Jaypee University of Engineering and Technology, Guna

[LAB ACTIVITY 5]

DATA STRUCTURES(18B11CI311)

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Questions:

1. Write a program to implement binary search algorithm. Assume user will enter the sorted array.

https://www.hackerrank.com/contests/launchpad-1-winter-challenge/challenges/binary- search-basic

Solution:

```cpp
#include <cmath>
#include <cstdio>
#include <vector>
#include <iostream>
#include <algorithm>
using namespace std;

int binary_search(int array[],int low,int high,int element){
    if(low<=high){
        int mid = (low + high)/2;
        if(array[mid]==element){
            return mid;
        }
        if( array[mid]<element){
            return binary_search(array,mid+1,high,element);
        }
        else{
            return binary_search(array,low,mid-1,element);
        }
    }
    return -1;
}

int main() {
    /* Enter your code here. Read input from STDIN. Print output to STDOUT */
    int n;
    cin>>n;
    int array[n];
    for(int i=0;i<n;i++){
        cin>>array[i];
    }
    int element;
    cin>>element;
    int index = binary_search(array,0,n-1,element);
    cout<<index<<endl;
    return 0;
}
```

Output:

```
Windows PowerShell
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Try the new cross-platform PowerShell https://aka.ms/pscore6

PS C:\Users\hp\Desktop\lab5> cd "c:\Users\hp\Desktop\lab5\" ; if ($?) { g++ Question1.cpp -o Question1 } ; if ($?) { .\Question1 }
5
1 2 3 4 5
4
3
PS C:\Users\hp\Desktop\lab5>
```

2. Write a function which accepts an array of integers along with the size of it. The numbers are arranged in the list in increasing order until a particular index and after that it is arranged in decreasing order. This function should find and return the index position at which the increasing list starts decreasing. Call this function from main function.

Sample Input Expected Output

1,4,7,8,9,5,4 5

Solution:

```cpp
#include <iostream>
using namespace std;
int findpos(int arr[], int size, int first, int last)
{
    int max = arr[first],count=0;
    for (int i = first + 1; i < last; i++)
    {
        if (arr[i] > max)
        {
            max = arr[i];
            count++;
        }
    }
    return count;
}
int main()
{
    int n;
    cin >> n;
    int arr[n];
    for (int i = 0; i < n; i++)
    {
        cin >> arr[i];
    }
    cout<<arr[findpos(arr, n, 0, n - 1)+1];
}
```

Output:

```
Windows PowerShell
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PS C:\Users\hp\Desktop\lab5> cd "c:\Users\hp\Desktop\lab5\" ; if ($?) { g++ QUESTION2.CPP -o QUESTION2 } ; if ($?) { .\QUESTION2 }
7
1 4 7 8 9 5 4
5
PS C:\Users\hp\Desktop\lab5>
```

3. Write a program to check whether given Matrix is sparse or not. We say a matrix as sparse when more than 50% of total elements are zero. If matrix is sparse then represent it in triplet form with the help of array data structure. Also print the number of bytes that are saved or wasted when you represent input matrix in the triplet form.

Solution:

```c
#include <stdio.h>

int main()
{
    int i, j, rows, columns, a[10][10], Total = 0;

    printf("\n Please Enter Number of rows and columns  :  ");
    scanf("%d %d", &i, &j);

    printf("\n Please Enter the Matrix Elements \n");
    for (rows = 0; rows < i; rows++)
    {
        for (columns = 0; columns < j; columns++)
        {
            scanf("%d", &a[rows][columns]);
        }
    }

    for (rows = 0; rows < i; rows++)
    {
        for (columns = 0; columns < j; columns++)
        {
            if (a[rows][columns] == 0)
            {
                Total++;
            }
        }
    }
    if (Total > (rows * columns) / 2)
    {
        printf("\n The Matrix that you entered is a Sparse Matrix ");
    }
    else
    {
        printf("\n The Matrix that you entered is Not a Sparse Matrix ");
```

```
    }

    return 0;
}
```

Output:

```
Windows PowerShell
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Try the new cross-platform PowerShell https://aka.ms/pscore6

PS C:\Users\hp\Desktop\lab5> cd "c:\Users\hp\Desktop\lab5\" ; if ($?) { g++ Question3.cpp -o Question3 } ; if ($?) { .\Question3 }

 Please Enter Number of rows and columns  :  4
4

 Please Enter the Matrix Elements
1 0 3 0 5 0 7 0 9 0 11 0 13 0 0 0

 The Matrix that you entered is a Sparse Matrix
```

4. Write a time efficient program for finding the element which appears maximum number of times in the array.

Sample input: 2, 4, 5, 6, 8, 9, 10, 13, 2, 3, 2

Sample output: 2 [as 2 is coming three times]

Solution:

```
#include <iostream>
using namespace std;

int main()
{
    int n, i, temp = 0;
    cin >> n;
    int array1[n], array2[1000] = {0};
    for (i = 0; i < n; i++)
    {
        cin >> array1[i];
        if (temp < array1[i])
        {
            temp = array1[i];
        }
    }
    for (i = 0; i < n; i++)
    {
        array2[array1[i]]++;
    }
    int max = array2[0], result = 0;
    for (i = 1; i <= temp; i++)
    {
        if (array2[i] > max)
        {
            max = array2[i];
```

```
            result = i;
        }
    }
    cout << result << endl;
}
```

Output:

```
Windows PowerShell
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PS C:\Users\hp\Desktop\lab5> cd "c:\Users\hp\Desktop\lab5\" ; if ($?) { g++ Question4.cpp -o Question4 } ; if ($?) { .\Question4 }
7
10 20 30 10 40 10 20
10
PS C:\Users\hp\Desktop\lab5>
```