

CS161 SU24: Homework 5 (Due July 12 11:00am)

❖ Problem 1

For the following problems, state whether or not it satisfies the greedy choice property. If it does, justify it with a proof. If it doesn't use a counter example to explain why it is not a good greedy choice.

1. In the ACTIVITYSELECTION problem, choose the activity with the last starting time (We claimed that this greedy choice works. Here, you must also prove this claim).
2. In the WEIGHTEDSCHEDULING problem, choose the activity with the highest value to time ratio.
3. In the MATRIXCHAIN problem, greedily parenthesize the two matrices that have the maximum middle dimension. Here, the middle dimension refers to k when multiplying matrices A with dimension n by k and B with k by m .
4. In the RODCUTTING problem, cut the rod into as many pieces of the highest price to length ratio.

❖ Problem 2

Problem (COINCHANGE).

INPUT: n cents of change to make using the smallest number of coins from a list $\{C_1, C_2, \dots, C_k\}$ of coin values.

OUTPUT: The smallest number of coins that can be used to make the target amount n .

1. Suppose we need to make 72 cents of change using coins with values $\{1, 5, 10, 25\}$ (penny, nickel, dime, quarter). Find the smallest number of these coins that can be used to create the target value of change.
2. Describe a greedy algorithm to make change consisting using coins with values $\{1, 5, 10, 25\}$ (penny, nickel, dime, quarter). State the greedy choice that you are making, and prove that this choice yields an optimal solution.
3. Suppose that the available coins have values that are powers of 2, starting from $2^0 = 1$ up to $2^{10} = 1024$. Show that the greedy algorithm always yields an optimal solution.
4. Give a list of coin values that does not yield an optimal solution if you make the same greedy choice stated in part 2. The list should include a coin with value 1. Justify your response by showing a counter example where the choice yields a suboptimal solution.

❖ Leetcode

Here is a sample of some Leetcode problems related to greedy algorithms that you should be able to start attempting now. As mentioned at the beginning of class, set a timer to try solving these on your own, then once the timer is up check a solution and try to understand why that works.

For any solution you write, try to justify why your proposed greedy strategy will work for the algorithm.

- Longest Palindrome [Easy]

<https://leetcode.com/problems/longest-palindrome/description/>

- Container with Most Water [Medium]

<https://leetcode.com/problems/container-with-most-water/description/>

- Create Maximum Number [Hard]

<https://leetcode.com/problems/create-maximum-number/description/>

- Candy [Hard]

<https://leetcode.com/problems/candy/description/>