Name-Diya Goyal Roll no-102215255 Sub-group-2NC11

Lab Assignment 1

UCS 406 Data Structures and Algorithms

Note: Use C/C++ or JAVA programming language.

- Q1. Write a program that
 - i. computes and returns the sum of all the integers between "first" and "last" inclusive.

```
computes and returns the sum of all the integers between "first" and "last" inclusive
3
     #include<iostream>
     using namespace std;
     int main(){
          int first;
          int last;
8
          cin>>first;
9
10
          cin>>last;
11
          int sum=0;
          if(first>last){
12
              for(int i=last;i<=first;i++){</pre>
13
14
                  sum=sum+i;
15
16
17
              for (int i = first; i <=last; i++)</pre>
18
19
20
                  sum=sum+i;
21
22
23
          cout<<"the sum is"<<sum<<endl;</pre>
          return 0;
25
26
```

```
C:\Users\diyag\OneDrive\Desktop\DSA-practice\labAssignments\assignment1>a.exe
3
9
the sum is42
```

ii. computes and returns the smallest positive integer n for which 1+2+3+...+n equals or exceeds the value of "goal".

```
// ii. computes and returns the smallest positive integer n for which 1+2+3+...+n equals or exceeds the value of "goal".

#include(iostream>
using namespace std;

int main()[]

int n=1,goal;
int sum=0;
cin>goal;
while(sum(goal)){

sum=sum+n;
if(sum=goal)){

break;
}

n++;

n++;

return 0;

if cout<<n;
return 0;</pre>
```

C:\Users\diyag\OneDrive\Desktop\DSA-practice\labAssignments\assignment1>a.exe
5
4
C:\Users\diyag\OneDrive\Desktop\DSA-practice\labAssignments\assignment1>

iii. computes and returns the greatest common divisor (g.c.d.) of the arguments passed to it.

```
computes and returns the greatest common divisor (g.c.d.) of the arguments passed to it.
     #include<iostream>
     using namespace std;
 4
 6
     int main(){
          int n1,n2,hcf;
8
          cout<<"enter 2 numbers: ";
 9
          cin>>n1>>n2;
10
          if(n2>n1){
              int temp = n2;
11
12
              n2=n1;
              n1=temp;
13
14
15
          for(int i=1;i<=n2;i++){</pre>
              if(n1\%i==0 \&\& n2\%i==0){
16
                  hcf=i;
17
18
19
          cout<<"hcf is: "<<hcf;</pre>
20
21
          return 0;
22
```

```
C:\Users\diyag\OneDrive\Desktop\DSA-practice\labAssignments\assignment1>a.exe enter 2 numbers: 3 4 hcf is: 1
```

iv. Determines whether an integer is prime.

```
//iv.
              Determines whether an integer is prime.
 1
 2
     #include<iostream>
 3
     using namespace std;
 4
 5
     int main(){
 6
 7
          int n;
          cout<<"enter an integer:";</pre>
 8
          cin>>n;
 9
          bool prime;
10
          if(n==0 || n==1){
11
              prime= false;
12
13
          for(int i=2; i <= n/2; i++){
14
15
              if(n\%i == 0){
                   prime= false;
16
17
                   break;
18
19
20
21
          if(prime){
              cout<<n<<" is not a prime number"<<endl;</pre>
22
23
          else{
24
25
              cout<<n<<" is a prime number"<<endl;</pre>
26
27
28
          return 0;
29
```

C:\Users\diyag\OneDrive\Desktop\DSA-practice\labAssignments\assignment1>a.exe
enter an integer:5
5 is a prime number

v. Prints the English name of an integer from 1 to 9.

```
#include<iostream>
  3
  4
       using namespace std;
  5
  6
       int main(){
  7
            int n;
  8
            cout<<"enter a number between 1 to 9: ";</pre>
  9
            cin>>n;
            switch (n)
 10
            {
 11
 12
            case 1:
                 cout<<"one";</pre>
 13
 14
                break;
 15
             case 2:
 16
                cout<<"two";
 17
                 break;
 18
             case 3:
 19
                 cout<<"three";</pre>
                break;
 20
 21
            case 4:
                 cout<<"four";</pre>
 22
 23
                 break;
            case 5:
 24
                 cout<<"five";</pre>
 25
 26
                 break;
 27
            case 6:
                cout<<"six";</pre>
 28
 29
                break;
 30
            case 7:
                cout<<"seven";</pre>
 31
 32
                break;
 33
            case 8:
 34
                 cout<<"eight";</pre>
                break;
 35
 36
            case 9:
                 cout<<"nine";</pre>
 37
 38
                 break;
 39
               break;
38
39
          default:
40
41
               break;
          }
42
43
          return 0;
44
```

C:\Users\diyag\OneDrive\Desktop\DSA-practice\labAssignments\assignment1>a.exe
enter a number between 1 to 9: 5
five

vi. Reverses the order of the objects in an array.

```
//vi.
              Reverses the order of the objects in an array.
 1
2
     #include<iostream>
 3
     using namespace std;
4
         void reverse(int arr[],int n){
 5
              int start=0;
6
 7
              int end = n-1;
             while (start<=end)
8
9
                  swap(arr[start],arr[end]);
10
                  start++;
11
                  end--;
12
13
14
15
         void printArray(int arr[], int n){
16
17
              for (int i = 0; i < n; i++)
18
                  cout<<arr[i]<<" ";
19
20
21
             cout<<endl;
22
23
     int main(){
24
25
         int arr[6]={1,2,3,4,5,6};
26
         reverse(arr,6);
27
         printArray(arr,6);
28
29
         return 0;
30
```

C:\Users\diyag\OneDrive\Desktop\DSA-practice\labAssignments\assignment1>a.exe
6 5 4 3 2 1

```
//vii. Finds the index of the largest number in an array.
 1
 2
 3
      #include<iostream>
 4
      using namespace std;
 5
      int largest(int arr[], int size){
 6
 7
          int max=arr[0];
 8
          int i;
 9
          int pos;
10
          for( i=0;i<size;i++){</pre>
              if(max<arr[i]){</pre>
11
                   max=arr[i];
12
                   pos=i;
13
14
15
16
17
          cout<<pos;
18
19
      int main(){
20
          int n;
21
          cin>>n;
22
          int arr[n];
23
24
          for(int i=0;i<n;i++){</pre>
25
              cin>>arr[i];
26
           for(int i=0;i<n;i++){</pre>
27
              cout<<arr[i];
28
29
30
          cout<<endl;
          largest(arr, n);
31
          return 0;
32
```

```
C:\Users\diyag\OneDrive\Desktop\DSA-practice\labAssignments\assignment1>a.exe
6
1 2 3 4 5 6
123456
```

viii. Shifts the contents of array cells one cell to the right, with the last cell's contents moved to the left end.

```
#include<iostream>
 3
     using namespace std;
 4
     void shift(int arr[], int size){
 5
          int temp=arr[size-1];
 6
          for( int i = size-1; i>0;--i){
 7
              arr[i]=arr[i-1];
 8
 9
          arr[0]=temp;
10
11
      int printArray(int arr[], int size){
12
          for(int i=0;i<size;i++){</pre>
13
              cout<<arr[i]<<" ";
14
15
16
17
18
     int main(){
19
20
             int n;
21
          cin>>n;
          int arr[n];
22
          for(int i=0;i<n;i++){</pre>
23
              cin>>arr[i];
24
25
           for(int i=0;i<n;i++){</pre>
26
27
              cout<<arr[i];
28
          cout<<endl;
29
          shift(arr,n);
30
31
          printArray(arr,n);
          return 0;
32
33
```

```
C:\Users\diyag\OneDrive\Desktop\DSA-practice\labAssignments\assignment1>a.exe
5
1 2 3 4 5
12345
5 1 2 3 4
```

ix. Examines an array of integers and eliminates all duplication of values. The distinct integers are all moved to the left part of the array.

```
#include<iostream>
4
 5
     using namespace std;
 6
     int removeDuplicates(int arr[], int n){
 7
8
         if(n==0 | n==1){
9
             return n;
10
         int temp[n];
11
12
         int j=0;
         for (int i = 0; i < n; i++)
13
14
              if(arr[i]!= arr[i+1]){
15
                  temp[j++]=arr[i];
16
17
18
          temp[j++]=arr[n-1];
19
          for(int i=0;i<j;i++){
20
21
              arr[i]= temp[i];
22
23
          return j;
24
25
26
27
28
     int main(){
         int arr[]= {1,2,2,3,4,4,5,6,7};
29
         int n= sizeof(arr)/sizeof(arr[0]);
30
         n = removeDuplicates(arr, n);
31
         for (int i = 0; i < n; i++)
32
33
34
              cout<<arr[i]<<" ";
35
36
         return 0;
37
38
39
```

```
C:\Users\diyag\OneDrive\Desktop\DSA-practice\labAssignments\assignment1>a.exe
1 2 3 4 5 6 7 7
```

x. Copies numbers from two arrays into a third array. The numbers from the second array are placed to the right of the numbers copied from the first array.

```
#include<iostream>
 3
     using namespace std;
 4
 5
 6
     int main(){
         int X[] = \{1,2,3\};
 7
8
         int Y[] = \{4,5,6\};
9
         int m= sizeof(X)/sizeof(X[0]);
         int n= sizeof(Y)/sizeof(Y[0]);
10
          int arr[m+n];
11
12
         for (int i = 0; i < m+n; i++)
13
              if(i<m){</pre>
14
                  arr[i]= X[i];
15
16
17
              else{
                  arr[i]=Y[i-m];
18
19
20
          for (int i = 0; i < m+n; i++)
21
22
              cout<<arr[i]<<" ";
23
24
25
26
27
          return 0;
```

C:\Users\diyag\OneDrive\Desktop\DSA-practice\labAssignments\assignment1>a.exe 1 2 3 4 5 6

Q2. Write a program to find sum of all elements of an array; write a program to find maximum of elements of an array; write a program for linear search of an array.

```
#include<iostream>
 3
     using namespace std;
4
 5
 6
     int sumofelements(int arr[],int size){
 7
          int sum=0;
8
9
          for(int i=0;i<size;i++){</pre>
10
11
              sum=sum+arr[i];
12
13
14
          return sum;
15
16
17
     int main(){
18
         int arr[]={1,2,3,4,5,6,7};
19
          int size=7;
20
21
22
          cout<<"sum of all elements ="<<(sumofelements(arr,size));</pre>
23
          return 0;
```

 $\label{lem:c:usersdivagoneDriveDesktopDSA-practicelabAssignments} assignment 1 > a.exe sum of all elements = 28$

Q3. Write a program for adding and subtracting Matrices using 2D Arrays.

```
#include<iostream>
 4
     using namespace std;
 5
 6
 7
     void subtractingmatrix(){
 8
          int n;
 9
          cout<<"Enter the size of the matrix: ";</pre>
10
          cin>>n;
11
          int arr1[n][n], arr2[n][n], arr3[n][n];
12
          cout<<"Enter the elements of the first matrix: ";</pre>
13
          for(int i=0;i<n;i++){
14
              for(int j=0;j<n;j++){</pre>
15
                   cin>>arr1[i][j];
16
17
18
          cout<<"Enter the elements of the second matrix: ";</pre>
19
          for(int i=0;i<n;i++){
20
              for(int j=0;j<n;j++){</pre>
21
                   cin>>arr2[i][j];
22
23
24
          cout<<"The subtraction of the two matrices is: ";</pre>
25
          for(int i=0;i<n;i++){
26
              for(int j=0;j<n;j++){
27
                   arr3[i][j] = arr1[i][j] - arr2[i][j];
28
                   cout<<arr3[i][j]<<" ";
29
30
              cout<<endl;
31
32
33
34
     int main(){
35
          subtractingmatrix();
36
          return 0;
```

```
C:\Users\diyag\OneDrive\Desktop\DSA-practice\labAssignments\assignment1>a.exe
Enter the size of the matrix: 2
Enter the elements of the first matrix: 1 2 3 4
Enter the elements of the second matrix: 5 6 7 8
The subtraction of the two matrices is: -4 -4
-4 -4
```

Q4. Write a program to Multiply Matrices of 10X10.

```
#include <iostream>
     using namespace std;
 2
 3 v int main()
     { int a[10][10], b[10][10], mult[10][10], r1, c1, r2, c2, i, j, k;
 4
          cout << "Enter rows and columns for first matrix: ";</pre>
 5
 6
          cin >> r1 >> c1;
          cout << "Enter rows and columns for second matrix: ";</pre>
 7
 8
          cin \gg r2 \gg c2;
 9 🗸
         while (c1!=r2) {
              cout << "Error! column of first matrix not equal to row of second.";</pre>
10
              cout << "Enter rows and columns for first matrix: ";</pre>
11
12
              cin >> r1 >> c1;
              cout << "Enter rows and columns for second matrix: ";</pre>
13
              cin >> r2 >> c2;
14
               cout << endl << "Enter elements of matrix 1:" << endl;</pre>
15
16
          for(i = 0; i < r1; ++i)
17 ~
              for(j = 0; j < c1; ++j)  {
                  cout << "Enter element a" << i + 1 << j + 1 << " : ";
18
                  cin >> a[i][j];
19
                   cout << endl << "Enter elements of matrix 2:" << endl;</pre>
20
21
          for(i = 0; i < r2; ++i)
22 🗸
              for(j = 0; j < c2; ++j) {
                  cout << "Enter element b" << i + 1 << j + 1 << " : ";
23
24
                  cin >> b[i][j];
                   for(i = 0; i < r1; ++i)
25
26 🗸
              for(j = 0; j < c2; ++j) {
27
                  mult[i][j]=0;
28
                   for(i = 0; i < r1; ++i)
29
              for(j = 0; j < c2; ++j)
                  for(k = 0; k < c1; ++k) {
30 🗸
31
                      mult[i][j] += a[i][k] * b[k][j];
32
                     cout << endl << "Output Matrix: " << endl;</pre>
33
          for(i = 0; i < r1; ++i)
34 🗸
          for(j = 0; j < c2; ++j){
              cout << " " << mult[i][j];</pre>
35
              if(j == c2-1)
36
37
                  cout << endl;</pre>
```

```
C:\Users\diyag\OneDrive\Desktop\DSA-practice\labAssignments\assignment1>a.exe
Enter rows and columns for first matrix: 2 2
Enter rows and columns for second matrix: 2 2

Enter elements of matrix 1:
Enter element a11 : 1 2 3 4
Enter element a12 : Enter element a21 : Enter element a22 :
Enter elements of matrix 2:
Enter elements of matrix 2:
Enter element b11 : 5 6 7 8
Enter element b12 : Enter element b21 : Enter element b22 :
Output Matrix:
19 22
43 50
```

Q5. Write a program for Linear Search using Functions.

```
2
 3
       #include<iostream>
 4
 5
       using namespace std;
 6
       int search(int arr[], int n, int key){
 7
               for(int i=0;i<n;i++){</pre>
 8
 9
                   if(arr[i]==key){
10
                        return i;
11
12
13
               return -1;
14
15
          int main(){
          int n;
16
17
          cin>>n;
18
          int arr[n];
          for(int i=0;i<n;i++){</pre>
19
20
               cin>>arr[i];
21
           for(int i=0;i<n;i++){</pre>
22
23
               cout<<arr[i];
24
25
          cout<<endl;
          cout<<"enter key:"<<endl;</pre>
26
          int key;
27
          cin>>key;
28
          cout<<search(arr, n, key);</pre>
29
          return 0;
30
```

```
C:\Users\diyag\OneDrive\Desktop\DSA-practice\labAssignments\assignment1>a.exe
6
1 2 3 4 5 6
123456
enter key:
5
4
```

Q6. Write a class for a rectangle. Create objects for this class and call the member functions to find the area and perimeter of the rectangle.

```
#include <iostream>
    using namespace std;
    class Rectangle{
         private:
             int 1, b;
9
         public:
0
             void input(int len, int bre){
                 1 = len;
2
                 b = bre;
3
4
5
             int area(){
6
                 return 1 * b;
7
8
             int perimeter(){
9
                 return 2*(1+b);
0
1
     };
2
    int main(){
         Rectangle r1, r2;
         r1.input(10, 9);
5
         r2.input(8, 6);
         cout << "Area of r1: " << r1.area() << endl;</pre>
6
         cout << "Area of r2: " << r2.area() << endl;</pre>
8
         cout << "Perimeter of r1: " << r1.perimeter() << endl;</pre>
9
         cout << "Perimeter of r2: " << r2.perimeter() << endl;</pre>
         return 0;
```

```
C:\Users\diyag\OneDrive\Desktop\DSA-practice\labAssignments\assignment1>a
Area of r1: 90
Area of r2: 48
Perimeter of r1: 38
Perimeter of r2: 28
```