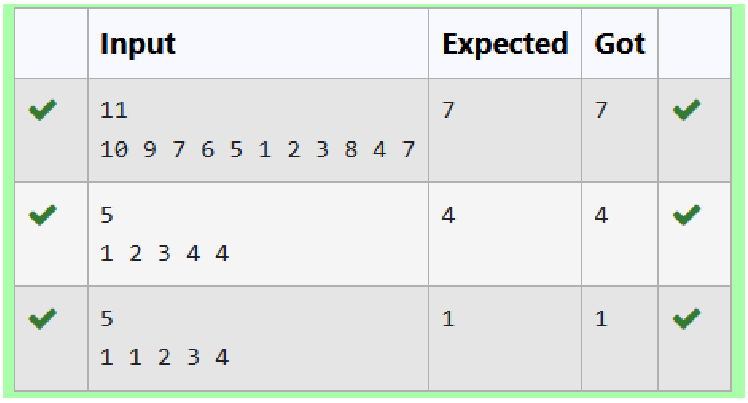
```
        read arr[i] from user
    }

    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:

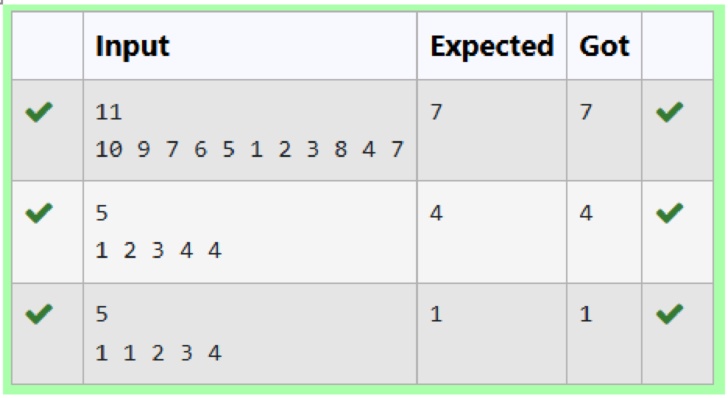
```
function main()
{

   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
```

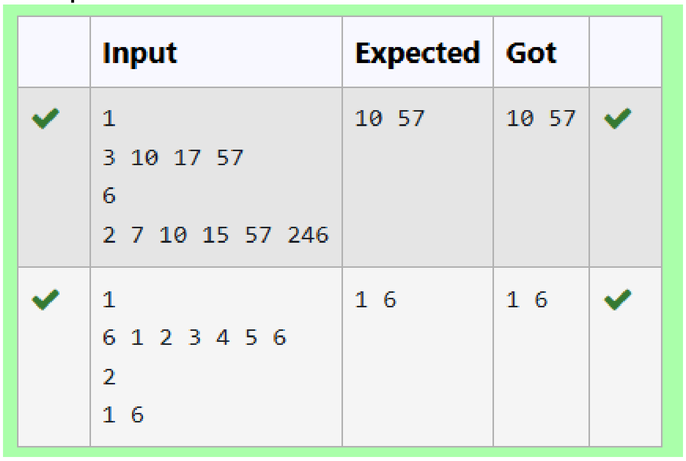
```
        {
           read arr2[j] from user
        }

        // 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",&
        n
1) ; 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

     }

  }
```

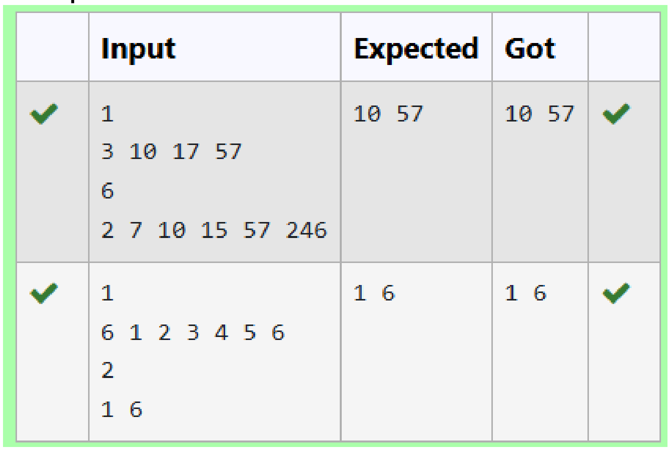
Program:

```
#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.

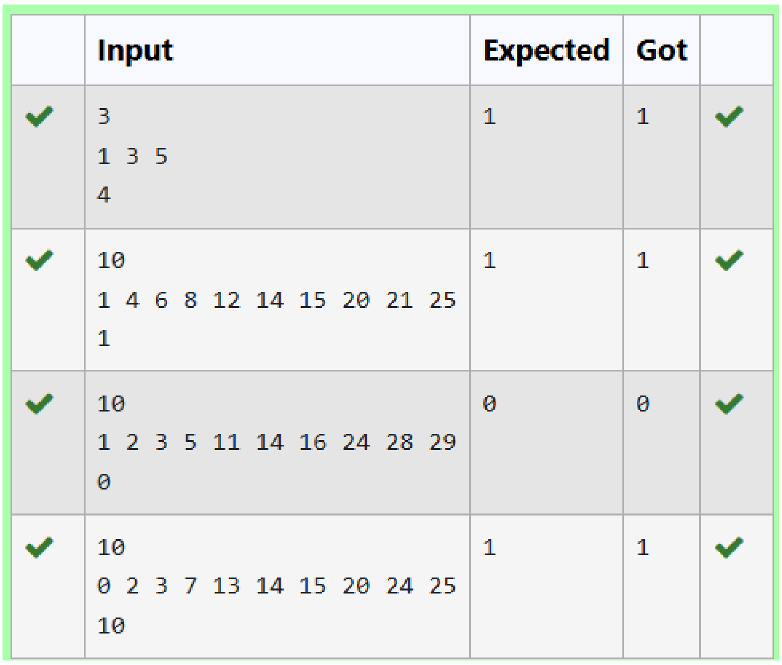
Algorithm:

```
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
```

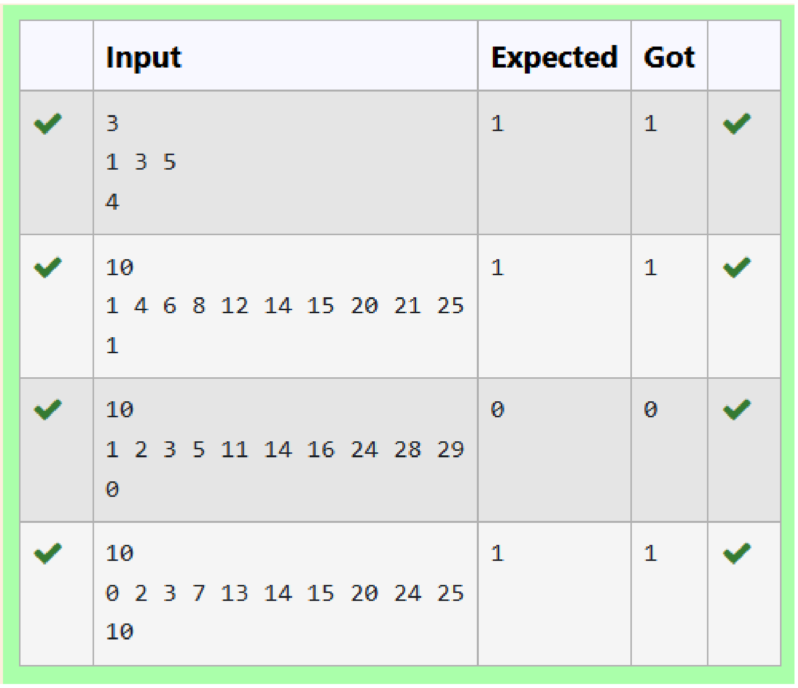
```
            break
        }

        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:

```
#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	✓