COIN CHANGING

Coin exchange problem is nothing but finding the minimum number of coins (of certain denominations) that add up to a given amount of money.

Make-Change(x,c,num_coins)
for i := 1 to num_coins do
num[i] := 0
for i := num_coins downto 1 do
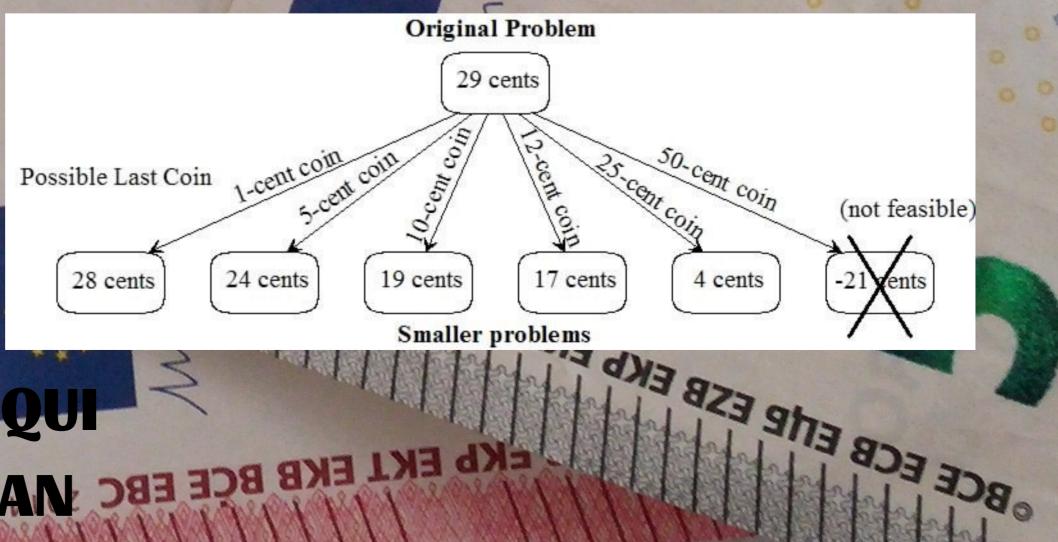while x >= c[i] do
num[i] := num[i] + 1
x := x - c[i]
return num

TLet's consider pennies and nickels. At most, I can use 4 pennies because any number larger than 4 pennies would be replaced by at least 1 nickel. This operation would reduce the total coin number by 4. In other words, when the remainder is greater than 5 and I'm allowed to use only pennies and nickels, I would use as many nickels as possible before considering pennies.

The greedy algorithm always provides a solution but doesn't guarantee the smallest number of coins used. The greedy algorithm takes O(nk) for any kind of coin set denomination, where k is the number of different coins in a particular set.

Make it Count in O(n)

Original Problem

29 cents

Possible Last Coin

1-cent coin — 28 cents
5-cent coin — 24 cents
10-cent coin — 19 cents
12-cent coin — 17 cents
25-cent coin — 4 cents
50-cent coin (not feasible) — -21 cents

Smaller problems

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