CS 141: Intermediate Data Structures and Algorithms

Discussion - Week 8, Winter 2018

Greedy Algorithms

- General idea
- Examples
- Group activity
- Review assignment #4

General idea

- Like dynamic programming, used to solve optimization problems.
- Problems exhibit optimal substructure (like DP).
- Problems also exhibit the greedy-choice property.

- When we have a choice to make, make the one that looks best at the moment.
- Make a locally optimal choice in hope of getting a globally optimal solution.

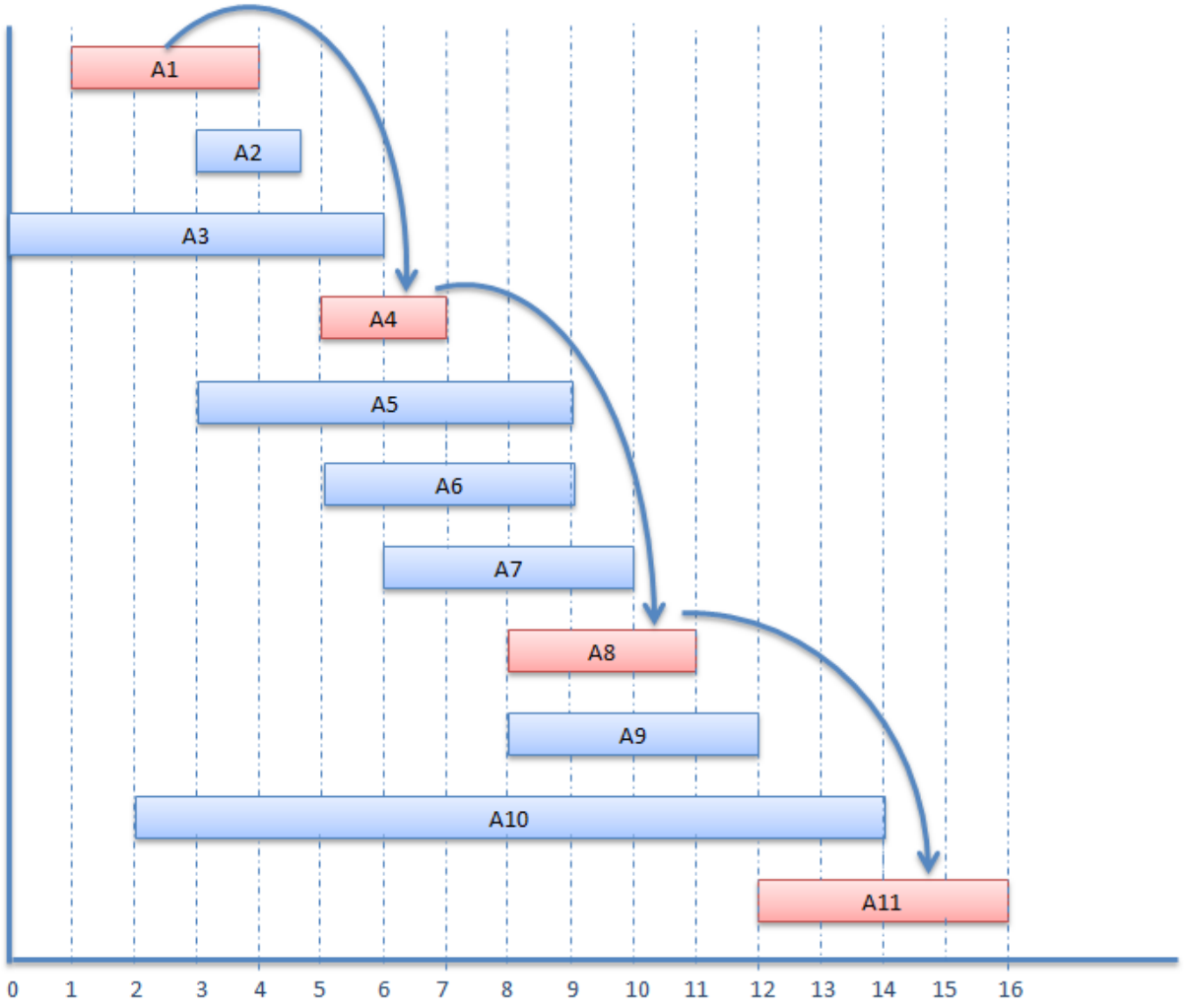
Greedy vs Dynamic Programming

What are their differences?

Greedy algorithm's elements

- **Greedy choice property:** a globally optimal solution can be reached by making a locally optimal choice
- **Optimal substructure:** optimal solution to the problem consists of optimal solutions to sub- problems.
- **Notice:** you have to show both elements above in every algorithm in your assignment solution.

Example: Activity selection problem



Example: Activity selection problem

- **Greedy choice property:** if $a_m = [s_m, f_m]$ has the earliest finish time f_m, it must be included in some optimal solution.
- **Optimal substructure:** if A is optimal to S, then A' = A – $\{a_m\}$ is optimal to S'=$\{i$ in S: $s_i \geq f_m\}$.

Group activity

Given a set T of 11 tasks with {start, finish} are:

[1, 3], [2, 5], [2, 5], [2, 5], [4, 7], [6, 9], [8, 11], [10, 13], [10, 13], [10, 13], [12, 14]

- Apply the algorithm in Problem 4, assignment #4 with this input.
- Discuss the result.

Group activity

1 5 7 11

2 6 8

3 9

4 10

1,3 5,4 7,4 11,3

2,4 6,2 8,4

3,4 9,4

4,4 10,4

Review assignment #4