03 - Greedy Algorithms

Ex. No. : 3.1 **Date: 26.08.24**

Register No.: 230701373 **NameSP Varun**

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:

Step 1: Start

Step 2: Initialize an array currency with denominations and read the value of n from the user.

Step 3: Initialize a variable count to 0 and a variable j to 0.

Step 4: Use a while loop to find the first denomination in currency that is less than or equal to n.

Step 5: While n is not 0, check if the current currency[j] is less than or equal to n. If true, update count by adding the integer division of n by currency[j], then update n using the remainder of that division. Increment j.

Step 6: Print the value of count, which represents the total number of currency notes/coins used.

Step 7: End

PROGRAM:

```
#include<stdio.h>

int main()

{

    int currency[]={1000,500,100,50,20,10,5,2,1};

    int n,count=0; scanf("%d",&n); int j = 0;

    while(currency[j]>n){ j++;

        }

        while(n!=0){

            if(currency[j]<n){

            count+=n/currency[j];

            n=n%currency[j];
```

```
            }
            j++;
        }
    printf("%d",count);
}
```

OUTPUT:

	Input	Expected	Got	
✔	49	5	5	✔

Passed all tests! ✔

Correct

Marks for this submission: 1.00/1.00.

RESULT:

Hence the above program has been executed successfully.

Ex. No. : 3.2 **Date: 26.08.24**

Register No.: 230701373 **NameSP Varun**

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] >= 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.

ALGORITHM:

Step 1: Start

Step 2: Read the value of c (the number of groups) from the user. Initialize an array g of size c and read c values into it.

Step 3: Read the value of n (the number of elements) from the user. Initialize an array s of size n and read n values into it.

Step 4: Initialize a variable count to 0.

Step 5: Use a nested loop to compare each element in g with elements in s. If any s[j] is greater than or equal to g[i], increment count and break the inner loop.

Step 6: Print the value of count, representing the number of successful comparisons.

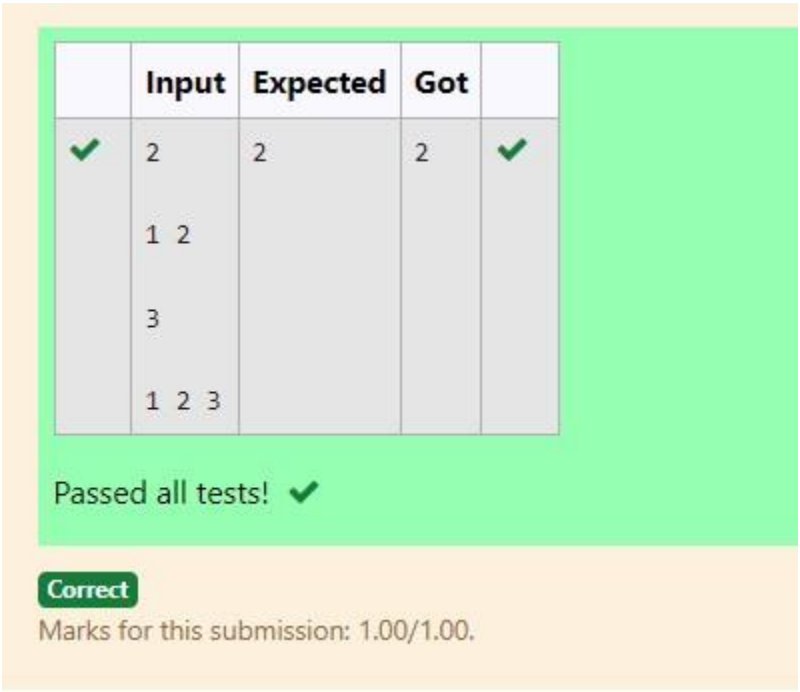
Step 7: End

PROGRAM:

```
#include<stdio.h> int

main(){ int c,n,count=0;

scanf("%d",&c); int g[c];

for(int i=0;i<c;i++) {

scanf("%d",&g[i]);} int

s[n]; scanf("%d",&n);

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

scanf("%d",&s[i]);}

for(int i=0;i<c;i++){

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

if(s[j]>=g[i]){
```

```
            count++;
            break;
        }}}
    printf("%d",count);
}
```

OUTPUT:



RESULT:

Hence the above program has been executed successfully.

Ex. No. : 3.3 **Date: 26.08.24**

Register No.: 230701373 **NameSP Varun**

AIM:

A person needs to eat burgers. Each burger contains a count of calories. 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 burgers 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-separated 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:

Step 1: Start

Step 2: Read the value of n from the user and initialize an array cal of size n. Read n values into the array.

Step 3: Use a nested loop to sort the array cal in descending order using the bubble sort algorithm.

Step 4: Initialize a variable s to 0.

Step 5: Loop through the sorted array and calculate the value of s by summing pow(n, i) * cal[i] for each index i.

Step 6: Print the value of s.

Step 7: End

PROGRAM:

```
#include<stdio.h>

#include<math.h>

int main()

{

    int n,km=0;

    scanf("%d",&n);

    int cal[n]; for(int

    i=0;i<n;i++)
```

```
{
    scanf("%d",&cal[i]);
}
for(int i=0;i<n-1;i++)
{
    for(int j=0;j<n-i-1;j++)
    { if(cal[j]<cal[j+1])
      {
          int temp=cal[j];
          cal[j]=cal[j+1];
          cal[j+1]=temp;
      }
    }
}
for(int i=0;i<n;i++)
{
    km+=pow(n,i)*cal[i];
}
printf("%d",km);
```

}

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	✔

Passed all tests! ✔

Correct

Marks for this submission: 1.00/1.00.

RESULT:

Hence the above program has been executed successfully.

Ex. No. : 3.4 **Date: 26.08.24**

Register No.: 230701373 **NameSP Varun**

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, ..., N).Write an algorithm based on Greedy technique with a Complexity O(nlogn).

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:

Step 1: Start

Step 2: Read the value of n from the user and initialize an array arr of size n. Read n values into the array.

Step 3: Use the qsort function to sort the array arr in ascending order by calling the compare function.

Step 4: Initialize a variable s to 0.

Step 5: Loop through the sorted array and calculate the value of s by summing arr[i] * i for each index i.

Step 6: Print the value of s.

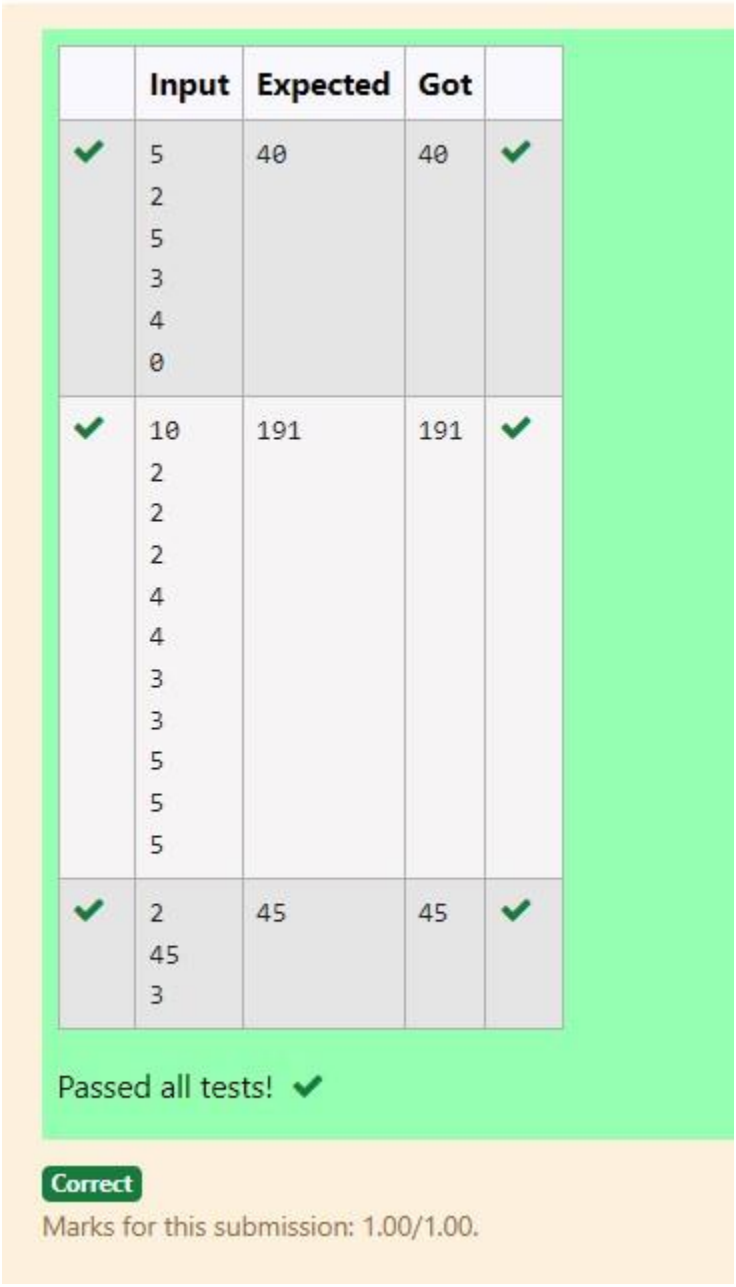
Step 7: End

PROGRAM:

```
#include<stdio.h>
int main()
{
    int n,sum=0;
    scanf("%d",&n);
    int arr[n]; for(int
    i=0;i<n;i++){
    scanf("%d",&arr[i]
    );
    }for(int i=1;i<n;i++){ int j=i; int
        temp=arr[j]; while(j>0 &&
        arr[j-1]>temp){
            arr[j]=arr[j-1];
            j--;
        }
        arr[j]=temp;}
    for(int i=0;i<n;i++){
    sum+=arr[i]*i;
```

```
    }
    printf("%d",sum);
}
```

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	✔

Passed all tests! ✔

Correct

Marks for this submission: 1.00/1.00.

RESULT:

Hence the above program has been executed successfully.

Ex. No. : 3.5 **Date: 26.08.24**

Register No.: 230701373 **NameSP Varun**

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 SUM (A[i] * B[i]) for all i is minimum.

For example:

Input	RESULT
3 1 2 3 4 5 6	28

ALGORITHM:

Step 1: Start

Step 2: Read the value of n from the user and initialize two arrays, arr1 and arr2, each of size n. Read n values into both arrays.

Step 3: Use the qsort function to sort arr1 in ascending order using compare1 and arr2 in descending order using compare2.

Step 4: Initialize a variable s to 0.

Step 5: Loop through both sorted arrays and calculate the value of s by summing arr1[i] * arr2[i] for each index i.

Step 6: Print the value of s.

Step 7: End

PROGRAM:

```
#include<stdio.h>
void sort(int a[],int x)
{
   for(int i=1;i<x;i++)
   {
      int j=i; int temp=a[j];
      while(j>0 && a[j-1]>temp)
      { a[j]=a[j-1];
         j--;
      }
      a[j]=temp;
   }
}
int main()
{
   int n,sum=0;
```

```
    scanf("%d",&n);
    int a[n],b[n];
    for(int i=0;i<n;i++)
    {
        scanf("%d",&a[i]);
    }
    for(int i=0;i<n;i++)
    {
        scanf("%d",&b[i]);
    } sort(a,n);
    sort(b,n); for(int
    i=0;i<n;i++)
    {
        sum+=a[i]*b[n-i-1];
    }
    printf("%d",sum);
}
```

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	✔

Passed all tests! ✔

Correct

Marks for this submission: 1.00/1.00.

RESULT:

Hence the above program has been executed successfully.