15. Problem Statement: Change Making Algorithm

**Problem Analysis:**

The change-making problem, also known as minimum coin change problem, addresses the question of finding the minimum number of coins (of certain denominations) that add up to a given amount of money. It is a knapsack type problem, and has applications wider than just currency.

It is also the most common variation of the coin change problem, a general case of partition in which, given the available denominations of an infinite set of coins, the objective is to find out the number of possible ways of making a change for a specific amount of money, without considering the order of the coins.

Given a value V, if we want to make change for V Rs, and we have infinite supply of each of the denominations in Indian currency, i.e., we have infinite supply of { 1, 2, 5, 10, 20, 50, 100, 500, 1000} valued coins/notes.

V = 70

We need a 50 Rs note and a 20 Rs note.

**Algorithm:**

MAKE-CHANGE (n)

C ← {100, 25, 10, 5, 1} *// constant.*

Sol ← {}; *// set that will hold the solution set.*

Sum ← 0 sum of item in solution set

WHILE sum not = n

x = largest item in set C such that sum + x ≤ n

IF no such item THEN

RETURN "No Solution"

S ← S {value of x}

sum ← sum + x

RETURN S

**Source Code:**

#include <bits/stdc++.h>

using namespace std;

int notes[5000];

int n = 5;

void CoinChange(int v)

{

vector<int> ans, res;

int cnt, xam = 10000000000;

int V = v;

for(int p = n-1; p >= 0; p--)

{

cnt = 0;

V = v;

for(int i = p; i>=0; i--)

{

while (V >= notes[i])

{

V -= notes[i];

ans.push\_back(notes[i]);

cnt++;

}

}

if(xam>cnt&&V==0)

{

xam = cnt;

res = ans;

}

ans.clear();

}

for (int i = 0; i < res.size(); i++)

cout << res[i] << " ";

}

int main()

{

int x;

cout<<"Please enter the number of notes: ";

cin>>n;

cout<<"\nEnter the nodes:\n";

for(int i = 0; i < n; i++) cin>>notes[i];

sort(notes, notes+n);

cout<<"\nPlease enter amount to make changes: ";

cin>>x;

cout << "\nMinimal number of change for " << x << " is ";

CoinChange(x);

cout<<endl;

return 0;

}

**Sample Input:**

Please enter the number of notes: 7

Enter the nodes: 1 2 4 5 7 9 11

Please enter amount to make changes: 6

**Sample Output:**

Minimal number of change for 6 is 5 1