LAB 5 - Searching

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

```
/********************************************************************
//This program is developed by Aman Singh Rawat (221B056)
/********************************************************************
#include <cmath>
#include <cstdio>
#include <vector>
#include <iostream>
#include <algorithm>
using namespace std;


int main() {
    int n, key;
    cin  >> n;
    int arr[n];
    for(int i = 0; i<n; i++) cin >> arr[i];
        cin >> key;
        int left = 0;
        int right = n-1;
        while (left <= right) {
        int mid = left + (right - left) / 2;
        if (arr[mid] == key) {
            cout << mid;
            return 0;
        } else if (arr[mid] < key) {
            left = mid + 1;
        } else {
            right = mid - 1;
        }
    }
    cout << "Error";
    return -1;
}
```

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

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

Expected Output

5

```
/************************************************************************
//This program is developed by Aman Singh Rawat (221B056)
/************************************************************************
#include <iostream>
#include <pthread.h>
using namespace std;

int check(int arr[], int n){
        int greatest_index = 0;
        for(int i = 0; i<n; i++){
                if((arr[i] > arr[greatest_index]) && (arr[i]> arr[i+1])){
                        greatest_index = i;
                }
        }
        return greatest_index+1;
}

int main(){
        int n;
        cout << "Enter the no of elements: ";
        cin >> n;
        int arr[n];
        cout << "Enter the array: ";
        for (int i = 0; i<n; i++){
                cin >> arr[i];
        }
        cout << "The index is: " << check(arr,n) << endl;
}
```

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.

```
/**********************************************************************
//This program is developed by Aman Singh Rawat (221B056)
/**********************************************************************
#include <iostream>
using namespace std;

int main(){
        int m, n;
        int size = 0;
        cout << "Enter the column and rows length: ";
        cin >> m >> n;
        int sparse[m][n];
        for(int i = 0; i<m; i++){
                cout << "Enter the " << i <<" column: ";
                for(int j = 0 ; j<n; j++){
                        cin >> sparse[i][j];
                        if(sparse[i][j] != 0) size++;
                }
        }
        int new_matrix[3][size];
        int tmp = 0;
        for(int i = 0; i<m; i++){
                for(int j = 0; j<n; j++){
                        if(sparse[i][j] != 0){
                                new_matrix[0][tmp] = i;
                                new_matrix[1][tmp] = j;
                                new_matrix[2][tmp] = sparse[i][j];
                                tmp++;
                        }
                }
        }

        for(int i = 0; i<3; i++){
                cout << endl;
                for(int j = 0 ; j<size; j++)
                        cout << new_matrix[i][j] << " ";
        }
}
```

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]

```
/************************************************************************
//This program is developed by Aman Singh Rawat (221B056)
/************************************************************************
#include <iostream>
using namespace std;

int main(){
        cout << "Enter the size of the array: ";
        int s;
        cin >> s;
        cout << "Enter the array: ";
        int arr[s];
        int key = 0;
        for(int i = 0; i<s; i++){
                cin >> arr[i];
                if(key < arr[i])
                key = arr[i];
        }
        int hash[key+1]= {0};
        for(int i = 0; i<s; i++){
                hash[arr[i]]++;
        }
        int tmp = hash[0];
        int res = 0;
        for(int i = 0; i<key+1; i++){
                if(hash[i] > tmp){
                        tmp = hash[i];
                        res = i;
                }
        }
        cout << endl << res << endl;

}
```