Lab Exercise 3

```
//1. WAP to insert new element at given index number in the array.
//*******************************************************
//*This program is developed by Fanindra Saini(211B116)*
//*******************************************************
#include<iostream>
using namespace std;
int main(){
   int r=0,e,in,arr[10]={1,3,5,6,8,9};
   cin>>e>>in;
   for(int i=0;i<10;i++){
      if(i==in){
         r=arr[i];
         arr[i]=e;
      }
      if(r!=0){
         arr[i+1]=arr[i+1]+r;
         r=arr[i+1]-r;
         arr[i+1]=arr[i+1]-r;
      }
   }
   for(int i=0;i<10;i++){cout<<arr[i]<<" ";}
   return 0;
}
```

```
/*2. WAP to implement the linear search. Use function concept, if element is found then
return index number of element otherwise return -1;*/
//*******************************************************
//*This program is developed by Fanindra Saini(211B116)*
//*******************************************************
#include<iostream>
using namespace std;
int ls(int n);
int arr[7]={6,3,5,1,9,4,8};
int main(){
   int n;
   cin>>n;
   cout<<ls(n)<<endl;
}
int ls(int n){
   for(int i=0;i<7;i++){
     if(arr[i]==n)
        return i;
   }
   return -1;
}
```

```
/*3. WAP to delete an element from an array, use search algorithm to find the index number
of given number; if element to be deleted is not found then print Error: element not found . */
//*******************************************************
//*This program is developed by Fanindra Saini(211B116)*
//*******************************************************
```

```
#include<iostream>
using namespace std;
int ls(int n);

int main(){
   int i,e,f=0;
   int arr[7]={6,3,5,1,9,4,8};
   cin>>e;
   for(i=0;i<7;i++){
      if(arr[i]==e){
         f=1;
      }
      if(f==1){
         arr[i]=arr[i+1];
      }
   }
   if(f==1){
      arr[i-1]=0;
   }
   else{
      cout<<"Error: element not found."<<endl;
   }
   for(int i=0;i<7;i++){
      cout<<arr[i]<<" ";
   }
}

/*4. WAP for checking whether there are any duplicated elements in the array or not?*/
//*********************************************************
//*This program is developed by Fanindra Saini(211B116)*
//*********************************************************
#include<iostream>
using namespace std;
int main(){
   int arr[7]={6,2,11,3,4,6,1};
   int i,n;
   for(int i=0;i<7;i++){
      for(int j=i+1;j<7;j++){
         if(arr[i]==arr[j]){
            cout<<"Duplicate Element Found"<<endl;
            return 0;
         }
      }
   }
   cout<<"No Duplicate Element Found."<<endl;
   return 0;
```

Lab Exercise 4

//1.Write a C program to reverse the elementsof an array.

```
//*********************************************************
//*This program is developed by Fanindra Saini(211B116)*
//*********************************************************
#include <stdio.h>
#include <stdlib.h>
int main()
{
   int num, *arr, i,f,r;
   scanf("%d", &num);
   arr = (int*) malloc(num * sizeof(int));
   for(i = 0; i < num; i++)
      scanf("%d", arr + i);
   r=num-1;
   for(i=0;i<=num/2 && r>=num/2;i++,r--){
      f=*(arr+i);
      *(arr+i)=*(arr+r);
      *(arr+r)=f;
   }
   for(i = 0; i < num; i++)
      printf("%d ", *(arr + i));
   return 0;
}
```

//2.Write a C program to print the frequencyof the digits in given alphanumeric string

```
//*********************************************************
//*This program is developed by Fanindra Saini(211B116)*
//*********************************************************
#include <stdio.h>
#include <string.h>
#include <math.h>
#include <stdlib.h>
int main() {
   char str[1000];
   int arr[10]={0,0,0,0,0,0,0,0,0,0};
   scanf("%s",str);
   for(int i=0;str[i]!='\0';i++){
         if(*(str+i)=='0'){arr[0]++;}
      else if(*(str+i)=='1'){arr[1]++;}
      else if(*(str+i)=='2'){arr[2]++;}
      else if(*(str+i)=='3'){arr[3]++;}
      else if(*(str+i)=='4'){arr[4]++;}
      else if(*(str+i)=='5'){arr[5]++;}
      else if(*(str+i)=='6'){arr[6]++;}
      else if(*(str+i)=='7'){arr[7]++;}
      else if(*(str+i)=='8'){arr[8]++;}
      else if(*(str+i)=='9'){arr[9]++;}
   }
   for(int i=0;i<10;i++){printf("%d ",arr[i]);}
   return 0;
}
```

```
//3.Write C program to complete “Students Marks Sum’ as mentioned below:
//*******************************************************
//*This program is developed by Fanindra Saini(211B116)*
//*******************************************************
int marks_summation(int* marks, int number_of_students, char gender) {
  //Write your code here.
  int sum=0,i;
  i=gender=='b'?0:1;
  for(;i<number_of_students;i+=2){
     sum=sum+*(marks+i);
    }
  return sum;
}

//4.Write a C/C++ program to left rotatean array of integers by dtimes
//*******************************************************
//*This program is developed by Fanindra Saini(211B116)*
//*******************************************************
vector<int> rotateLeft(int d,int n ,vector<int> arr) {
    for(int i=0,j=0;i<d;i++){
        int temp=arr[0];
        for(j=0;j<n;j++){
            arr[j]=arr[j+1];
        }
        arr[n-1]=temp;
    }

    return arr;
}
```

Lab Exercise 5

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

```
//*******************************************************
//*This program is developed by Fanindra Saini(211B116)*
//*******************************************************
#include <iostream>
using namespace std;
int main() {
   int n,x,l=0,r,f=-1;
   cin>>n;
   int arr[n];
   r=n-1;
   for(int i=0;i<n;i++){cin>>arr[i];}
   cin>>x;
   while(l<=r){
      int mid=(l+r)/2;
      if(x==arr[mid]){
         f=mid;
         break;
      }
      else if(x<arr[mid])
         r=mid-1;
      else if(arr[mid]<x)
         l=mid+1;
   }
   cout<<f<<endl;
   return 0;
}
```

/*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.*/

```
//*******************************************************
//*This program is developed by Fanindra Saini(211B116)*
//*******************************************************
#include<iostream>
using namespace std;
int in_dec(int arr[],int n);
int main(){
   int n;
   cin>>n;
   int arr[n];
   for(int i=0;i<n;i++){cin>>arr[i];}
   cout<<in_dec(arr,n)<<endl;
   return 0;
}
int in_dec(int arr[],int n){
   int i=0;
   while(arr[i]<arr[i+1]){i++;}
   return i+1;
}
```

/*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 representinput matrix in the triplet form*/

```
//*******************************************************
//*This program is developed by Fanindra Saini(211B116)*
//*******************************************************
#include<iostream>
using namespace std;
int main(){
   int k=0,z=0,arr[6][6]={{15,0,0,22,0,-15},
                  {0,11,3,0,0,0},
                  {0,0,0,-6,0,0},
                  {0,0,0,0,0,0},
                  {91,0,0,0,0,0},
                  {0,0,28,0,0,0}};
   int **trip=new int *[3];
   for(int i=0;i<6;i++){
      for(int j=0;j<6;j++){
         if (arr[i][j]==0){z++;}
         else{
            trip[k]=new int(1);
            trip[k][0]=i;
            trip[k][1]=j;
            trip[k][2]=arr[i][j];
            k++;
         }
      }
   }
   if(z>6*6/2){
      cout<<"This matrix is a Sparse Matrix."<<endl;
   }
   else
      cout<<"This is not a Sparse Matrix."<<endl;
   for (int i = 0; i<k; i++){
      for (int j = 0; j < 3; j++){cout<<trip[i][j]<<" ";}
      cout<<endl;
   }
   cout<<"Memory Saved = "<<(6*6)-(3*k)<<" Bytes."<<endl;
}
```

/*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 Fanindra Saini(211B116)*
//*******************************************************
#include<iostream>
using namespace std;
int main(){
   int n;
   cin>>n;
   int arr[n];
   for(int i=0,k=0;i<n;i++){cin>>arr[i];}
   int e,m = 0;
   for (int i=0;i<n;i++){
      int c=0;
      for (int j=0;j<n;j++) {
```

```
            if (arr[i]==arr[j])
                c++;
        }
        if(c>m){
            m=c;
            e=arr[i];
        }
    }
    cout<<"Element Appeared Maximum nunber of times = "<<e<<endl;
}
```

Lab Exercise 6

/*1. WAP to implement a function Rdm(n) which returns an array of random numbers{between 0 to 99}, where n is the size of array. (Hint: use dynamic memory allocation concept)*/

```
//*******************************************************
//*This program is developed by Fanindra Saini(211B116)*
//*******************************************************
#include<iostream>
#include<cstdlib>
#include<ctime>
using namespace std;
int *rdm(int n);
void print_arr(int arr[],int n);
int main()
{
   int n;
   srand(time(NULL));
   cin>>n;
   int *ar;
   ar=rdm(n);
   print_arr(ar,n);
}
int *rdm(int n){
   int e;
   int *a=new int[n];
   srand((unsigned)time(NULL));
   for(int i=0;i<n;i++){
      e=rand()%100;
      *(a+i)=e;
   }
   return a;
}
void print_arr(int *arr,int n){
   for(int i=0;i<n;i++){cout<<arr[i]<<endl;}
}
```

//2. WAP to implement the bubble sort and show the output of each pass.

```
//*******************************************************
//*This program is developed by Fanindra Saini(211B116)*
//*******************************************************
#include<iostream>
#include "le6q1.h"
using namespace std;
int main(){
   int n;
   cin>>n;
   int *arr=rdm(n);
   print_arr(arr,n);
   cout<<endl;
   for(int i=0;i<n;i++){
      int f=0;
      for(int j=0;j<n-i-1;j++){
         if(arr[j]>arr[j+1]){
            int t=arr[j];
            arr[j]=arr[j+1];
```

```
            arr[j+1]=t;
            f=1;
        }
    }
    if(f==0){break;}print_arr(arr,n);}
}
```

/*3. WAP to implement the selection sort and show the output of each pass.*/

```
//*******************************************************
//*This program is developed by Fanindra Saini(211B116)*
//*******************************************************
#include<iostream>
#include "le6q1.h"
using namespace std;
int main(){
   int n,min;
   cin>>n;
   int *arr=rdm(n);

   for(int j,i=0;i<n;i++){
      min=i;
      for(j=i+1;j<n;j++){
         if(arr[min]>arr[j]){
            min=j;
         }
      }
      if(min!=i){
            int tem=arr[min];
            arr[min]=arr[i];
            arr[i]=tem;
         }
      print_arr(arr,n);
   }
}
```

/*4. WAP to implement the insertion sort and show the output of each pass.*/

```
//*******************************************************
//*This program is developed by Fanindra Saini(211B116)*
//*******************************************************
#include<iostream>
#include"le6q1.h"
using namespace std;
int main(){
   int n,min;
   cin>>n;
   int *arr=rdm(n);
   print_arr(arr,n);
   for(int i=1;i<n;i++){
      int key=arr[i];
      int j=i-1;
      while(j>=0 && arr[j]>key){
         arr[j+1]=arr[j];
         j=j-1;
      }
      arr[j+1]=key;
      print_arr(arr,n);
```

```
    }
}

//*This program is developed by Fanindra Saini(211B116)*
//*******************************************************
#include<iostream>
#include "le6q1.h"
using namespace std;
int qsort(int arr[],int l,int h);
int n;
int main(){
    int min;
    cin>>n;
    int *arr=rdm(n);
    print_arr(arr,n);
    qsort(arr,0,n-1);
    print_arr(arr,n);
}
int qsort(int arr[],int l,int h){
    if(l<h){
        int piv=arr[h];
        int i=l-1;
        for(int j=l;j<h;j++){
            if(arr[j]<piv){
                i++;
                int tem=arr[i];
                arr[i]=arr[j];
                arr[j]=tem;
            }
        }
        int tem=arr[i+1];
        arr[i+1]=arr[h];
        arr[h]=tem;
        print_arr(arr,n);
        qsort(arr,l,i);
        qsort(arr,i+2,h);
    }
    return 0;
}

/*6. WAP to implement the merge sort and show the output of each pass.*/
//*******************************************************
//*This program is developed by Fanindra Saini(211B116)*
//*******************************************************
#include<iostream>
#include "le6q1.h"
using namespace std;
int merge_sort(int arr[],int l,int h);
int merge(int arr[],int l, int m1, int m2, int h);
int main(){
    int n;
    cin>>n;
    int *arr=rdm(n);
    print_arr(arr,n);
    merge_sort(arr,0,n-1);
    print_arr(arr,n);
```

```
    return 0;
}
int merge_sort(int arr[],int l,int h){
    if(l<h){
        int mid=(l+h)/2;
        merge_sort(arr,l,mid);///////
        merge_sort(arr,mid+1,h);
        merge(arr,l,mid-1,mid,h);
    }
    return 0;
}
int merge(int arr[],int l, int m1, int m2, int h){
    int c=l,lt=l,rt=m2;
    int tem_arr[h-l+1];
    while(l<=m1 && rt<=h){
        if(arr[lt]<=arr[rt]){
            tem_arr[c]=arr[lt];
            lt+=1;
        }
        else{
            tem_arr[c]=arr[rt];
            rt+=1;
        }
        c+=1;
    }
    while(l<=m1){
        tem_arr[c]=arr[lt];
        lt+=1;
        c+=1;
    }
    while (rt<=h){
        tem_arr[c]=arr[rt];
        rt+=1;
        c+=1;
    }
    for(int i=l,j=0;i<=h;i++,j++){
        arr[i]=tem_arr[j];
    }
    return 0;
}
```

Lab Exercise 7

/*1. Write a function Insert_Beginning() to insert a new node at the beginning of singly linked list. Call this function N time to create a linked list with N nodes. Also write display function to print the linked list.*/

```
//*****************************************************
//*This program is developed by Fanindra Saini(211B116)*
//*****************************************************
#include<iostream>
using namespace std;
struct node{
        int data;
        node *next;
};
node *insert_Beginning(node * start, node * newnode){
   newnode->next=start;
   start=newnode;
   return start;
}
void display(node * start){
   node *tem=start;
   while (tem->next!=NULL){
      cout<<tem->data<<endl;
      tem=tem->next;
   }
   cout<<tem->data<<endl;
   delete tem;
}
int main(){
   node * start=NULL;
   int n,i=1;
   cin>>n;
   while(n--){
      node * newnode=new node();
      newnode->data=i;
      start=insert_Beginning(start,newnode);
      i++;
   }
   display(start);
}
```

/*2.Write a menu driven program using switch-case to insert the node at beginning, from specified position and at the end of linked list.*/

```
//*****************************************************
//*This program is developed by Fanindra Saini(211B116)*
//*****************************************************
#include <iostream>
using namespace std;
struct node{
   int info;
   node *next;
};
node *insert_at_end(node *start, node *newnode);
node *insert_at_beginning(node *start, node *newnode){
   newnode->next = start;
```

```
    start = newnode;
    return start;

}
node *insert_at_loc(node *start, node *newnode, int i){
    node *temp = start;
    if(i==1){
        start=insert_at_beginning(start,newnode);
    }
    else if(start!=NULL){
        i=i-2;
        while (--i){
            temp = temp->next;
        }
        newnode->next = temp->next;
        temp->next = newnode;
        delete temp;
        return start;
    }
    return start;
}
node *insert_at_end(node *start, node *newnode){
    node *temp = start;
    if (start == NULL){start=newnode;}
    else{
        while (temp->next != NULL){
            temp = temp->next;
        }
        newnode->next = NULL;
        temp->next = newnode;
    }
    delete temp;
    return start;
}
void display(node *start){
    node *temp = start;
    while (temp != NULL){
        cout << temp->info << endl;
        temp = temp->next;
    }
    delete temp;
}
int main(){
    node *start=NULL;
    node *newnode;
    int ins_at;
    cout << "Insert at Beginning : 1\nInsert at Specific Position: 2\nInsert at End : 3 " << endl;
    while (true){
        cout<<"----------"<<endl;
        display(start);
        cout<<"----------"<<endl;
        cout << "Choose one of the option : ";
        cin >> ins_at;
        if (ins_at == 0){break;}
        cout << "Enter the Value = ";
        cin >> newnode->info;
```

```
        switch (ins_at){
        case 1:
            start = insert_at_beginning(start, newnode);
            break;
        case 2:
            int i;
            cout << "Enter the location = ";
            cin >> i;
            start = insert_at_loc(start, newnode, i - 1);
            break;
        case 3:
            start = insert_at_end(start, newnode);
            break;
        default:
            cout << "Wrong Input";
            break;
        }
    }
}
```

/*3. Write a menu driven program to delete the node from the beginning, from specified position and from the end of linked list.*/

```
//*********************************************************
//*This program is developed by Fanindra Saini(211B116)*
//*********************************************************
#include <iostream>
using namespace std;
struct node{
    int info;
    node *next;
};
node *delete_at_end(node *start, node *newnode);
node *delete_at_beginning(node *start){
    start = start->next;
    return start;
}
node *delete_at_loc(node *start,int i){
    node *temp = start;
    if(i==1){
        start=delete_at_beginning(start);
    }
    else if(start!=NULL){
        i=i-2;
        while (--i){
            temp = temp->next;
        }
        temp->next = temp->next->next;
        delete temp;
        return start;
    }
    return start;
}
node *delete_at_end(node *start){
    node *temp = start;
    if (start == NULL){return start;}
```

```
    else{
        while (temp->next->next != NULL){
            temp = temp->next;
        }
        temp->next = NULL;
    }
    delete temp;
    return start;
}
void display(node *start){
    node *temp = start;
    while (temp != NULL){
        cout << temp->info << endl;
        temp = temp->next;
    }
    delete temp;
}
int main(){
    node *node3=NULL;
    node *node2=node3;
    node *node1=node2;
    node *start=node1;
    node1->info=10;
    node2->info=20;
    node3->info=30;
    int del_at;
    cout << "delete at Beginning : 1\ndelete at Specific Position: 2\ndelete at End : 3 " << endl;
    while (true){
        cout<<"-------------"<<endl;
        display(start);
        cout<<"-------------"<<endl;
        cout << "Choose one of the option : ";
        cin >> del_at;
        if (del_at == 0){break;}
        switch (del_at){
        case 1:
            start = delete_at_beginning(start);
            break;
        case 2:
            int i;
            cout << "Enter the location = ";
            cin >> i;
            start = delete_at_loc(start,i - 1);
            break;
        case 3:
            start = delete_at_end(start);
            break;
        default:
            cout << "Wrong Input";
            break;
        }
    }
}

/*4.WAP to reverse the singly linked list.*/
//*****************************************************
```

```
//*This program is developed by Fanindra Saini(211B116)*
//*****************************************************
#include<iostream>
using namespace std;
struct node{
	int info;
	node *next;
};
node *reverse(node * start){
	node* curr = start;
	node *prev = NULL, *next = NULL;
	while (curr != NULL) {
	   next = curr->next;
	   curr->next = prev;
	   prev = curr;
	   curr = next;
	}
	start = prev;
   }
void display(node * start){
   node *temp=start;
   while (temp->next!=NULL){
      cout<<temp->info<<endl;
      temp=temp->next;
   }
   cout<<temp->info<<endl;
   delete temp;
}
int main(){
   node *node3=NULL;
   node *node2=node3;
   node *node1=node2;
   node *start=node1;
   node1->info=10;
   node2->info=20;
   node3->info=30;
   start=reverse(start);
   display(start);
}

//5.WAP to search an element in the linked list
//*****************************************************
//*This program is developed by Fanindra Saini(211B116)*
//*****************************************************
#include<iostream>
using namespace std;
struct node{
	int data;
	node *next;
};
int search(node * start, int e){
   int loc=1;
   node * temp=start;
   while(temp->data!=e){
      temp=temp->next;
      loc++;
```

```
    }
    return loc;
}
void display(node * start){
    node *tem=start;
    while (tem->next!=NULL){
        cout<<tem->data<<endl;
        tem=tem->next;
    }
    cout<<tem->data<<endl;
    delete tem;
}
int main(){
    node *node3=NULL;
    node *node2=node3;
    node *node1=node2;
    node *start=node1;
    node1->data=10;
    node2->data=20;
    node3->data=30;
    int e;
    cin>>e;
    int loc=search(start,e);
    cout<<e<<endl;
}
```