Greedy Algorithm in Coin Change

Understanding the greedy approach to solve the coin change problem.

What is the Coin Change Problem?

Given an amount and a set of coin denominations, determine the minimum number of coins needed to make that amount.

Greedy Strategy

1. Sort denominations in descending order.
2. Pick the largest coin <= amount.
3. Subtract and repeat until amount is 0.

Example: Indian Currency

Denominations: {500, 200, 100, 50, 20, 10, 5, 2, 1}

Amount: 880

Steps:

500 -> 200 -> 100 -> 50 -> 20 -> 10

Total Coins = 6

Why Greedy Works Here

Indian currency is canonical.

Greedy always gives the minimum number of coins.

When Greedy Fails

Non-canonical example:

Denominations: {9, 6, 1}, Amount: 11

Greedy: 9 + 1 + 1 = 3 coins

Optimal: 6 + 6 = 2 coins

Conclusion

Greedy is fast and simple (O(n))

Ideal for canonical systems like INR, USD

For non-canonical systems, use Dynamic Programming.