CSE 431/531: Algorithm Analysis and Design (Fall 2022)

Greedy Algorithms – Exercise Problems

Lecturer: Shi Li

Department of Computer Science and Engineering
University at Buffalo

Maximum Independent Set on Trees

Given a tree $T = (V, E)$, find the maximum independent set of the tree. For example, maximum independent set of the tree of following tree has size 7.

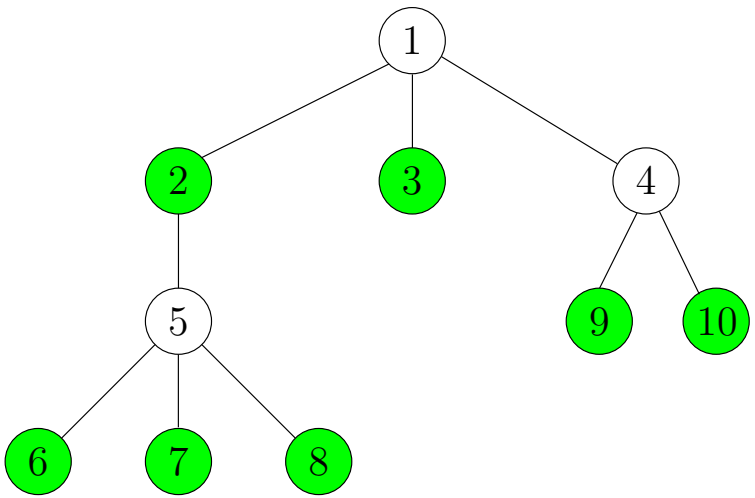


Figure: The green vertices shows that the maximum indpendent set of the tree has size 7.

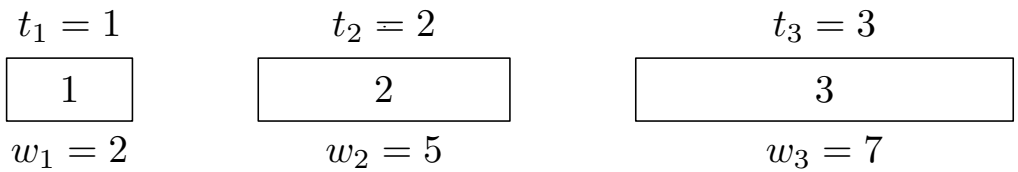
Design an efficient greedy algorithm to solve the problem.

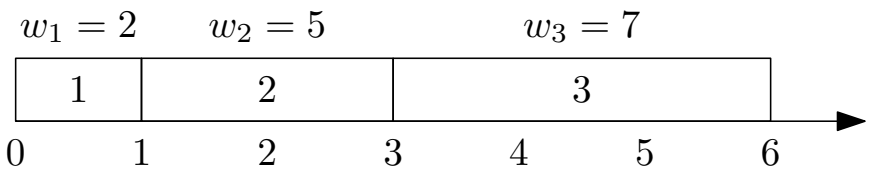
Scheduling to Minimize Weighted Completion Time

Input: A set of n jobs $[n] := \{1, 2, 3, \cdots, n\}$

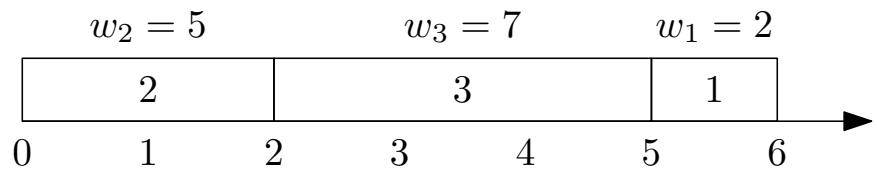
each job j has a weight w_j and processing time t_j

Output: an ordering of jobs so as to minimize the total weighted completion time of jobs





$\text{cost} = 2 \times 1 + 5 \times 3 + 7 \times 6 = 59$



$\text{cost} = 5 \times 2 + 7 \times 5 + 2 \times 6 = 57$

Driving from A to B using with minimum number of gas stops

You wish to drive from point A to point B along a highway minimizing the time that you are stopped for gas. You are told beforehand the capacity number L of miles you can drive when the tank is full, the locations $x_1, \cdots, x_n$ of the gas stations along the highway, where x_i indicates the distance from the i-th gas station from A. Design a greedy algorithm to compute the minimum number of times you need to fill the gas tank.

Balanced Strings

A string of "(" and ")" is said to be "balanced", if it satisfies the recursive definition:

- The empty string"" is balanced.
- If A is balanced then (A) is balanced.
- If A and B are balanced, then AB is balanced.

For example, "(()())()" is balanced.

Problem: Given a string of "(" and ")", our goal is to remove the minimum number of characters so that the residual string is a balanced.

- Example: ())(()()))()

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