INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

Programming with C and C++ (CSC-101)

Assignment 7 100 marks

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Q-1) Given an array of size n and the numbers in the array are from [1, n-1]. One of the elements in the array is repeated. So return the number in the array which is repeated. Try to solve it without using a nested loop.

For example: n=5, arr = [2, 3, 4, 1, 1]

Output: 1

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```c
#include<stdio.h>

int main() {
        int n;
        printf("Enter the array size n :");scanf("%d",&n);
        printf("Enter the elements of array : \n");
        int arr[n];
        for(int i = 0;i < n ;i++){
                scanf("%d",&arr[i]);
                if((arr[i] > n-1) || (arr[i]<1)){printf("Error!!Numebrs in array are from [1,n-1].\n");
                        return 0;
                }
        }
        int sum , total;

        for(int i = 0; i < n ;i++){
                total += arr[i];
                sum += i;
        }


        printf("Repeated number : %d \n",total-=sum);


        return 0;
}
```

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```
garvmehta991@omnitrix-1000:~/25114035/Assignment7/Question1$ vim q1.c
garvmehta991@omnitrix-1000:~/25114035/Assignment7/Question1$ gcc q1.c && ./a.out
Enter the array size n :5
Enter the elements of array :
2 3 4 1 2
Repeated number : 2
garvmehta991@omnitrix-1000:~/25114035/Assignment7/Question1$ gcc q1.c && ./a.out
Enter the array size n :7
Enter the elements of array :
1 2 3 7 4 5 2
Error!!Numebrs in array are from [1,n-1].
garvmehta991@omnitrix-1000:~/25114035/Assignment7/Question1$ gcc q1.c && ./a.out
Enter the array size n :9
Enter the elements of array :
1 2 3 7 4 5 8 6 2
Repeated number : 2
garvmehta991@omnitrix-1000:~/25114035/Assignment7/Question1$ gcc q1.c && ./a.out
Enter the array size n :4
Enter the elements of array :
0 1 2 3
Error!!Numebrs in array are from [1,n-1].
garvmehta991@omnitrix-1000:~/25114035/Assignment7/Question1$ gcc q1.c && ./a.out
Enter the array size n :3
Enter the elements of array :
2 1 1
Repeated number : 1
garvmehta991@omnitrix-1000:~/25114035/Assignment7/Question1$
```

Q-2) Given an integer array nums return true if any value appears at least twice in the array and return false if all the elements are distinct.
Example: nums = [10, 20, 30, 40, 10]
Output = True

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```c
#include <stdio.h>

int main() {
        int n;
        printf("Enter the array size n :");scanf("%d",&n);
        printf("Enter the elements of array : \n");
        int a[n];
        for(int i = 0;i < n ;i++){
                scanf("%d",&a[i]);
                }
        int x = 1;
        for(int i = 0; i < n;i++){
                for(int j = i + 1;j < n;j++){
                        if(a[j] == a[i] && x){
                                printf("True\n");
                                x = 0;
                        }
                }
        }
        if(x){
                printf("False\n");
        }


        return 0;
}
```

1,1 All

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```
garvmehta991@omnitrix-1000:~/25114035/Assignment7/Question2$ vim q2.c
garvmehta991@omnitrix-1000:~/25114035/Assignment7/Question2$ gcc q2.c && ./a.out
Enter the array size n :5
Enter the elements of array :
10 20 30 40 10
True
garvmehta991@omnitrix-1000:~/25114035/Assignment7/Question2$ gcc q2.c && ./a.out
Enter the array size n :7
Enter the elements of array :
1 4 8 3 7 9 10
False
garvmehta991@omnitrix-1000:~/25114035/Assignment7/Question2$ gcc q2.c && ./a.out
Enter the array size n :4
Enter the elements of array :
45 87 25 45
True
garvmehta991@omnitrix-1000:~/25114035/Assignment7/Question2$
```

Q-3) Write a program that finds the Union and intersection of two arrays (elements that are present in both arrays) and stores it in a new array.
Input: arr1[] = {7, 1, 5, 2, 3, 6}
arr2[] = {3, 8, 6, 20, 7}
Output : Union - {1, 2, 3, 5, 6, 7, 8, 20}
Intersection as {3, 6, 7}

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```c
#include <stdio.h>

int main() {
        int a,b;

        printf("Array 1 size : ");scanf("%d",&a);
        int arr1[a];
        printf("Enter array 1 distinct elements : ");
        for(int i = 0;i < a ;i++){
                scanf("%d",&arr1[i]);
                }
        for(int i = 0; i < a ; i++){
                for(int j = i + 1;j < a; j++){
                        if(arr1[i] == arr1[j]){
                                printf("Error!!Enter distinct elements.\n");
                                return 0;
                        }
                }
        }

        printf("Array 2 size : ");scanf("%d",&b);
        int arr2[b];
        printf("Enter array 2 distinct elements :");
        for(int i = 0;i < b ;i++){
                scanf("%d",&arr2[i]);
                }
        for(int i = 0; i < b ; i++){
                for(int j = i + 1;j < b; j++){
                        if(arr2[i] == arr2[j]){
                                printf("Error!!Enter distinct elements.\n");
                                return 0;
                        }
                }
        }

        int c = 0, arr3[a+b] ;
        for(int i = 0; i < a ; i++){
                for(int j = 0;j<b;j++){
                        if(arr1[i] == arr2[j]){
                                c++;
                        }
                }
        }
        int d = 0 , inter[c] , uni[a+b-c] , e = c ;
        for(int i = 0 ;i < a + b;i++){
                if(i<a){arr3[i] = arr1[i];}
                else {arr3[i] = arr2[i-a];}
        }
        for(int i = 0;i< a+b;i++){
                for(int j = i+1;j<a+b;j++){
                        if(arr3[i] > arr3[j]) {
                                int temp = arr3[i];
                                arr3[i]  = arr3[j];
                                arr3[j] = temp ;
                        }
                }
        }
        for(int i = 0 ; i < a + b  ;i++) {
```

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```
        for(int i = 0 ; i < a + b  ;i++) {
                if(arr3[i] == arr3[i+1]) {
                        inter[--c] = arr3[i];
                        uni[d++] = arr3[i];
                        i++;
                }
                else {
                        uni[d++] = arr3[i];
                }
        }

        printf("Intersection : ");
        for(int i = e-1 ; i >= 0;i--) {
                printf("%d ",inter[i]);
        }
        printf("\nUnion : ");
        for(int i = 0 ;i < a + b - e; i++) {
                printf("%d ",uni[i]);
        }
        printf("\n");
        return 0;
}
```

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```
garvmehta991@omnitrix-1000:~/25114035/Assignment7/Question3$ vim q3.c
garvmehta991@omnitrix-1000:~/25114035/Assignment7/Question3$ gcc q3.c && ./a.out
Array 1 size : 6
Enter array 1 distinct elements : 7 1 5 2 3 6
Array 2 size : 5
Enter array 2 distinct elements :3 8 6 20 7
Intersection : 3 6 7
Union : 1 2 3 5 6 7 8 20
garvmehta991@omnitrix-1000:~/25114035/Assignment7/Question3$ gcc q3.c && ./a.out
Array 1 size : 5
Enter array 1 distinct elements : 1 2 1 4 5
Error!!Enter distinct elements.
garvmehta991@omnitrix-1000:~/25114035/Assignment7/Question3$ gcc q3.c && ./a.out
Array 1 size : 7
Enter array 1 distinct elements : 1 7 8 9 4 3 2
Array 2 size : 4
Enter array 2 distinct elements :2 3 8 7
Intersection : 2 3 7 8
Union : 1 2 3 4 7 8 9
garvmehta991@omnitrix-1000:~/25114035/Assignment7/Question3$ gcc q3.c && ./a.out
Array 1 size : 5
Enter array 1 distinct elements : 1 2 7 8 9
Array 2 size : 4
Enter array 2 distinct elements :1 2 1 4
Error!!Enter distinct elements.
garvmehta991@omnitrix-1000:~/25114035/Assignment7/Question3$
```

Q-4) Write a C program to remove the element from the array and shift the rest.

Input: {1, 2, 3, 5, 6, 7, 8, 20}
Output: {1, 2, 5, 6, 7, 8, 20}

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```c
#include <stdio.h>

int main() {
        int n ;
        printf("Enter the array size(n) : ");scanf("%d",&n);
        int arr[n];
        printf("Enetr the elements of array : ");
        int i;
        for(i = 0 ; i < n ;i++){
                scanf("%d",&arr[i]);
        }
        printf("Enter the position(0 to n-1) of element to be removed : ");
        scanf("%d",&i);

        int arr1[n-1];
        printf("The output array : ");
        for(int j = 0 ; j < n - 1 ;j++){
                if(j < i){
                        arr1[j] = arr[j];
                }
                else if(j >=  i){
                        arr1[j] = arr[j+1];
                }
                printf("%d ",arr1[j]);
        }
        printf("\n");
        return 0;
}
```

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```
garvmehta991@omnitrix-1000:~/25114035/Assignment7/Question4$ vim q4.c
garvmehta991@omnitrix-1000:~/25114035/Assignment7/Question4$ gcc q4.c && ./a.out
Enter the array size(n) : 8
Enetr the elements of array : 1 2 3 5 6 7 8 20
Enter the position(0 to n-1) of element to be removed : 2
The output array : 1 2 5 6 7 8 20
garvmehta991@omnitrix-1000:~/25114035/Assignment7/Question4$ gcc q4.c && ./a.out
Enter the array size(n) : 4
Enetr the elements of array : 12 3 2 4
Enter the position(0 to n-1) of element to be removed : 0
The output array : 3 2 4
garvmehta991@omnitrix-1000:~/25114035/Assignment7/Question4$ gcc q4.c && ./a.out
Enter the array size(n) : 5
Enetr the elements of array : 87 54 96 32 14
Enter the position(0 to n-1) of element to be removed : 4
The output array : 87 54 96 32
garvmehta991@omnitrix-1000:~/25114035/Assignment7/Question4$
```

Q-5) You have been given two unsorted arrays. Write a C program to merge the unsorted array into a single sorted array.

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```c
#include<stdio.h>

int main() {
        int a , b ;

        printf("Enter array 1 size : ");scanf("%d",&a);
        printf("Enter array 1 elememts : ");
        int arr1[a];
        for(int i = 0; i < a;i++){
                scanf("%d",&arr1[i]);
        }

        printf("Enter array 2 size : ");scanf("%d",&b);
        printf("Enter array 2 elememts : ");
        int arr2[b];
        for(int i = 0; i < b;i++){
                scanf("%d",&arr2[i]);
        }

        int arr3[a+b];
        for(int i = 0 ; i < a + b ; i++) {
                if(i<a){arr3[i] = arr1[i];}
                else {arr3[i] = arr2[i-a];}
        }

        for(int i = 0 ; i < a + b ; i++) {
                for(int j = i + 1 ; j < a + b ; j++) {
                        if(arr3[i] > arr3[j]) {
                                int temp = arr3[i];
                                arr3[i] = arr3[j];
                                arr3[j] = temp;
                        }
                }
        }
        printf("Output array : \n\t\t");
        for(int i = 0 ; i < a + b ; i++) {
                printf("%d ",arr3[i]);
        }
        printf("\n");
        return 0;
}
```

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```
garvmehta991@omnitrix-1000:~/25114035/Assignment7/Question5$ gcc q5.c && ./a.out

Enter array 1 size : 5
Enter array 1 elememts : 7 8 9 1 2
Enter array 2 size : 7
Enter array 2 elememts : 25 3 6 4 71 12 5
Output array :
                1 2 3 4 5 6 7 8 9 12 25 71
garvmehta991@omnitrix-1000:~/25114035/Assignment7/Question5$ gcc q5.c && ./a.out
Enter array 1 size : 3
Enter array 1 elememts : 1 2 4
Enter array 2 size : 4
Enter array 2 elememts : 9 8 5 3
Output array :
                1 2 3 4 5 8 9
garvmehta991@omnitrix-1000:~/25114035/Assignment7/Question5$ gcc q5.c && ./a.out
Enter array 1 size : 5
Enter array 1 elememts : 3 5 4 8 9
Enter array 2 size : 4
Enter array 2 elememts : 78 4 2 0
Output array :
                0 2 3 4 4 5 8 9 78
garvmehta991@omnitrix-1000:~/25114035/Assignment7/Question5$
```

Q-6) Write a program to apply circular right shift by “K” positions on an array A and store the result in a new array B and print the content of B. Here the array and the value n should be user input. Ex: Input: A[5] = 2 3 4 -1 0 , k = 2
Output: B[5] = -1 0 2 3 4

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```c
#include <stdio.h>

int main() {
        int n , k ;
        printf("Enter array size(n) :  ");scanf("%d",&n);
        int a[n],b[n] ;
        printf("A[%d] = ",n);
        for(int i = 0 ; i < n ; i++) {
                scanf("%d",&a[i]);
        }
        printf("Enter K(Right shift index) = ");scanf("%d",&k);
        for(int i = 0 ; i < n ; i++) {
                b[(i+k)%n] = a[i];
        }
        printf("Output array B[%d] = ",n);
        for(int i = 0; i < n ; i++) {
                printf("%d ",b[i]);
        }
        printf("\n");
        return 0;
}
```

1,1 All

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```
garvmehta991@omnitrix-1000:~/25114035/Assignment7/Question6$ vim q6.c
garvmehta991@omnitrix-1000:~/25114035/Assignment7/Question6$ gcc q6.c && ./a.out
Enter array size(n) :  5
A[5] = 2 3 4 -1 0
Enter K(Right shift index) = 2
Output array B[5] = -1 0 2 3 4
garvmehta991@omnitrix-1000:~/25114035/Assignment7/Question6$ gcc q6.c && ./a.out
Enter array size(n) :  7
A[7] = 4 3 8 7 9 -1 0
Enter K(Right shift index) = 4
Output array B[7] = 7 9 -1 0 4 3 8
garvmehta991@omnitrix-1000:~/25114035/Assignment7/Question6$ gcc q6.c && ./a.out
Enter array size(n) :  5
A[5] = 7 2 3 9 4
Enter K(Right shift index) = 3
Output array B[5] = 3 9 4 7 2
garvmehta991@omnitrix-1000:~/25114035/Assignment7/Question6$ gcc q6.c && ./a.out
Enter array size(n) :  3
A[3] = 1 4 2
Enter K(Right shift index) = 1
Output array B[3] = 2 1 4
garvmehta991@omnitrix-1000:~/25114035/Assignment7/Question6$
```

Q-7) A temperature monitoring system collects sensor readings every minute and stores them in an array. However, due to occasional glitches, some readings are clearly incorrect (e.g., sudden spikes or dips). Your task is to smooth the data by replacing every anomalous reading with the average of its two neighbors, but only if the anomaly is detected. An anomaly is defined as a reading that differs from the average of its two neighbors by more than a given threshold T.

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```c
#include <stdio.h>

int main() {
        int n ;
        printf("Enter array size(n) : ");scanf("%d",&n);
        float a[n] , t;
        printf("Enter array elements : ");
        for(int i = 0 ; i < n ; i++) {
                scanf("%f",&a[i]);
        }
        printf("Enter threshold(T) : ");scanf("%f",&t);
        printf("Anamalous readings : ");
        for(int i = 1 ; i < n - 1 ; i++) {
                float x = a[i] - (a[i-1] + a[i+1])/2.0 ;
                if((x > t) || (x < -t)) {
                        printf("%.2f(%d) ",a[i],i+1);
                        a[i] = a[i] - x ;
                }
        }
        printf("\nCorrected readings : ");
        for(int i = 0 ;i < n ;i++) {
                printf("%.2f ",a[i]);
        }
        printf("\n");
        return 0;
}
```

1,1 All

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```
garvmehta991@omnitrix-1000:~/25114035/Assignment7/Question7$ gcc q7.c && ./a.out

Enter array size(n) : 5
Enter array elements : 32 33 35 10 37
Enter threshold(T) : 20
Anamalous readings : 10.00(4)
Corrected readings : 32.00 33.00 35.00 36.00 37.00
garvmehta991@omnitrix-1000:~/25114035/Assignment7/Question7$ gcc q7.c && ./a.out
Enter array size(n) : 7
Enter array elements : 48 46 50 52 20 53 55
Enter threshold(T) : 20
Anamalous readings : 20.00(5)
Corrected readings : 48.00 46.00 50.00 52.00 52.50 53.00 55.00
garvmehta991@omnitrix-1000:~/25114035/Assignment7/Question7$
```

Q-8) You are given a time-series array representing the number of cars entering (+ve) or leaving (-ve) a parking lot. Find the peak occupancy and the time (index) it occurred.

Input: Array of integers

Output: Peak occupancy and the index (0-based)
Example:

Input:
[5, -2, 3, -1, 4, -3]

Output:
9 4

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```c
#include <stdio.h>

int main() {
        int n ;
        printf("Enter array size : ");scanf("%d",&n);
        int a[n];
        printf("Enter time-series array : ");
        for(int i = 0 ; i < n ; i++) {
                scanf("%d",&a[i]);
        }
        int sum = 0 , max = 0 , index;
        for(int i = 0 ; i < n ; i++) {
                sum+=a[i] ;
                if(sum < 0) {
                        printf("Error!!Invalid Occupancy(due to index %d)\n",i);
                        return 0;
                }
                if(sum > max) {
                        max = sum ;
                        index = i;
                }
        }
        printf("Peak Occupancy : %d , Index(0-based) : %d \n",max,index);
        return 0;
}
```

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```
garvmehta991@omnitrix-1000:~/25114035/Assignment7/Question8$ vim q8.c
garvmehta991@omnitrix-1000:~/25114035/Assignment7/Question8$ gcc q8.c && ./a.out
Enter array size : 6
Enter time-series array : 5 -2 3 -1 4 -3
Peak Occupancy : 9 , Index(0-based) : 4
garvmehta991@omnitrix-1000:~/25114035/Assignment7/Question8$ gcc q8.c && ./a.out
Enter array size : 7
Enter time-series array : 8 -5 3 -9 4 5 8
Error!!Invalid Occupancy(due to index 3)
garvmehta991@omnitrix-1000:~/25114035/Assignment7/Question8$ gcc q8.c && ./a.out
Enter array size : 7
Enter time-series array : 8 -5 9 4 -6 3 2
Peak Occupancy : 16 , Index(0-based) : 3
garvmehta991@omnitrix-1000:~/25114035/Assignment7/Question8$
```

Q-9) You're given the prefix sum array of an unknown array. Write a C program to reconstruct the original array.

Input: [3, 8, 12]
Output: [3, 5, 4]

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```c
#include <stdio.h>

int main() {
        int n;
        printf("Enter array size : ");scanf("%d",&n);
        int a[n];
        printf("Enter prefix sum array : ");
        for(int i = 0 ; i < n ; i++) {
                scanf("%d",&a[i]);
        }

        printf("Original array : ");
        for(int i = 0 ; i < n ; i++) {
                if(i == 0) {printf("[%d",a[0]);}
                else {
                        printf(", %d",a[i] - a[i-1]);
                }
        }
        printf("]\n");
        return 0;
}
```

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```
garvmehta991@omnitrix-1000:~/25114035/Assignment7/Question9$ vim q9.c
garvmehta991@omnitrix-1000:~/25114035/Assignment7/Question9$ gcc q9.c && ./a.out
Enter array size : 3
Enter prefix sum array : 3 8 12
Original array : [3, 5, 4]
garvmehta991@omnitrix-1000:~/25114035/Assignment7/Question9$ gcc q9.c && ./a.out
Enter array size : 7
Enter prefix sum array : 4 1 2 35 4 8 9
Original array : [4, -3, 1, 33, -31, 4, 1]
garvmehta991@omnitrix-1000:~/25114035/Assignment7/Question9$ gcc q9.c && ./a.out
Enter array size : 5
Enter prefix sum array : 1 2 3 4 5
Original array : [1, 1, 1, 1, 1]
garvmehta991@omnitrix-1000:~/25114035/Assignment7/Question9$ gcc q9.c && ./a.out
Enter array size : 4
Enter prefix sum array : 4 8 14 23
Original array : [4, 4, 6, 9]
garvmehta991@omnitrix-1000:~/25114035/Assignment7/Question9$
```

Q-10) Given an array and a window size k, write a C program to output an array of the **maximum** values for each window.

Array: [1, 3, -1, -3, 5, 3, 6, 7]
k = 3
Output: [3, 3, 5, 5, 6, 7]

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```c
#include<stdio.h>

int main() {
        int n , k;

        printf("Enter array size : ");scanf("%d",&n);

        int a[n], i ,max ;
        printf("Enter elements of array : ");
        for(i=0;i<n;i++){
                scanf("%d",&a[i]);
        }

        printf("Enter window size :");scanf("%d",&k);


        printf("Ouptut array : ");
        for(int i = 0 ; i < n - k + 1 ; i++){
                max = a[i];
                for(int j = i ; j < i + k ; j++){
                        if(a[j] > max) {
                                max = a[j];
                        }
                }
                printf("%d ",max);

        }

        printf("\n");
        return 0;
}
```

1,1 All

garvmehta991@omnitrix-1000: ~/25114035/Assignment7/Question10

```
garvmehta991@omnitrix-1000:~/25114035/Assignment7/Question10$ vim q10.c
garvmehta991@omnitrix-1000:~/25114035/Assignment7/Question10$ gcc q10.c && ./a.out
Enter array size : 8
Enter elements of array : 1 3 -1 -3 5 3 6 7
Enter window size :3
Ouptut array : 3 3 5 5 6 7
garvmehta991@omnitrix-1000:~/25114035/Assignment7/Question10$ gcc q10.c && ./a.out
Enter array size : 5
Enter elements of array : 1 4 2 5 3
Enter window size :2
Ouptut array : 4 4 5 5
garvmehta991@omnitrix-1000:~/25114035/Assignment7/Question10$ gcc q10.c && ./a.out
Enter array size : 7
Enter elements of array : -7 8 2 3 9 -4 5
Enter window size :4
Ouptut array : 8 9 9 9
garvmehta991@omnitrix-1000:~/25114035/Assignment7/Question10$ gcc q10.c && ./a.out
Enter array size : 7
Enter elements of array : -7 8 2 3 9 -4 5
Enter window size :2
Ouptut array : 8 8 3 9 9 5
garvmehta991@omnitrix-1000:~/25114035/Assignment7/Question10$
```