



Design and Analysis of Algorithms

Unit -4

Bharathi R

Department of Computer Science & Engineering

DESIGN AND ANALYSIS OF ALGORITHMS

Unit 4: Greedy Technique

Bharathi R

Department of Computer Science & Engineering

The greedy approach suggests constructing a solution through a sequence of steps, each expanding a partially constructed solution obtained so far, until a complete solution to the problem is reached. On each step, the choice made must be:

- feasible*: it has to satisfy the problem's constraints
- locally optimal*: it has to be the best local choice among all feasible choices available on that step
- *irrevocable*: once decision was made, it cannot be changed on subsequent steps of the algorithm

Design and Analysis of Algorithms

Examples of Greedy Algorithms:



- Coin-change problem
- Minimum Spanning Tree (MST)
 - Prim's Algorithm
 - Kruskal's Algorithm
- Single-source shortest paths
 - Dijkstra's Algorithm
- Huffman codes

A greedy algorithm to find the minimum number of coins for making the change of a given amount of money. Usually, this problem is referred to as the change-making problem.

- In the change-making problem, we're provided with an array, $D = \{d_1, d_2, d_3, \dots, d_m\}$ of m distinct coin denominations.
- Now we need to find an array(subset) s having minimum number of coins that add up to a given amount of money n , provided that there exists a viable solution.
- Let's consider a real-life example for a better understanding of the change-making problem.
- Let's assume that we're working at a cash counter and have an infinite supply of $D = \{1, 2, 5, 10\}$ valued coins.
- A person buys things worth **Rs. 72** and gives a **Rs. 100** bill. How does the cashier give change for **Rs. 28**?
















Design and Analysis of Algorithms

Change Making Problem



Change-making problem:
How can a given amount of money be made with the least number of coins of given denominations?

Example:
Change for Rs. **28**

Option	Chosen Coins
$28-10 = 18$	
$18-10 = 8$	 
$8-5 = 3$	  
$3-2 = 1$	   
$1-1 = 0$	    

Design and Analysis of Algorithms

Change Making Problem

Iteration 1
D = {1,2,5,10}
n = 28 and i=4

Select D[3] = 10 as $28 \geq 10$
Decrease n by 10 (n= 18)
Add 10 to set S = {10}

Iteration 2
D = {1,2,5,10}
n = 18 and i=3

Select D[3] = 10 as $18 \geq 10$
Decrease n by 10 (n= 8)
Add 10 to set S = {10, 10}

Iteration 3
D = {1,2,5,10}
n = 8 and i=2

Select D[2] = 5 as $8 \geq 5$
Decrease n by 5 (n= 3)
Add 5 to set S = {10, 10, 5}

Iteration 4
D = {1,2,5,10}
n = 3 and i=1

Select D[1] = 2 as $3 \geq 2$
Decrease n by 2 (n= 1)
Add 2 to set S = {10, 10, 5, 2}

Iteration 5
D = {1,2,5,10}
n = 1 and i=0

Select D[0] = 1 as $1 \geq 1$
Decrease n by 1 (n= 0)
Add 1 to set S = {10, 10, 5, 2, 1}

The ***greedy technique*** suggests constructing a solution to an optimization problem through a sequence of steps, each expanding a partially constructed solution obtained so far, until a complete solution to the problem is reached.

On each step, the choice made must be ***feasible, locally optimal***, and ***irrevocable***.

Design and Analysis of Algorithms

Text Books

Chapter 9 ,Introduction to The Design and Analysis of Algorithms by Anany Levitin





THANK YOU

Bharathi R

Department of Computer Science & Engineering

rbharathi@pes.edu