

Ex. No: 3

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Register No.: 230701360

Name: Tejushree sanjeevikumar

Greedy Algorithm

3.a. 1-G-Coin Problem

Aim: Write a program to take value V and 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, what is the minimum number of coins and/or notes needed to make the change.

Input Format:

Take an integer from stdin.

Output Format:

print the integer which is change of the number.

Example Input :

64

Output:

4

Explanaton:

We need a 50 Rs note and a 10 Rs note and two 2 rupee coins.

Algorithm:

```
void function(int n){
```

```
    set count = 0
```

```
    increment count by 1
```

```
    read n from input
```

increment count by 1

set rev = 0

set remainder = 0

increment count by 1

while n != 0:

 increment count by 1

 set remainder = n % 10

 increment count by 1

 set rev = rev * 10 + remainder

 increment count by 1

 set n = n / 10

 increment count by 1

increment count by 1

print count

}Program:

```
#include<stdio.h>
```

```
int main()
```

```
{
```

```
    int v,a=0;
```

```
    scanf("%d",&v);
```

```
    if((v/1000)!=0)
```

```
    {
```

```
        a+=v/1000;
```

```
        v=v%1000;
```

```
    }
```

```
if((v/500)!=0)
```

```
{
```

```
    a+=v/500;
```

```
    v=v%500;
```

```
}
```

```
if((v/100)!=0)
```

```
{
```

```
    a+=v/100;
```

```
    v=v%100;
```

```
}
```

```
if((v/50)!=0)
```

```
{
```

```
    a+=v/50;
```

```
    v=v%50;
```

```
}
```

```
if((v/20)!=0)
```

```
{
```

```
    a+=v/20;
```

```
    v=v%20;
```

```
}
```

```
if((v/20)!=0)
```

```
{
```

```
    a+=v/20;
```

```
    v=v%20;
```

```
}
```

```
if((v/10)!=0)
```

```
{
```

```
    a+=v/10;
```

```

        v=v%10;
    }
    if((v/5)!=0)
    {
        a+=v/5;
        v=v%5;
    }
    if((v/2)!=0)
    {
        a+=v/2;
        v=v%2;
    }
    if((v/1)!=0)
    {
        a+=v/1;
        v=v%1;
    }
    printf("%d",a);

```

}Output:

	Input	Expected	Got	
✓	49	5	5	✓

3.b. 2-G-Cookies Problem

Aim:

Assume you are an awesome parent and want to give your children some cookies. But, you should give each child at most one cookie.

Each child i has a greed factor $g[i]$, which is the minimum size of a cookie that the child will be content with; and each cookie j has a size $s[j]$. If $s[j] \geq g[i]$, we can assign the cookie j to the child i , and the child i will be content. Your goal is to maximize the number of your content children and output the maximum number.

Example 1:

Input:

3

1 2 3

2

1 1

Output:

1

Explanation: You have 3 children and 2 cookies. The greed factors of 3 children are 1, 2, 3.

And even though you have 2 cookies, since their size is both 1, you could only make the child whose greed factor is 1 content.

You need to output 1.

Constraints:

$1 \leq g.length \leq 3 \cdot 10^4$

$0 \leq s.length \leq 3 \cdot 10^4$

$1 \leq g[i], s[j] \leq 2^{31} - 1$

Algorithm:

```
void function(int c, int cs){  
    set count = 0
```

```

read c from input
read cs from input

create array g of size c
create array s of size cs

for i = 0 to c - 1:
    read g[i] from input

for j = 0 to cs - 1:
    read s[j] from input

for i = 0 to c - 1:
    for j = 0 to cs - 1:
        if g[i] >= s[j]:
            increment count by 1
            break

print count
}

```

Program:

```

#include<stdio.h>

int main()
{
    int c,cs,count=0;
    scanf("%d",&c);
    int g[c];
    scanf("%d",&cs);
    int s[cs];
    for(int i=0;i<c;i++)

```

```

{
    scanf("%d",&g[i]);
}
for(int j=0;j<cs;j++)
{
    scanf("%d",&s[j]);
}
for(int i=0;i<c;i++)
{
    for(int j=0;j<cs;j++)
    {
        if(g[i]>=s[j])
        {
            count+=1;
            break;
        }
    }
}
printf("%d",count);
}

```

Output:

	Input	Expected	Got	
✓	2	2	2	✓
	1 2			
	3			
	1 2 3			

3.c. 3-G-Burger Problem

Aim:

A person needs to eat burgers. Each burger contains a count of calorie. After eating the burger, the person needs to run a distance to burn out his calories.

If he has eaten i burgers with c calories each, then he has to run at least $3^i * c$ kilometers to burn out the calories. For example, if he ate 3

burgers with the count of calorie in the order: [1, 3, 2], the kilometers he needs to run are $(3^0 * 1) + (3^1 * 3) + (3^2 * 2) = 1 + 9 + 18 = 28$.

But this is not the minimum, so need to try out other orders of consumption and choose the minimum value. Determine the minimum distance

he needs to run. Note: He can eat burger in any order and use an efficient sorting algorithm. Apply greedy approach to solve the problem.

Input Format

First Line contains the number of burgers

Second line contains calories of each burger which is n space-separate integers

Output Format

Print: Minimum number of kilometers needed to run to burn out the calories

Sample Input

```
3
5 10 7
```

Sample Output

```
76
```

Algorithm:

```
void function(int n){
```

```
    set f = 0
```

```
    read n from input
```

```
    create array a of size n
```

```
    for i = 0 to n - 1:
```

```
        read a[i] from input
```

```

set temp = 0
for i = 0 to n - 1:
    for j = 0 to n - 2:
        if a[i] > a[j]:
            set temp = a[j]
            set a[j] = a[j + 1]
            set a[j + 1] = temp

```

```

set f = 0
for i = 0 to n - 1:
    set d = (int)pow(n, i)
    set e = d * a[i]
    increment f by e

```

```

print f

```

}Program:

```

#include<stdio.h>
#include<math.h>
int main()
{
    int n;
    scanf("%d",&n);
    int a[n];
    for(int i=0;i<n;i++)
    {
        scanf("%d",&a[i]);
    }
}

```

```

int temp;
for(int i=0;i<n;i++)
{
    for(int j=0;j<n-1;j++)
    {
        if(a[i]>a[j])
        {
            temp=a[j];
            a[j]=a[j+1];
            a[j+1]=temp;
        }

    }
}

int f=0,e,d;
for(int i=0;i<n;i++)
{
    d=(int)pow(n,i);
    e=d*a[i];
    f=f+e;
}

printf("%d",f);
}

```

Output:

	Test	Input	Expected	Got	
✓	Test Case 1	3 1 3 2	18	18	✓
✓	Test Case 2	4 7 4 9 6	389	389	✓
✓	Test Case 3	3 5 10 7	76	76	✓

3.d. 4-G-Array Sum Max Problem

Aim:

Given an array of N integer, we have to maximize the sum of $arr[i] * i$, where i is the index of the element ($i = 0, 1, 2, \dots, N$). Write an algorithm based on Greedy technique with a Complexity $O(n \log n)$.

Input Format:

First line specifies the number of elements-n

The next n lines contain the array elements.

Output Format:

Maximum Array Sum to be printed.

Sample Input:

5

2 5 3 4 0

Sample output:

40

Algorithm:

```
void function(int n){
```

```
    set c = 0
```

```
    read n from input
```

```
    create array a of size n
```

```
    for i = 0 to n - 1:
```

```
        read a[i] from input
```

```
    set temp = 0
```

```
    for i = 0 to n - 1:
```

```
        for j = 0 to n - 2:
```

```
    if a[j] > a[j + 1]:  
        set temp = a[j]  
        set a[j] = a[j + 1]  
        set a[j + 1] = temp
```

```
set c = 0
```

```
for i = 0 to n - 1:
```

```
    set d = a[i] * i
```

```
    increment c by d
```

```
print c
```

```
}
```

Program:

```
#include<stdio.h>
```

```
int main()
```

```
{
```

```
    int n,c=0;
```

```
    scanf("%d",&n);
```

```
    int a[n];
```

```
    for(int i=0;i<n;i++)
```

```
    {
```

```
        scanf("%d",&a[i]);
```

```
    }
```

```
    int temp;
```

```
    for(int i=0;i<n;i++)
```

```
    {
```

```
        for(int j=0;j<n-1;j++){
```

```
            if(a[j]>a[j+1]){
```

```
                temp=a[j];
```

```
        a[j]=a[j+1];  
        a[j+1]=temp;  
    }  
}  

```

```
for(int i=0;i<n;i++)  
{  
    int d=a[i]*i;  
    c=c+d;  
}  
printf("%d",c);
```

}Output:

	Input	Expected	Got	
✓	5 2 5 3 4 0	40	40	✓
✓	10 2 2 2 4 4 3 3 5 5 5	191	191	✓
✓	2 45 3	45	45	✓

3.e. 5-G-Product of Array Elements-Minimum

Aim:

Given two arrays array_One[] and array_Two[] of same size N. We need to first rearrange the arrays such that the sum of the product of pairs(1 element from each) is minimum. That is $\text{SUM}(A[i] * B[i])$ for all i is minimum.

Algorithm:

```
void function(int n){  
    set c = 0  
    set temp = 0  
    read n from input  
  
    create array a of size n  
    create array b of size n  
  
    for i = 0 to n - 1:  
        read a[i] from input  
  
    for i = 0 to n - 1:  
        read b[i] from input  
  
    for i = 0 to n - 1:  
        for j = 0 to n - 2:  
            if a[j] < a[j + 1]:  
                set temp = a[j]  
                set a[j] = a[j + 1]  
                set a[j + 1] = temp
```

```

for i = 0 to n - 1:
    for j = 0 to n - 2:
        if b[j] > b[j + 1]:
            set temp = b[j]
            set b[j] = b[j + 1]
            set b[j + 1] = temp

```

```

set c = 0
for i = 0 to n - 1:
    set s = a[i] * b[i]
    increment c by s

```

```

print c

```

}Program:

```

#include<stdio.h>

int main()
{
    int n,c=0,temp;
    scanf("%d",&n);
    int a[n];
    int b[n];
    for(int i=0;i<n;i++)
    {
        scanf("%d",&a[i]);
    }
    for(int i=0;i<n;i++)
    {
        scanf("%d",&b[i]);
    }

```

```

}

for(int i=0;i<n;i++)
{
    for(int j=0;j<n-1;j++){
        if(a[j]<a[j+1]){
            temp=a[j];
            a[j]=a[j+1];
            a[j+1]=temp;
        }
    }
}

for(int i=0;i<n;i++)
{
    for(int j=0;j<n-1;j++){
        if(b[j]>b[j+1]){
            temp=b[j];
            b[j]=b[j+1];
            b[j+1]=temp;
        }
    }
}

for(int i=0;i<n;i++)
{
    int s=a[i]*b[i];
    c=c+s;
}

printf("%d",c);
}

```

Output:

	Input	Expected	Got	
✓	3 1 2 3 4 5 6	28	28	✓
✓	4 7 5 1 2 1 3 4 1	22	22	✓
✓	5 20 10 30 10 40 8 9 4 3 10	590	590	✓