Week 3 - Greedy, recursive and DP algorithms

Goals

By the end of this week, students should be able to:

- write simple recursive algorithms,
- use memoization and/or dynamic programming to improve the run-time of their recursive solutions,
- Notice when sorting and searching (in particular binary searching) are the right tools/algorithms,
- and to do sorting and searching with ease in their programming language of choice.

Topics

- Greedy algorithms
- Binary search
- Sorting
- Recursion and memoization
- Dynamic programming

Reading and videos

- https://www.coursera.org/learn/algorithms-greedy
- https://www.khanacademy.org/computing/computer-science/algorithms/binary-search/a/binary-search
- https://medium.freecodecamp.org/follow-these-steps-to-solve-any-dynamic-programming-interview-problem-cc98e508cd0e
- https://medium.freecodecamp.org/demystifying-dynamic-programming-3efafb8d4296
- https://hackernoon.com/dynamic-programming-python-80f944aa6e6c
- https://www.scribd.com/doc/234807254/Learn-Regex-the-Hard-Way
- https://twitter.com/s0md3v/status/1171394403065155584
- JavaScript Resources:
  - https://dev.to/fernandoblima/tree-and-binary-search-tree-data-structure-algorithm-part-v-1pmo

Coding exercises

- Greedy algorithms
  - https://leetcode.com/problems/lemonade-change
  - https://leetcode.com/problems/assign-cookies
  - https://leetcode.com/problems/is-subsequence
  - https://leetcode.com/problems/minimum-number-of-arrows-to-burst-balloons

    - (A bit harder) https://leetcode.com/problems/partition-labels
- Binary search
    - https://leetcode.com/problems/binary-search
    - https://leetcode.com/problems/peak-index-in-a-mountain-array
- Sorting
    - https://leetcode.com/problems/valid-anagram
    - https://leetcode.com/problems/array-partition-i
    - https://leetcode.com/problems/merge-intervals
    - Use sorting, not a multiset (we will look at multisets next week!): https://leetcode.com/problems/find-all-anagrams-in-a-string
- Simple recursion
    - https://leetcode.com/problems/powx-n
- Recursion and memoization (make sure you use memoization for the problems below)
    - https://leetcode.com/problems/best-time-to-buy-and-sell-stock
    - https://leetcode.com/problems/edit-distance
    - https://leetcode.com/problems/house-robber-ii
    - Do not use a built-in regex for this one! https://leetcode.com/problems/regular-expression-matching/
- Dynamic Programming (same problems but use dynamic programming now!)
    - https://leetcode.com/problems/powx-n
    - https://leetcode.com/problems/best-time-to-buy-and-sell-stock
    - https://leetcode.com/problems/edit-distance
    - https://leetcode.com/problems/house-robber-ii
    - Do not use a built-in regex for this one! https://leetcode.com/problems/regular-expression-matching/