CSE 431/531: Algorithm Analysis and Design (Spring 2020)

Greedy Algorithms – Recitation

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Different Strategy for Activity Scheduling Problem

Consider the interval scheduling problem given by a set $\{1, 2, \cdots, n\}$ of activities, each activity i with a starting time s_i and finish time f_i. Decide if the following strategy for designing greedy algorithm is safe of not:

- Select the longest job i (i.e, the i with the largest $f_i - s_i$). If i is conflicts with some other job, then we do not schedule i; otherwise we schedule i.

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.

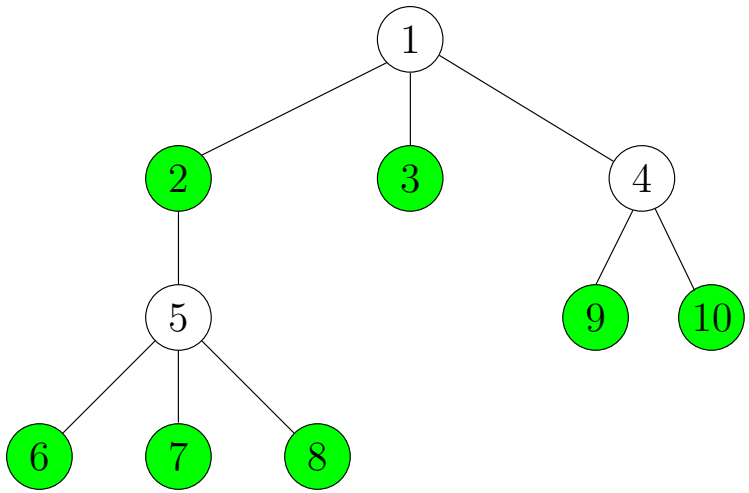

Figure: The red vertices shows that the maximum indpendent set of the tree has size 7.

Design an efficient greedy algorithm to solve the problem.

Weighted Completion Time

Given a set of n jobs $\{1, 2, 3, \cdots, n\}$, each job j with a processing time $t_j > 0$ and a weight $w_j > 0$, we need to schedule the n jobs on a machine in some order. Let C_j be the completion time of j on in the schedule. Then the goal of the problem is to find a schedule to minimize the weighted sum of the completion times, i.e, $\sum_{j=1}^{n} w_j C_j$.
Example. Suppose there are two jobs: the first takes time $t_1 = 1$ and has weight $w_1 = 10$, while the second job takes time $t_2 = 3$ and has weight $w_2 = 2$. Then doing job 1 first would yield a weighted completion time of $10 \cdot 1 + 2 \cdot 4 = 18$, while doing the second job first would yield the larger weighted completion time of $10 \cdot 4 + 2 \cdot 3 = 46$.
Design an efficient greedy algorithm to solve the problem.

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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