
Ex. No: 6 **Date: 17.09.24**

Register No.: 230701502 **Name: Guru Raja T**

Competitive Programming

6.a. Finding Duplicates-O(n^2) Time Complexity (1) Space Complexity

Aim: Find Duplicate in Array.

Given a read only array of n integers between 1 and n, find one number that repeats.

Input Format:

First Line - Number of elements

n Lines - n Elements

Output Format:

Element x - That is repeated

Algorithm:

```
function main()
{
   initialize n  // Number of elements in the array
   read n from user

   initialize arr[n]  // Array to hold input values

   // Read values into the array
   for i from 0 to n - 1
   {
```

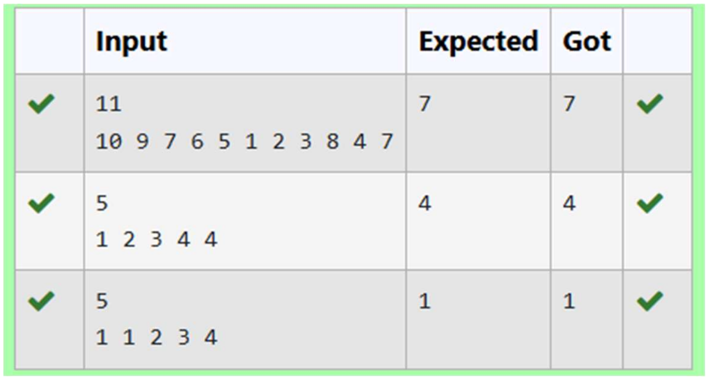

```
        read arr[i] from user
    }

    flag = 0  // Initialize a flag to indicate if a duplicate is found

    // Search for the first duplicate element
    for i from 0 to n - 1
    {
        el1 = arr[i]  // Current element

        for j from 0 to n - 1
        {
            // Check for duplicates and ensure indices are different
            if el1 == arr[j] and i != j
            {
                print el1  // Print the duplicate element
                flag = 1  // Set flag to indicate a duplicate was found
                break  // Exit inner loop
            }
        }

        if flag
            break  // Exit outer loop if a duplicate was found
    }
}
```

Program:

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

```
int main(){
   int n;
   scanf("%d",&n);
   int arr[n];
   for(int i=0;i<n;i++){
      scanf("%d ",&arr[i]);
   }

   int flag=0;
   for(int i=0;i<n;i++){
      int el1=arr[i];

      for(int j=0;j<n;j++){
         if (el1==arr[j] && i!=j){
            printf("%d",el1);
            flag=1;
            break;
         }
      }
      if(flag)
      break;

   }
}
```

Output:



	Input	Expected	Got	
✓	11 10 9 7 6 5 1 2 3 8 4 7	7	7	✓
✓	5 1 2 3 4 4	4	4	✓
✓	5 1 1 2 3 4	1	1	✓

6.b. Finding Duplicates-O(n) Time Complexity (1) Space Complexity

Aim: Find Duplicate in Array.

Given a read only array of n integers between 1 and n, find one number that repeats.

Input Format:

First Line - Number of elements

n Lines - n Elements

Output Format:

Element x - That is repeated

Algorithm:

```
function main()
{
  initialize n  // Number of elements in the array
  read n from user

  initialize a[n]  // Array to hold input values

  // Read values into the array
  for i from 0 to n - 1
  {
    read a[i] from user
  }

  initialize b[n]  // Array to keep track of seen elements
  for i from 0 to n - 1
  {
    b[i] = 0  // Initialize the tracking array
  }
```


```
  // Search for the first duplicate element
  for i from 0 to n - 1
  {
    // If the element is already present, i.e., b[a[i]] = 1
    if b[a[i]]
    {
      print a[i]  // Print the duplicate element
      break  // Exit the loop
    }
    else
    {
      b[a[i]] = 1  // Mark the element as seen
    }
  }
}
```

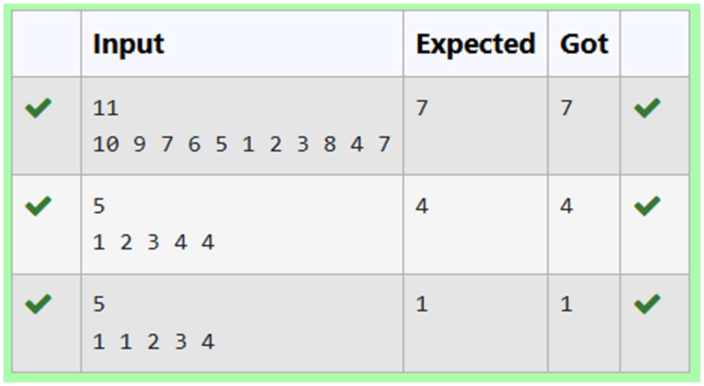
Program:

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



```
    b[i]=0;
  }
  for(int i=0;i<n;i++){
    //if el already present i.e, b[i]=1
    if(b[a[i]]){
      printf("%d",a[i]);
      break;
    }
    else
    b[a[i]]=1;
  }

}
```

Output:



	Input	Expected	Got	
✓	11 10 9 7 6 5 1 2 3 8 4 7	7	7	✓
✓	5 1 2 3 4 4	4	4	✓
✓	5 1 1 2 3 4	1	1	✓

6.c. Print Intersection of 2 sorted arrays-O(m*n)Time Complexity,O(1) Space Complexity

Aim:

Find the intersection of two sorted arrays.

OR in other words,

Given 2 sorted arrays, find all the elements which occur in both the arrays.

Input Format

- The first line contains T, the number of test cases. Following T lines contain:

1. Line 1 contains N1, followed by N1 integers of the first array
2. Line 2 contains N2, followed by N2 integers of the second array

Output Format

The intersection of the arrays in a single line

Example

Input:

1

3 10 17 57

6 2 7 10 15 57 246

Output:

10 57

Input:

1

6 1 2 3 4 5 6

2 1 6

Output:

1 6

Algorithm:

function main()

{


```
initialize n  // Number of test cases
read n from user

for i from 0 to n - 1
{
   initialize n1  // Size of the first array
   read n1 from user

   initialize arr1[n1]  // First array

   // Read values into the first array
   for j from 0 to n1 - 1
   {
      read arr1[j] from user
   }

   initialize n2  // Size of the second array
   read n2 from user

   initialize arr2[n2]  // Second array

   // Read values into the second array
   for j from 0 to n2 - 1
   {
      read arr2[j] from user
   }

   // Check for common elements in both arrays
   for j from 0 to n1 - 1
```

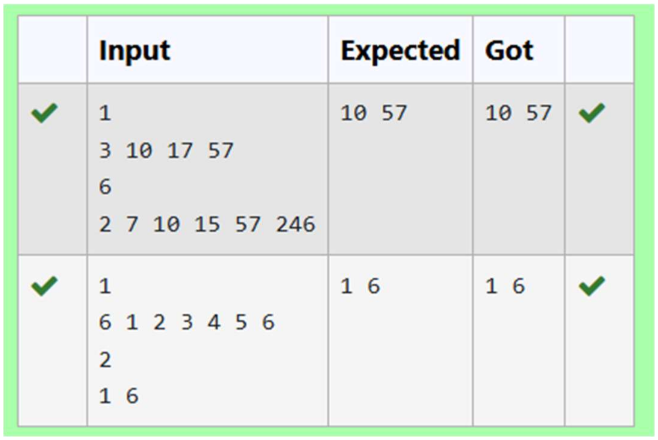

```
        {
            for k from 0 to n2 - 1
            {
                if arr1[j] == arr2[k]
                {
                    print arr1[j]  // Print the common element
                }
            }
        }
    }
}
```

Program:

```
#include<stdio.h>
int main(){
    int n;
    scanf("%d",&n);
    for(int i=0;i<n;i++){
        int n1;
        scanf("%d",&n1);
        int arr1[n1];
        for(int j=0;j<n1;j++){
            scanf("%d ",&arr1[j]);
        }
        int n2;
        scanf("%d",&n2);
        int arr2[n2];
        for(int j=0;j<n2;j++){
```


```
            scanf("%d ",&arr2[j]);
        }
        for(int j=0;j<n1;j++){
            for(int k=0;k<n2;k++){
                if(arr1[j]==arr2[k]){
                    printf("%d ",arr1[j]);
                }
            }
        }
    }

}
```

Output:



	Input	Expected	Got	
✓	1 3 10 17 57 6 2 7 10 15 57 246	10 57	10 57	✓
✓	1 6 1 2 3 4 5 6 2 1 6	1 6	1 6	✓

6.d. Print Intersection of 2 sorted arrays-O(m+n)Time Complexity,O(1) Space Complexity

Aim:

Find the intersection of two sorted arrays.

OR in other words,

Given 2 sorted arrays, find all the elements which occur in both the arrays.

Input Format

· The first line contains T, the number of test cases. Following T lines contain:

1. Line 1 contains N1, followed by N1 integers of the first array
2. Line 2 contains N2, followed by N2 integers of the second array

Output Format

The intersection of the arrays in a single line

Example

Input:

1

3 10 17 57

6 2 7 10 15 57 246

Output:

10 57

Input:

1

6 1 2 3 4 5 6

2 1 6

Output:

1 6

Algorithm:

function main()

{

```
initialize T  // Number of test cases
read T from user

while T > 0
{
  // Decrement the test case counter
  T--

  initialize n1, n2  // Sizes of the two arrays
  read n1 from user
  initialize arr1[n1]  // First array

  // Read values into the first array
  for i from 0 to n1 - 1
  {
    read arr1[i] from user
  }

  read n2 from user
  initialize arr2[n2]  // Second array

  // Read values into the second array
  for i from 0 to n2 - 1
  {
    read arr2[i] from user
  }

  initialize i = 0, j = 0  // Indices for both arrays
```

```
    // Iterate through both arrays to find common elements
    while i < n1 and j < n2
    {
      if arr1[i] < arr2[j]
      {
        i++  // Move to the next element in arr1
      }
      else if arr2[j] < arr1[i]
      {
        j++  // Move to the next element in arr2
      }
      else
      {
        print arr1[i]  // Print the common element
        i++  // Move to the next element in arr1
        j++  // Move to the next element in arr2
      }
    }

    print new line  // Move to the next line for output
  }
}
```

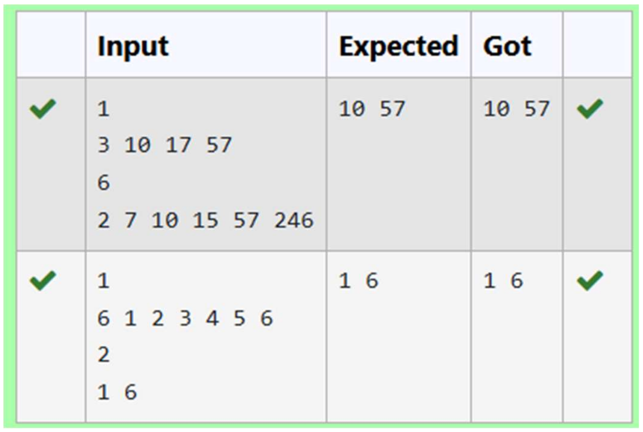
Program:

```
#include <stdio.h>

int main() {
```

```
int T;
scanf("%d", &T);
while (T--) {
    int n1, n2;

    scanf("%d", &n1);
    int arr1[n1];
    for (int i = 0; i < n1; i++) {
        scanf("%d", &arr1[i]);
    }

    scanf("%d", &n2);
    int arr2[n2];
    for (int i = 0; i < n2; i++) {
        scanf("%d", &arr2[i]);
    }

    int i = 0, j = 0;
    while (i < n1 && j < n2) {
        if (arr1[i] < arr2[j]) {
            i++;
        }
        else if (arr2[j] < arr1[i]) {
            j++;
        }
        else {
            printf("%d ", arr1[i]);
            i++;
            j++;
```

```
          }
       }
       printf("\n");
    }

}
```

Output:



	Input	Expected	Got	
✓	1 3 10 17 57 6 2 7 10 15 57 246	10 57	10 57	✓
✓	1 6 1 2 3 4 5 6 2 1 6	1 6	1 6	✓

6.e. Pair with Difference-O(n^2)Time Complexity,O(1) Space Complexity

Aim:

Given an array A of sorted integers and another non negative integer k, find if there exists 2 indices i and j such that A[j] - A[i] = k, i != j.

Input Format:

First Line n - Number of elements in an array

Next n Lines - N elements in the array

k - Non - Negative Integer

Output Format:

1 - If pair exists

0 - If no pair exists

Explanation for the given Sample Testcase:

YES as 5 - 1 = 4

So Return 1.

Algorithm:

```
function main()
{
  initialize n  // Number of elements in the array
  read n from user


  initialize arr[n]  // Array to hold input values


  // Read values into the array
  for i from 0 to n - 1
  {
    read arr[i] from user
  }
```

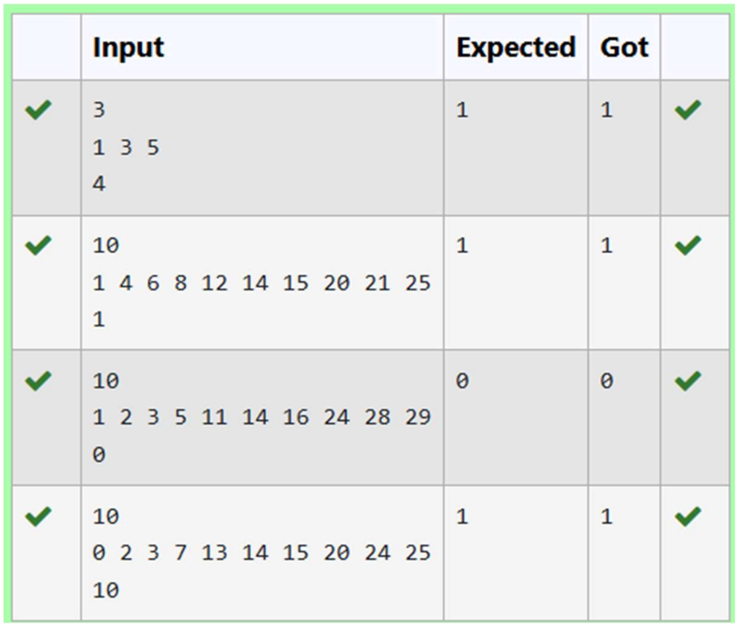
```
initialize t  // Target difference
read t from user

initialize flag = 0  // Flag to indicate if a pair is found

// Check for pairs with the specified difference
for i from 0 to n - 1
{
  for j from 0 to n - 1
  {
    if i != j and abs(arr[i] - arr[j]) == t
    {
      flag = 1  // Pair found
      break
    }
  }
  if flag
  {
    break
  }
}

// Output the result based on the flag
if flag
{
  print 1  // Pair found
}
else
```

```
  {
    print 0  // No pair found
  }

  return 0
}
```

Program:

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

int main() {
  int n;
  scanf("%d", &n);

  int arr[n];



  for (int i = 0; i < n; i++) {
    scanf("%d", &arr[i]);
  }

  int t;
  scanf("%d", &t);

  int flag = 0;

  for (int i = 0; i < n; i++) {
        for (int j = 0; j < n; j++) {
            if (i!=j && abs(arr[i] - arr[j]) == t) {
                flag = 1;
                break;
            }
        }
        if (flag) {
            break;
        }
    }

    if (flag) {
        printf("%d\n", 1);
    } else {
        printf("%d\n", 0);
    }

    return 0;
}
```

Output:



	Input	Expected	Got	
✓	3 1 3 5 4	1	1	✓
✓	10 1 4 6 8 12 14 15 20 21 25 1	1	1	✓
✓	10 1 2 3 5 11 14 16 24 28 29 0	0	0	✓
✓	10 0 2 3 7 13 14 15 20 24 25 10	1	1	✓

6.f. Pair with Difference -O(n) Time Complexity,O(1) Space Complexity

Aim: Given an array A of sorted integers and another non negative integer k, find if there exists 2 indices i and j such that A[j] - A[i] = k, i != j.

Input Format:

First Line n - Number of elements in an array

Next n Lines - N elements in the array

k - Non - Negative Integer

Output Format:

1 - If pair exists

0 - If no pair exists

Explanation for the given Sample Testcase:

YES as 5 - 1 = 4

So Return 1.

Algorithm:

```
function main()
{
  initialize n  // Number of elements in the array
  read n from user

  initialize arr[n]  // Array to hold input values

  // Read values into the array
  for i from 0 to n - 1
  {
    read arr[i] from user
  }
```

```
initialize t  // Target difference
read t from user


initialize flag = 0  // Flag to indicate if a pair is found


initialize i = 0  // First index
initialize j = 1  // Second index


// Loop to find pairs with the specified difference
while i < n and j < n
{
  diff = abs(arr[i] - arr[j])  // Calculate the difference


  if i != j and diff == t
  {
    flag = 1  // Pair found
    break
  }
  else if diff < t
  {
    j++  // Increment second index
  }
  else
  {
    i++  // Increment first index
  }
}


// Output the result based on the flag
```

```
   if flag
   {
      print 1  // Pair found
   }
   else
   {
      print 0  // No pair found
   }

   return 0
}
```

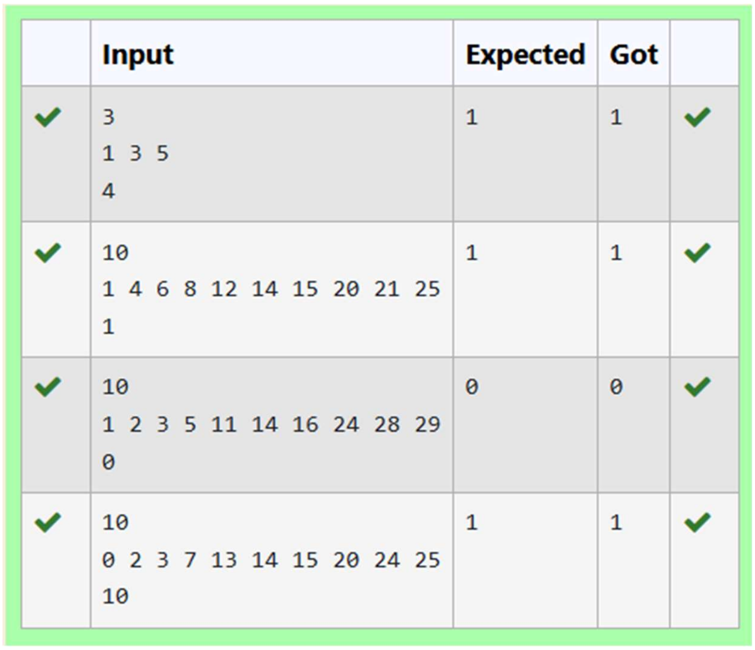
Program:

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

int main() {
   int n;
   scanf("%d", &n);

   int arr[n];



   for (int i = 0; i < n; i++) {
      scanf("%d", &arr[i]);
   }

   int t;
```

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

int flag = 0;

int i=0;
int j=1;
while(i<n && j<n){
    int diff = abs(arr[i] - arr[j]);
    if(i!=j && diff==t){
        flag=1;
        break;
    }
    else if(diff<t){
        j++;
    }
    else{
        i++;
    }

}



if (flag) {
    printf("%d\n", 1);
} else {
    printf("%d\n", 0);
}

return 0;
```

}

Output:



	Input	Expected	Got	
✓	3 1 3 5 4	1	1	✓
✓	10 1 4 6 8 12 14 15 20 21 25 1	1	1	✓
✓	10 1 2 3 5 11 14 16 24 28 29 0	0	0	✓
✓	10 0 2 3 7 13 14 15 20 24 25 10	1	1	✓