Greedy Algorithms with Sorting

https://usaco.guide/silver/greedy-sorting

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Greedy and Sorting

- Recall that a greedy algorithm is one that repeatedly uses a local optimum.
  - For example, consider the Coin Change Problem with US denominations.
    - The local optimum is the largest coin you can take, which is repeatedly taken in greedy problems.
- In certain greedy problems, sorting the given input by some quantity will make it easy to see what that local optimum is.

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Greedy with Sorting Example Problem 1

Codeforces - Studying Algorithms

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Solution Sketch

- Intuitively, you want to study the least-time algorithms first.
- Sorting the algorithms by their time-to-learn makes this easy to do.
- `O(n log n)`

Solution Code

USACO Guide - Studying Algorithms

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Greedy with Sorting Example Problem 2

CSES - Movie Festival

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Solution Sketch

- Greedily choosing intervals in order of start time won’t work.
- But greedily choosing intervals in order of end time DOES work.
    - The end time is the “important” quantity because it determines how early until we are free to choose another movie.
- Sort the intervals by their end times, iterate over them in that order, and use them whenever possible.

Movie Festival Solution

USACO Guide - The Scheduling Problem

Greedy with Sorting Example Problem 3

CSES - Ferris Wheel

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Solution Sketch

- Greedily try to assign the heaviest and lightest children to a gondola.
- If this isn't possible, assign only the heaviest child to a gondola.
- Repeat this process until finished.

Greedy with Sorting Challenge Problems

Stick Divisions

USACO - Berry Picking

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