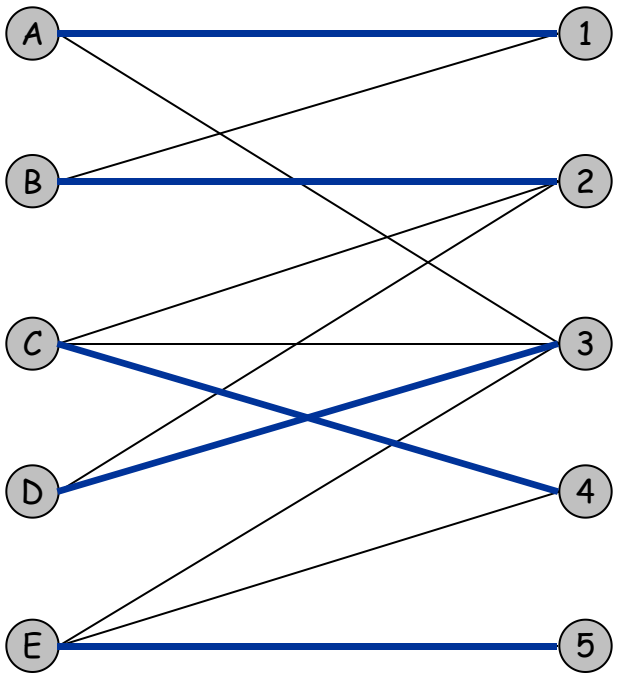
Goal. Find maximum weight subset of mutually compatible jobs.



Bipartite Matching

Input. Bipartite graph.

Goal. Find maximum cardinality matching.

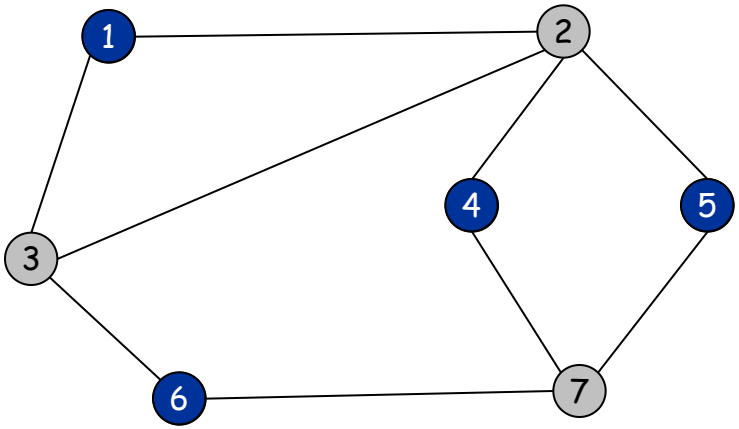


Independent Set

Input. Graph.

Goal. Find maximum cardinality independent set.

subset of nodes such that no two joined by an edge



Competitive Facility Location

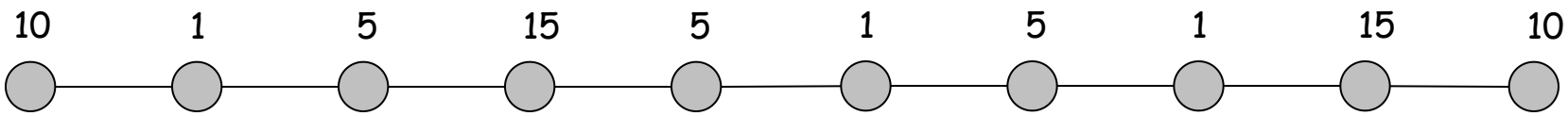
Input. Graph with weight on each node.

Game. Two competing players alternate in selecting nodes.

Not allowed to select a node if any of its neighbors have been selected.

Goal. Select a maximum weight subset of nodes.

independent set



Second player can guarantee 20, but not 25.

Five Representative Problems

covered in this course

Interval scheduling: n log n greedy algorithm.

Weighted interval scheduling: n log n dynamic programming algorithm.

Bipartite matching: n^k max-flow based algorithm.

Independent set: NP-complete.

Competitive facility location: PSPACE-complete.

Lessons Learned

Powerful ideas learned in course.

- Isolate underlying structure of problem.
- Create useful and efficient algorithms.

Potentially deep social ramifications. [legal disclaimer]

- Historically, men propose to women. Why not vice versa?
- Men: propose early and often.
- Men: be more honest.
- Women: ask out the guys.
- Theory can be socially enriching and fun!
- CS majors get the best partners!

Course Homework Assignment 1

Assignment 1:

Chapter 1: Exercises 1, 2, and 3.
Optional: Chapter 1, Exercise 8

Deadline: Please submit your homework through the Blackboard system before 20:50PM on March 12, 2024.

No late submission is allowed.
No re-submission is allowed.