

Coin Change Problem

The type of algorithm sorting/ranking and picking the best to worst in order is called a greedy algorithm.

Write proof to show an algorithm is optimal, make counterexample to show algorithm is not optimal.

Greedy algorithm is not optimal for all currencies.

Depending on the currency, greedy does not return the optimal solution but it is fast.

Dynamic Programming

To solve the coin change problem for $x=30$, we solve all the problems leading to it starting at $x=1$. As we solve each problem, we reuse the results of the problems that have already been solved.

Dynamic programming returns the optimal solution for the coin problem no matter the currency.

We are looping from 1 penny to n pennies, therefore total running time is $O(c * n)$, or $O(n)$. The algorithm is still very fast, even though it requires reusing the results from previous problems. We can prove it is optimal by strong induction.