DATA STRUCTURES LAB

LAB RECORD

Submitted by

Tanishq Agarwal

Submitted to: Dr. Kunj Bihari Meena

2022-2023

Department of Computer Science & Engineering

JAYPEE UNIVERSITY OF ENGINEERING & TECHNOLOGY,

AB ROAD, RAGHOGARH, DT. GUNA-473226 MP, INDIA

Table of Contents

Lab Exercise 1: Revisit to C++

Q1. WAP to find out largest element of an array.

```
/*************************************************************
//This program is developed by Tanishq Agarwal(211B326)

/*************************************************************
```

Solution:

```
#include<iostream>
using namespace std;
int main(){
        cout<<"**TO FIND LARGEST ELEMENT OF AN ARRAY**"<<endl;
        cout<<"Enter original array to be sorted:"<<endl;
        int *arr = NULL;
        int n=0;
        cout<<"Enter number of elements in the array:"<<endl;
        cin>>n;
        arr= new int[n];
        for(int i=0;i<n;i++)
           {cin>>arr[i];}
           cout<<"Array inserted successfully!!"<<endl;
           cout<<"Starting operation!!"<<endl;
           int large= arr[0];
        for(int j=0;j<n;j++){
              if(arr[j]<arr[j+1]){
                 large=arr[j+1];
              }
              else{}
        }
           cout<<"The largest number in the array is:"<<endl;
           cout<<large;

return 0;
}
```

Q2. WAP to search an element in array.

```
/*************************************************************
//This program is developed by Tanishq Agarwal(211B326)

/*************************************************************
```

Solution:

```
#include<iostream>
using namespace std;
int main(){

    cout<<"Enter original array data from which data set is to be searched!!"<<endl;
        int *arr= NULL;
        int n;
        cout<<"Enter number of elements in the original array!"<<endl;
        cin>>n;
        arr= new int[n];
        cout<<"Enter array elements:"<<endl;
        for (int i = 0; i < n; i++)
        {
           cin>>arr[i];
        }
        int query;
        cout<<"Enter the value of data to be searched for:"<<endl;
        cin>>query;
        cout<<"SEARCHING STARTED!!"<<endl;
        for (int i = 0; i < n; i++)
        {
           if(arr[i]==query){
              cout<<"Data found and query matched in the array at position:"<<i<<endl;
              goto ex;
           }
           else{
           }
        }
        cout<<"The data query searched is not found in the array!!"<<endl;
        ex:
        break;
```

```
return 0;
}
```

Q3. WAP to check whether the number is prime or not.

```
/*****************************************************************
//This program is developed by Tanishq Agarwal(211B326)

/*****************************************************************
Solution:
#include<iostream>
using namespace std;
int main(){
int num=0;
        int fact=0;
        cout<<"Enter the number for being checked if it is prime or not>>:"<<endl;
        cin>>num;
        for (int i = 2; i <= sqrt(num); i++)
        {
           if(num%i==0)
           {fact++;}
           else{}
        }
        if(fact==1){
           cout<<"The number is prime!!"<<endl;
        }
        else{
           cout<<"The number is not prime!!"<<endl;
        }
return 0;
}
```

Q4. WAP to calculate xy where x and y are two integer numbers entered by the user. [do not use pow() function].

```
/*****************************************************************
//This program is developed by Tanishq Agarwal(211B326)

/*****************************************************************
```

Solution:

```
#include<iostream>
using namespace std;
int main(){
        int x,y=0;
        int pow=1;
        cout<<"Enter base x:"<<endl;
        cin>>x;
        cout<<"Enter power for base y:"<<endl;
        cin>>y;
        for(int i=1;i<=y;i++){
            pow=x*x;
        }
        cout<<"Value of x^y is :"<<pow<<endl;
return 0;
}
```

Q5. WAP to replace a character by another character in a string. Take both the choices from the user.

```
/*************************************************************
//This program is developed by Tanishq Agarwal(211B326)

/*************************************************************
```

Solution:

```
#include<iostream>
using namespace std;
int main(){
char *str_orig;
        int n=0;
        char ch_rep;
        char ch_replacer;
        cout<<"Enter the string length"<<endl;
        cin>>n;
        str_orig=new char[n+1];
        cout<<"Enter a string first to start the question:"<<endl;
```

```
        cin>>str_orig;
        cout<<"Enter the character to be replaced form the string:"<<endl;
        cin>>ch_rep;
        cout<<"Enter the character to be replaced with:"<<endl;
        cin>>ch_replacer;
        cout<<"Starting the replacement"<<endl;
        for (int i = 0; i < n; i++)
        {
            if(str_orig[i]==ch_rep){
                str_orig[i]=ch_replacer;
            }
            else{}
        }
        cout<<"The edited string with replaced character is :"<<str_orig<<endl;

return 0;
}
```

Q6. WAP to find the reverse of given string.

```
/*****************************************************************
//This program is developed by Tanishq Agarwal(211B326)

/*****************************************************************
```

Solution:

```
#include<iostream>
using namespace std;
int main(){
        int sz=0;
        int n=0;
        char *str_orig;
        cout<<"Enter the string length to be enetered:"<<endl;
        cin>>n;
        str_orig=new char[n+1];
        cout<<"Enter the string to be reversed:"<<endl;
        cin>>str_orig;
        cout<<"Starting reversal process:"<<endl;
```

```
        char *str_rev;
        str_rev= new char[n+1];
        sz=n+1;
        for (int i = 0; i<=sz; i++)
        {
            str_rev[i]=str_orig[n+1];
            n--;
        }
        cout<<"The reversed string is :"<<str_rev<<endl;
return 0;
}
```

Q7. WAP to sort the array and ask the choice from user for ascending/descending.

```
/*************************************************************
//This program is developed by Tanishq Agarwal(211B326)

/*************************************************************
```

Solution:

```
#include<iostream>
using namespace std;
int main(){
        int n=0;
        cout<<"Enter no of elements in the array to be sorted:"<<endl;
        cin>>n;
        int *arr;
        arr= new int[n];
        cout<<"Enter elements in the original array unsorted:"<<endl;
        for(int i=0;i<n;i++){
            cin>>arr[i];
        }
        cout<<"Array elements entered successfully!!"<<endl;
        char choice;
        C:
        cout<<"Enter the type of sorting to be performed:"<<endl<<"1.) 'A' or 'a' for ascending order."<<endl<<"2.) 'D' or 'd' for descending order."<<endl;
        cin>>choice;
        if(choice=='A' || choice=='a')
```

```
        {
            cout<<"You choose Ascending sorting of the array;"<<endl;
            int min=arr[0];
            for (int i = 0; i < n; i++)
            {
                if(arr[i]<min){
                    min=arr[i];
                }
            }

        }
        else if(choice=='D' || choice=='d'){

        }
        else{
            cout<<"Enter a valid choice again!!"<<endl;
            goto C;
        }
return 0;
}
```

Q8. WAP to find a word in given statement.

```
/*************************************************************
//This program is developed by Tanishq Agarwal(211B326)

/*************************************************************
```

Solution:

```
#include<iostream>
using namespace std;
int main(){

return 0;
}
```

Q9. WAP to concatenate two strings using pointer.

```
/*************************************************************
//This program is developed by Tanishq Agarwal(211B326)
```

```
/*************************************************************
```

Solution:

```
#include<iostream>
using namespace std;
int main(){
return 0;
}
```

Q10. WAP to create a dynamic array of user desired size and search an element in that array.

```
/*************************************************************
//This program is developed by Tanishq Agarwal(211B326)
/*************************************************************
```

Solution:

```
#include<iostream>
using namespace std;
int main(){
        int n;
        cout<<"Enter the size of array you want to create:"<<endl;
        cin>>n;
        int *array;
        array=new int[n];
        cout<<"Array of size "<<n<<" generated successfully!!"<<endl;
        int srch;
        cout<<"Enter the element to be searched for:"<<endl;
        cin>>srch;
        for (int i = 0; i <n; i++)
        {
            if(array[i]==srch){
                cout<<"The element is found successfully at position:"<< n<<endl;
                exit(0);
            }
            else{
```

```
            }
        }
        cout<<"The element requested for search operation was not found in the array elemnts provided!!"<<endl;
return 0;
}
```

Advanced Programming Problems:

Q11. WAP to calculate difference between two time periods using the C structures.

```
/*****************************************************************
//This program is developed by Tanishq Agarwal(211B326)

/*****************************************************************
```

Solution:

```
#include<iostream>
using namespace std;
struct time
{
    int hr=0;
    int min=0;
    int sec=0;
};
int main(){
        time t1;
        time t2;
        cout<<"Enter time 1 hours:"<<endl;
        cin>>t1.hr;
        cout<<"Enter time 1 minutes:"<<endl;
        cin>>t1.min;
        cout<<"Enter time 1 seconds:"<<endl;
        cin>>t1.sec;
        cout<<"Enter time 2 hours:"<<endl;
        cin>>t2.hr;
        cout<<"Enter time 2 minutes:"<<endl;
```

```
        cin>>t2.min;
        cout<<"Enter time 2 seconds:"<<endl;
        cin>>t2.sec;
        cout<<"Time data entered is:"<<t1.hr<<":"<<t1.min<<":"<<t1.sec<<"and
"<<t2.hr<<":"<<t2.min<<":"<<t2.sec<<"respectively."<<endl;

        int hr_diff,min_diff,sec_diff=0;
        if(t1.hr>t2.hr){
            hr_diff=t1.hr-t2.hr;
        }
        else{
            hr_diff=t2.hr-t1.hr;
        }

        if(t1.min>t2.min){
            min_diff=t1.min-t2.min;
        }
        else{
            min_diff=t2.min-t1.min;
        }

        if(t1.sec>t2.sec){
            sec_diff=t1.sec-t2.sec;
        }
        else{
            sec_diff=t2.sec-t1.sec;
        }

        cout<<"The time difference between entered time is:
"<<hr_diff<<":"<<min_diff<<":"<<sec_diff<<endl;
return 0;
}
```

Q12. WAP to add two complex numbers by passing structure to a function.

```
/*************************************************************
//This program is developed by Tanishq Agarwal(211B326)
```

```
/*************************************************************
Solution:
#include<iostream>
using namespace std;
struct complex
{
   int real=0;
   int imag=0;
};
complex compadd(complex comp1,complex comp2){
                complex res;
                 res.real=comp1.real+comp2.real;
                 res.imag=comp1.imag+comp2.imag;
                 return res;
}
int main(){
            complex c1;
            complex c2;
            complex c_res;
            cout<<"Enter complex number 1 real part and imaginary part respectively:"<<endl;
            cin>>c1.real>>c1.imag;
            cout<<"Enter complex number 2 real part and imaginary part respectively:"<<endl;
            cin>>c2.real>>c2.imag;
            c_res=compadd(c1,c2);
            cout<<"The additive result of the two complex numbers provided
is:"<<c_res.real<<"+"<<c_res.imag<<endl;
return 0;
}
```

Lab Exercise 2: Revisit to C++

Q1. WAP to generate a Fibonacci series up to n terms.

Input

Input number of terms: 10

Output

Fibonacci series:

0, 1, 1, 2, 3, 5, 8, 13, 21, 34

```
/*****************************************************************
//This program is developed by Tanishq Agarwal(211B326)

/*****************************************************************
```

Solution:

```
#include<iostream>
using namespace std;
int main(){
        int n=1;
        cout<<"Enter the number of fibonacci series you want to print:"<<endl;
        cin>>n;
        int s=0,f=1;
        cout<<"Fibonacci series is :"<<s<<","<<f<<",";
        int nxt_sm=0;
        for(int i=2;i<=n-2;i++){
           nxt_sm=f+s;
           s=f;
           f=nxt_sm;
           cout<<nxt_sm<<",";
        }
return 0;
}
```

Q2. WAP to find out series sum of 1^2 + 2^2 + …. + n^2

```
/*****************************************************************
//This program is developed by Tanishq Agarwal(211B326)

/*****************************************************************
```

Solution:

```
#include<iostream>
using namespace std;
int main(){
        int n=1;
        int sum=0;
        cout<<"Enter the series limit upto n:"<<endl;
        cin>>n;
        cout<<"The value of the series is:";
        for (int i = 1; i < n; i++)
        {
           sum+=i*i;
        }
        cout<<"The sum upto n for given series is:"<<sum<<endl;
return 0;
}
```

Q3. WAP to find out GCD of two numbers.

```
/*****************************************************************
//This program is developed by Tanishq Agarwal(211B326)

/*****************************************************************
```

Solution:

```
#include<iostream>
#include<math.h>
using namespace std;
int main(){
int a=0,b=0;
cout<<"Enter a and b :"<<endl;
cin>>a>>b;
int result = min(a, b);
   while (result > 0) {
      if (a % result == 0 && b % result == 0) {
         break;
      }
      result--;
```

```
   }
cout<<”The GCD of entered a and b is :”<<result;
return 0;
}
```

Q4. WAP to multiply two numbers by using addition.

```
/*************************************************************
//This program is developed by Tanishq Agarwal(211B326)

/*************************************************************
```

Solution:

```
#include<iostream>
using namespace std;
int main(){
        int a,b=0;
        int sum=0;
        cout<<"Enter the numbers to be multiplied using addition:"<<endl;
        cin>>a,b;
        for(int i=1;i<=b;i++){
           sum+=a;
        }
        cout<<"The value of a*b using additive multiplication is:"<<sum<<endl;
return 0;
}
```

Q5. WAP to convert a binary number into decimal.

```
/*************************************************************
//This program is developed by Tanishq Agarwal(211B326)

/*************************************************************
```

Solution:

```
#include<iostream>
using namespace std;
int main(){
        int sz=0;
        cout<<"Enter the size of the binary number in digits:"<<endl;
        cin>>sz;
```

```
        int *bin;
        bin = new int[sz];
        cout<<"Enter binary number:"<<endl;
        for(int j=0;j<sz;j++){
           cout<<"Enter the binary value for position:"<<j<<endl;
           cin>>bin[j];
        }
        int dec=0;
        for (int i = sz; i >= 0; i--)
        {
           dec+=bin[i]*pow(2,sz-i);
        }
        cout<<"The decimal value for entered binary number is:"<<dec<<endl;
return 0;
}
```

Q6. WAP to convert a decimal into binary number.

```
/*****************************************************************
//This program is developed by Tanishq Agarwal(211B326)

/*****************************************************************
```

Solution:

```
#include<iostream>
using namespace std;
int main(){
        int dec=0;
        int bin[20]={0};
        cout<<"Enter the decimal number to be converted into binary format:"<<endl;
        cin>>dec;
        int i=0;
        int temp_bin[20];
        while(dec!=0){
           temp_bin[i]=dec%2;
           dec=dec/2;
           i++;
        }
```

```
        for (int i = 0; i < 20; i++)
        {
           bin[i]=temp_bin[19-i];
        }
        cout<<"The binary equivalent of given decimal number is:"<<endl;
        for (int i = 0; i < 20; i++)
        {
           cout<<bin[i];
        }
return 0;
}
```

Q7. WAP to display lower triangular matrix of a given n by n size matrix entered by user.

```
/*************************************************************
//This program is developed by Tanishq Agarwal(211B326)

/*************************************************************
```

Solution:

```
#include<iostream>
using namespace std;
int main(){
    int i, j, rows, columns, a[10][10];
    cout<<" Enter Number of rows and columns of the matrix to be entered  :  ";
    cin>>i>>j;
    cout<<"Enter matrix elements ";
    for(rows = 0; rows < i; rows++)
    {
            for(columns = 0;columns < j;columns++)
    {
            cin>>a[rows][columns];
    }
    }

    for(rows = 0; rows < i; rows++)
    {
            cout<<endl;
```

```
            for(columns = 0; columns < j; columns++)
            {
                    if(rows >= columns)
                    {
                            cout<<a[rows][columns];
                    }
                    else
                    {
                            printf("0  ");
                    }
            }
      }
return 0;
}
```

Q8. WAP to find out nCr factor of given numbers.

Note:

nCr = n! /((n-r)!r!)

```
/*************************************************************
//This program is developed by Tanishq Agarwal(211B326)
/*************************************************************
```

Solution:

```
#include<iostream>
using namespace std;
int main(){
            int n,r=0;
            int n_fact=1;
            int r_fact=1;
            int nr_fact=1;
            cout<<"Enter the value of n and r:"<<endl;
            cin>>n,r;
            //Calculating n!
            for (int i = 1; i <= n; i++)
            {
               n_fact*=i;
```

```
        }
        //Calculating r!
        for (int i = 1; i <= r; i++)
        {
           r_fact*=i;
        }
        //Calculating (n-r)!
        for (int i = 1; i <= (n-r); i++)
        {
           nr_fact*=i;
        }
        //Calculating value for nCr
        int res=n_fact/(nr_fact*r_fact);
        cout<<"The value of combinational factor nCr for given n and r is:"<<res<<endl;
return 0;
}
```

Advanced Programming Problems:

Q9. WAP for finding the element which appears maximum number of times in the array.

```
/*************************************************************
//This program is developed by Tanishq Agarwal(211B326)

/*************************************************************
```

Solution:

```
#include<iostream>
using namespace std;
int main(){
        int maxcnt=0;
        int max_freq_elem=0;
        for(int i=0;i<n;i++) {
          int count=0;
          for(int j=0;j<n;j++){
             if(arr[i] == arr[j])
             count++;
```

```
        }
          if(count>maxcnt){
             maxcnt=count;
             max_freq_elem = arr[i];
          }
        }
return 0;
}
```

Q10. Consider that you are given with a database of employee records (at least 5).
Each employee record having following information –
Emp_id(integer), Emp_name(string), Emp_city(string)
Assume that Emp_id is unique. Write a function for taking database and put it in your header file. Use this function by including your own header file for following questions.
{Use the structure for creating database}a. Write a function to find out the employee record from this database on the basis of Emp_id.
b. Write a function to sort the employee records on the basis of Emp_id.
c. Write a function to sort (alphabetically) the array of characters.
d. Write a function to count the number of employees in database.
e. Write a function to add 5 more records in database.

```
/*************************************************************
//This program is developed by Tanishq Agarwal(211B326)

/*************************************************************
```

Solution:

Datab.h:

```
//datab.h
#pragma once
#include<iostream>
namespace datab
{
   struct emp_data{
   int Emp_id=0;
```

```
    string Emp_name;
    string Emp_city;
    };

    struct emp_data ed[100];

    void emp_entry(int n){

        for(int i=0;i<n;i++){
                cout<<"Enter employee number for Employee number:"<<i+1<<endl;
                cin>>ed[i].Emp_id;
                cout<<"Enter employee name for Employee number:"<<i+1<<endl;
                cin>>ed[i].Emp_name;
                cout<<"Enter employee city for Employee number:"<<i+1<<endl;
                cin>>ed[i].Emp_city;
              }
              cout<<"Data entered successfully!!"<<endl;
    }
}
```

Main.cpp:

```
#include<iostream>
using namespace std;
#include"datab.h" //Header File Imported in Main.cpp file
using namespace datab;
//Functions
void search_emp(int n,int k){
     cout<<"Searching for Emp_ID:"<<n<<endl;
     for(int j=0;j<k;j++){
        if(datab::ed[j].Emp_id==n){
          cout<<"Data found!!"<<endl;
          cout<<"Data: Employee ID: "<<datab::ed[j].Emp_id<<" Employee name:
"<<datab::ed[j].Emp_name<<" Employee city: "<<datab::ed[j].Emp_city<<endl;
          goto V;
        }
        else{}
```

```
   }
  cout<<"Data not found for given Employee ID!!"<<endl;
  V:{}
 }

void emp_sort(int l){
 cout<<"Sorting started for given Emp_ID's in the database:"<<endl;
 int max_id=ed[0].Emp_id;
 int temp_emp_id=0;
 string temp_emp_name;
 string temp_emp_city;
 for(int i=0;i<l;i++){
   if(ed[i].Emp_id>=max_id){
      temp_emp_id=ed[i].Emp_id;
      ed[i].Emp_id=ed[i+1].Emp_id;
      ed[i+1].Emp_id=temp_emp_id;

      temp_emp_name=ed[i].Emp_name;
      ed[i].Emp_name=ed[i+1].Emp_name;
      ed[i+1].Emp_name=temp_emp_name;

      temp_emp_city=ed[i].Emp_city;
      ed[i].Emp_city=ed[i+1].Emp_city;
      ed[i+1].Emp_city=temp_emp_city;
   }
   else{}
   cout<<"Data sorted successfully!!"<<endl<<"Printing sorted now:"<<endl;
   for(int i=0;i<l;i++){
      cout<<"Data: Employee ID: "<<datab::ed[i].Emp_id<<" Employee name:
"<<datab::ed[i].Emp_name<<" Employee city: "<<datab::ed[i].Emp_city<<endl;
   }
  }
}

 int count=0;
```

```
void count_emp(){
   int n=11;
   while(n!=0){
      if (ed->Emp_id!=0)
      {
         count++;
         n--;
      }
      else{n--;}
   }
}

void add_emp(int cnt){
   cout<<"Add 5 more employees to the database:"<endl;
   for (int i = cnt; i < cnt+5; i++)
   {
      cout<<"Enter employee number for Employee number:"<<i+1<<endl;
      cin>>ed[i].Emp_id;
      cout<<"Enter employee name for Employee number:"<<i+1<<endl;
      cin>>ed[i].Emp_name;
      cout<<"Enter employee city for Employee number:"<<i+1<<endl;
      cin>>ed[i].Emp_city;
   }

}

int main(){
         int no_of_emp=0;
         cout<<"Enter the number of Employees in the database:"<<endl;
         cin>>no_of_emp;
         cout<<"Enter employee database values:"<<endl;
         datab::emp_entry(no_of_emp);
            //Custom functions
            int i=0;
```

```
            cout<<" Enter the Employee ID of employee to be searched:";
            cin>>i;
            search_emp(i,no_of_emp);
            emp_sort(no_of_emp);
            count_emp();
            add_emp();
return 0;
}
```