DAY 4
C PROGRAMMING – DATA STRUCTURE – 4

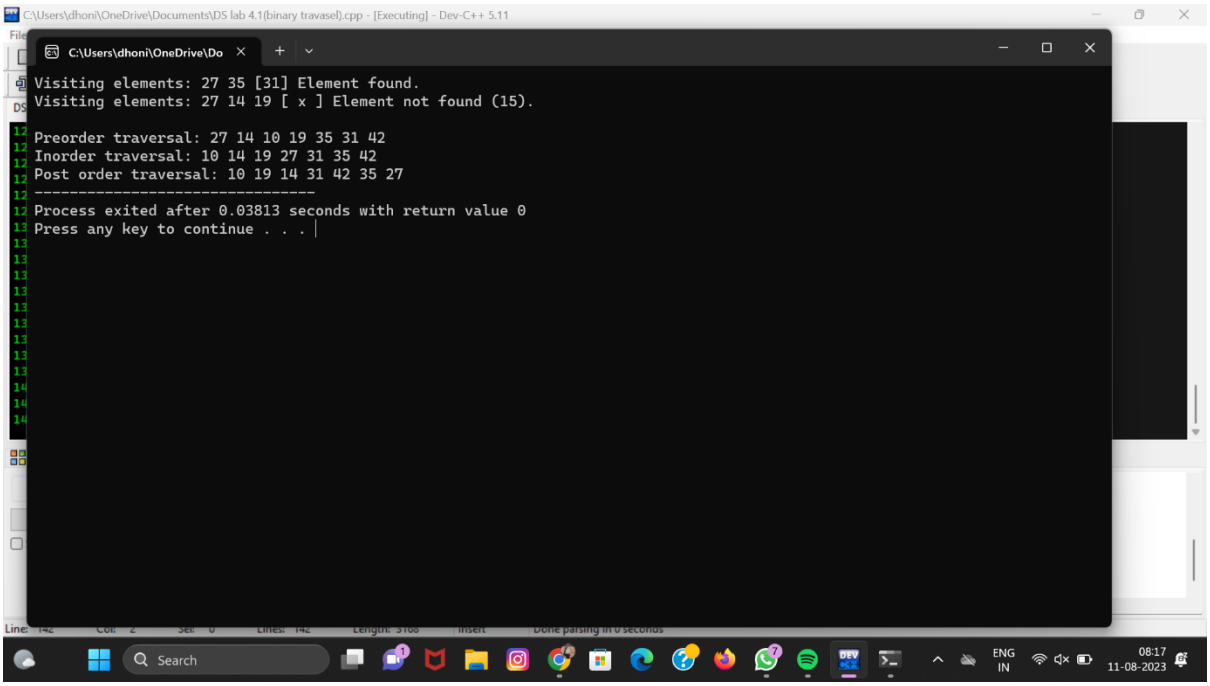
1.C programming to find binary transversal tree:

```
#include <stdio.h>
#include <stdlib.h>
struct node {
  int data;
  struct node *leftChild;
  struct node *rightChild;
};
struct node *root = NULL;
void insert(int data) {
  struct node *tempNode = (struct node*) malloc(sizeof(struct node));
  struct node *current;
  struct node *parent;
  tempNode->data = data;
  tempNode->leftChild = NULL;
  tempNode->rightChild = NULL;
  if(root == NULL) {
    root = tempNode;
  } else {
    current = root;
    parent = NULL;
    while(1) {
      parent = current;
      if(data < parent->data) {
        current = current->leftChild;
        if(current == NULL) {
          parent->leftChild = tempNode;
```

```
            return;
          }
        }
        else {
          current = current->rightChild;
          if(current == NULL) {
            parent->rightChild = tempNode;
            return;
          }
        }
      }
    }
}
struct node* search(int data) {
   struct node *current = root;
   printf("Visiting elements: ");
   while(current->data != data) {
      if(current != NULL)
         printf("%d ",current->data);

      //go to left tree
      if(current->data > data) {
         current = current->leftChild;
      }
      //else go to right tree
      else {
         current = current->rightChild;
      }

      //not found
      if(current == NULL) {
```

```
        return NULL;
      }
    }

    return current;
}
void pre_order_traversal(struct node* root) {
    if(root != NULL) {
        printf("%d ",root->data);
        pre_order_traversal(root->leftChild);
        pre_order_traversal(root->rightChild);
    }
}
void inorder_traversal(struct node* root) {
    if(root != NULL) {
        inorder_traversal(root->leftChild);
        printf("%d ",root->data);
        inorder_traversal(root->rightChild);
    }
}
void post_order_traversal(struct node* root) {
    if(root != NULL) {
        post_order_traversal(root->leftChild);
        post_order_traversal(root->rightChild);
        printf("%d ", root->data);
    }
}
int main() {
    int i;
    int array[7] = { 27, 14, 35, 10, 19, 31, 42 };
    for(i = 0; i < 7; i++)
```

```
    insert(array[i]);
  i = 31;
  struct node * temp = search(i);
  if(temp != NULL) {
    printf("[%d] Element found.", temp->data);
    printf("\n");
  }else {
    printf("[ x ] Element not found (%d).\n", i);
  }
  i = 15;
  temp = search(i);
  if(temp != NULL) {
    printf("[%d] Element found.", temp->data);
    printf("\n");
  }else {
    printf("[ x ] Element not found (%d).\n", i);
  }
  printf("\nPreorder traversal: ");
  pre_order_traversal(root);
  printf("\nInorder traversal: ");
  inorder_traversal(root);
  printf("\nPost order traversal: ");
  post_order_traversal(root);
  return 0;
}
```



2.C programming to implement AVL tree with all rotations:

```
#include <stdio.h>

#include <stdlib.h>

struct Node {

  int key;

  struct Node *left;

  struct Node *right;

  int height;

};

int max(int a, int b);

int height(struct Node *N) {

  if (N == NULL)

    return 0;

  return N->height;

}

int max(int a, int b) {

  return (a > b) ? a : b;

}
```

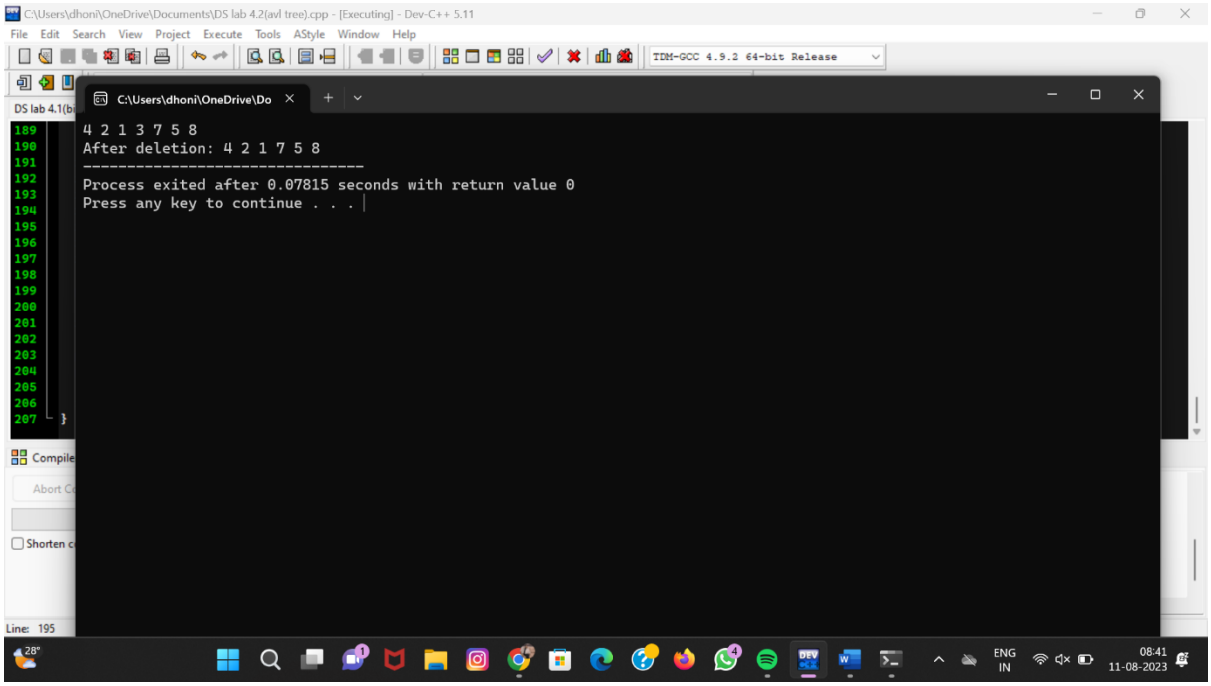
```
struct Node *newNode(int key) {
  struct Node *node = (struct Node *)
    malloc(sizeof(struct Node));
  node->key = key;
  node->left = NULL;
  node->right = NULL;
  node->height = 1;
  return (node);
}
struct Node *rightRotate(struct Node *y) {
  struct Node *x = y->left;
  struct Node *T2 = x->right;
  x->right = y;
  y->left = T2;
  y->height = max(height(y->left), height(y->right)) + 1;
  x->height = max(height(x->left), height(x->right)) + 1;
  return x;
}
struct Node *leftRotate(struct Node *x) {
  struct Node *y = x->right;
  struct Node *T2 = y->left;
  y->left = x;
  x->right = T2;
  x->height = max(height(x->left), height(x->right)) + 1;
  y->height = max(height(y->left), height(y->right)) + 1;
  return y;
}
int getBalance(struct Node *N) {
  if (N == NULL)
    return 0;
  return height(N->left) - height(N->right);
```

```
}
struct Node *insertNode(struct Node *node, int key) {
  // Find the correct position to insertNode the node and insertNode it
  if (node == NULL)
    return (newNode(key));
  if (key < node->key)
    node->left = insertNode(node->left, key);
  else if (key > node->key)
    node->right = insertNode(node->right, key);
  else
    return node;
  node->height = 1 + max(height(node->left),
               height(node->right));
  int balance = getBalance(node);
  if (balance > 1 && key < node->left->key)
    return rightRotate(node);
  if (balance < -1 && key > node->right->key)
    return leftRotate(node);
  if (balance > 1 && key > node->left->key) {
    node->left = leftRotate(node->left);
    return rightRotate(node);
  }
  if (balance < -1 && key < node->right->key) {
    node->right = rightRotate(node->right);
    return leftRotate(node);
  }
  return node;
}
struct Node *minValueNode(struct Node *node) {
  struct Node *current = node;
```

```
  while (current->left != NULL)
    current = current->left;
  return current;
}
struct Node *deleteNode(struct Node *root, int key) {
  if (root == NULL)
    return root;
  if (key < root->key)
    root->left = deleteNode(root->left, key);
  else if (key > root->key)
    root->right = deleteNode(root->right, key);
  else {
    if ((root->left == NULL) || (root->right == NULL)) {
      struct Node *temp = root->left ? root->left : root->right;
      if (temp == NULL) {
        temp = root;
        root = NULL;
      } else
        *root = *temp;
      free(temp);
    } else {
      struct Node *temp = minValueNode(root->right);
      root->key = temp->key;
      root->right = deleteNode(root->right, temp->key);
    }
  }
  if (root == NULL)
    return root;
  root->height = 1 + max(height(root->left),
              height(root->right));
```

```
  int balance = getBalance(root);
  if (balance > 1 && getBalance(root->left) >= 0)
    return rightRotate(root);
  if (balance > 1 && getBalance(root->left) < 0) {
    root->left = leftRotate(root->left);
    return rightRotate(root);
  }
  if (balance < -1 && getBalance(root->right) <= 0)
    return leftRotate(root);
  if (balance < -1 && getBalance(root->right) > 0) {
    root->right = rightRotate(root->right);
    return leftRotate(root);
  }
  return root;
}
void printPreOrder(struct Node *root) {
  if (root != NULL) {
    printf("%d ", root->key);
    printPreOrder(root->left);
    printPreOrder(root->right);
  }
}
int main() {
  struct Node *root = NULL;
  root = insertNode(root, 2);
  root = insertNode(root, 1);
  root = insertNode(root, 7);
  root = insertNode(root, 4);
  root = insertNode(root, 5);
  root = insertNode(root, 3);
  root = insertNode(root, 8);
```

```
 printPreOrder(root);
 root = deleteNode(root, 3);
 printf("\nAfter deletion: ");
 printPreOrder(root);
 return 0;
}
```

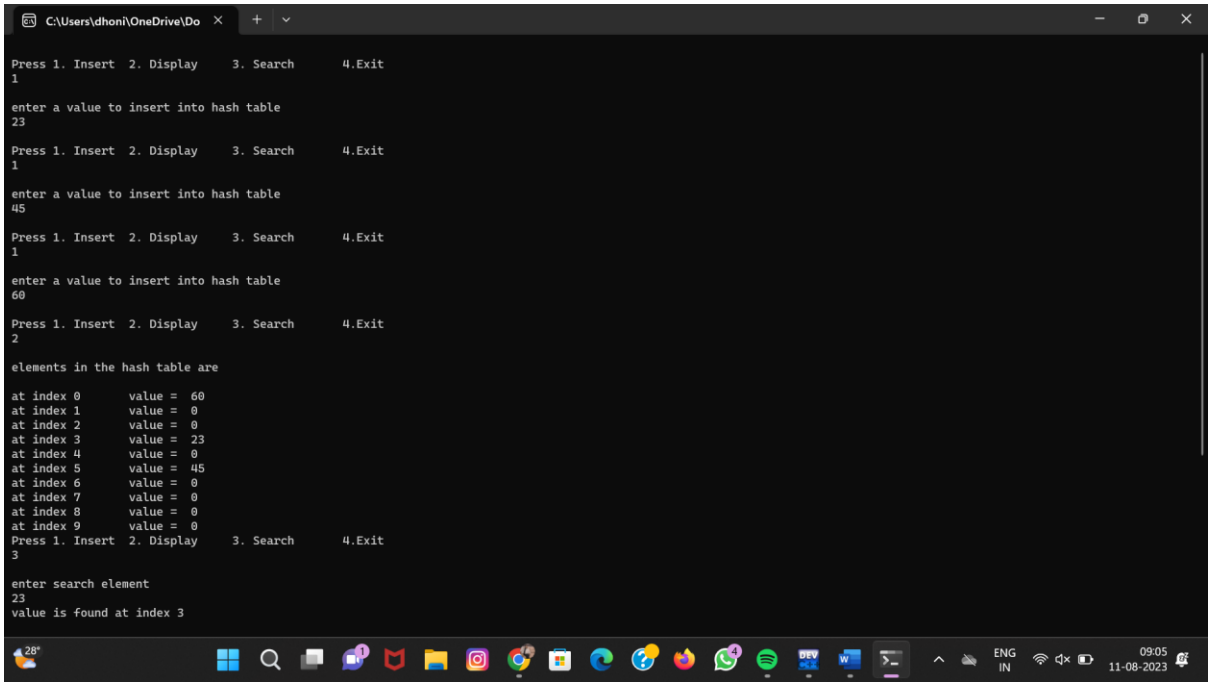


3.C programming to implement hashing using linear probing technique:

```
#include <stdio.h>
#include<stdlib.h>
#define TABLE_SIZE 10
int h[TABLE_SIZE]={NULL};
void insert()
{
 int key,index,i,flag=0,hkey;
 printf("\nenter a value to insert into hash table\n");
 scanf("%d",&key);
 hkey=key%TABLE_SIZE;
```

```
 for(i=0;i<TABLE_SIZE;i++)
    {
     index=(hkey+i)%TABLE_SIZE;
     if(h[index] == NULL)
     {
        h[index]=key;
         break;
     }
    }
    if(i == TABLE_SIZE)
     printf("\nelement cannot be inserted\n");
}
void search()
{
 int key,index,i,flag=0,hkey;
 printf("\nenter search element\n");
 scanf("%d",&key);
 hkey=key%TABLE_SIZE;
 for(i=0;i<TABLE_SIZE; i++)
 {
    index=(hkey+i)%TABLE_SIZE;
    if(h[index]==key)
    {
      printf("value is found at index %d",index);
      break;
    }
  }
  if(i == TABLE_SIZE)
    printf("\n value is not found\n");
}
void display()
```

```
{


  int i;
  printf("\nelements in the hash table are \n");
  for(i=0;i< TABLE_SIZE; i++)
  printf("\nat index %d \t value =  %d",i,h[i]);
}
main()
{
    int opt,i;
    while(1)
    {
        printf("\nPress 1. Insert\t 2. Display \t3. Search \t4.Exit \n");
        scanf("%d",&opt);
        switch(opt)
        {
            case 1:
                insert();
                break;
            case 2:
                display();
                break;
            case 3:
                search();
                break;
            case 4:exit(0);
        }
    }
}
```

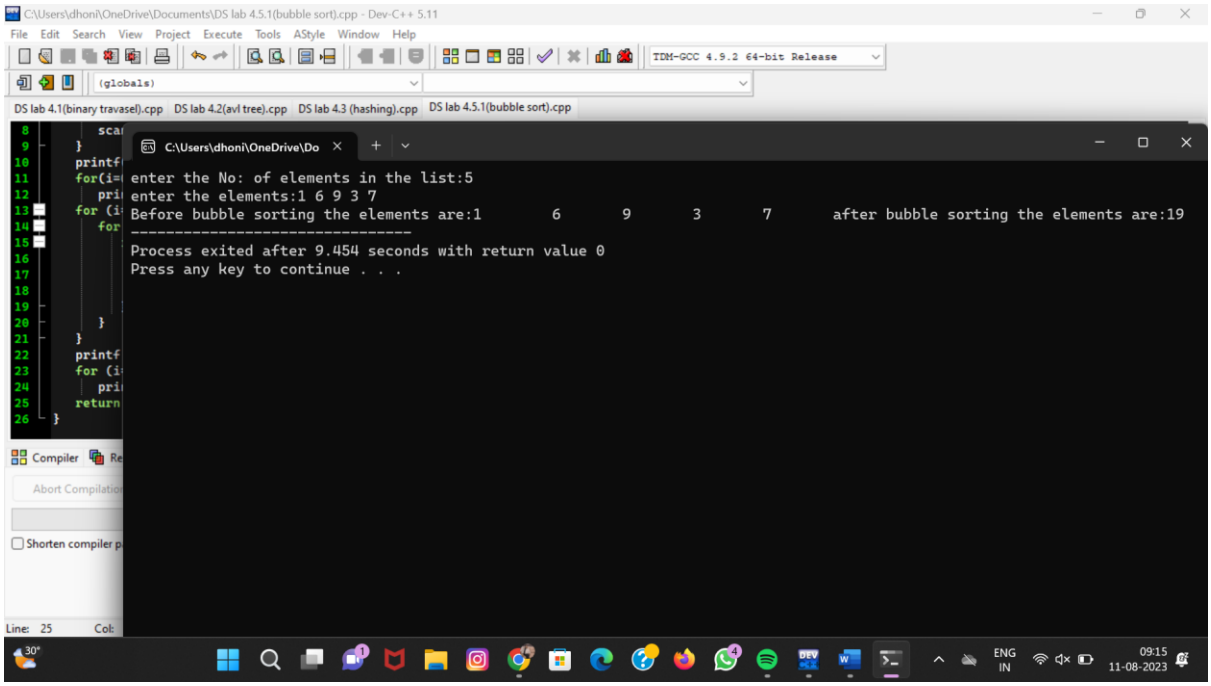


4.C programming to implement :

1.bubble sorting :

```
#include<stdio.h>

int main(){

  int a[50], i,j,n,t;

  printf("enter the No: of elements in the list:");

  scanf("%d", &n);

  printf("enter the elements:");

  for(i=0; i<n; i++){

    scanf ("%d", &a[i]);

  }

  printf("Before bubble sorting the elements are:");

  for(i=0; i<n; i++)

    printf("%d \t", a[i]);

  for (i=0; i<n-1; i++){

    for (j=i+1; j<n; j++){

      if (a[i] > a[j]){

        t = a[i];
```

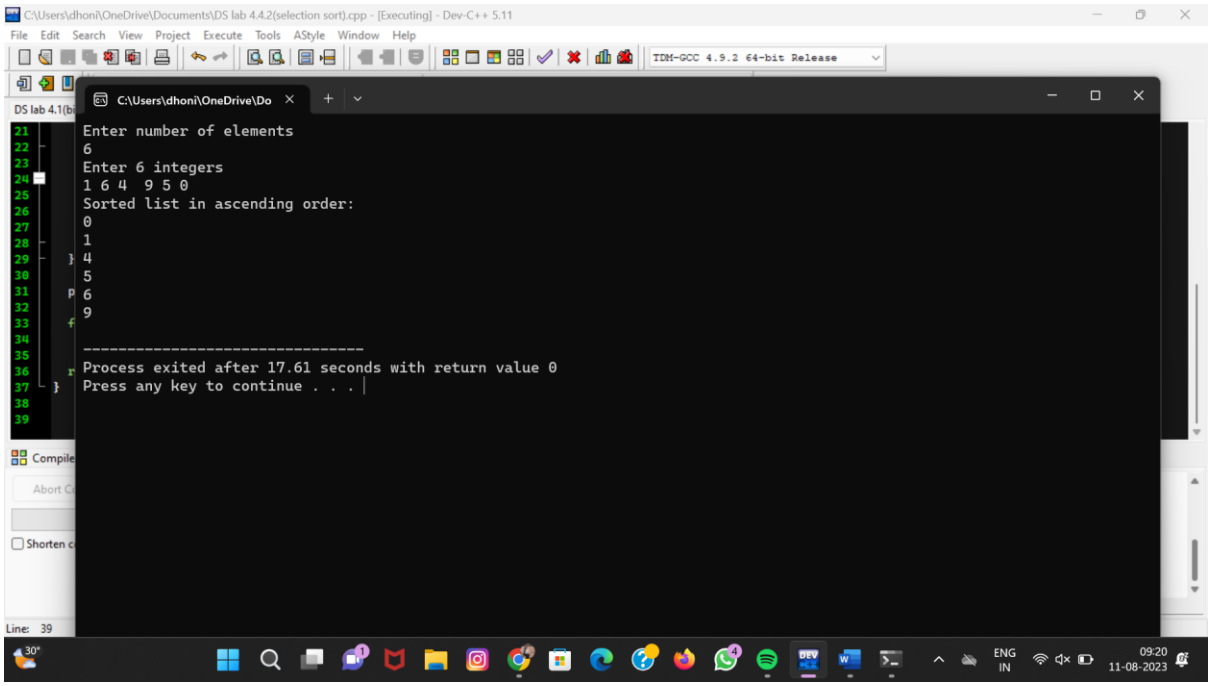
```
            a[i] = a[j];
            a[j] = t;
          }
        }
    }
    printf ("\nafter bubble sorting the elements are:");
    for (i=0; i<n; i++)
      printf("%d\t", a[i]);
    return 0;
}
```



2.selection sorting:

```
#include <stdio.h>

int main()

{

  int array[100], n, c, d, position, t;

  printf("Enter number of elements\n");

  scanf("%d", &n);

  printf("Enter %d integers\n", n);

  for (c = 0; c < n; c++)
```

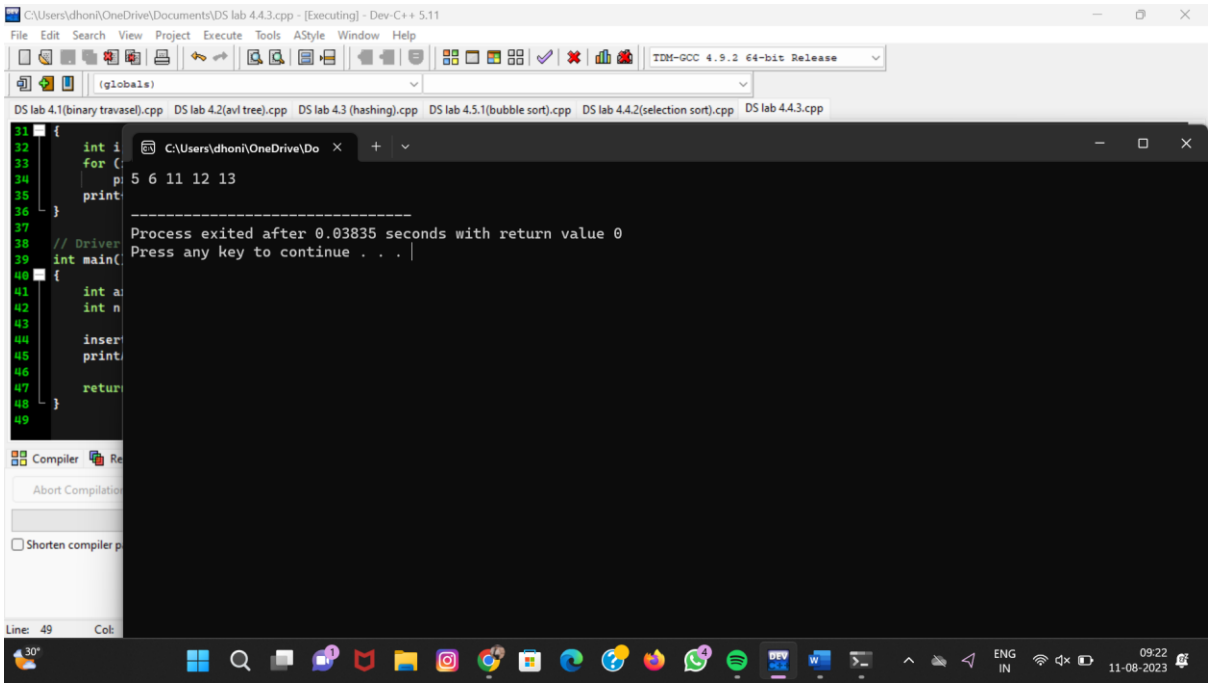
```
    scanf("%d", &array[c]);
  for (c = 0; c < (n - 1); c++) // finding minimum element (n-1) times
  {
    position = c;
    for (d = c + 1; d < n; d++)
    {
      if (array[position] > array[d])
        position = d;
    }
    if (position != c)
    {
      t = array[c];
      array[c] = array[position];
      array[position] = t;
    }
  }
  printf("Sorted list in ascending order:\n");
  for (c = 0; c < n; c++)
    printf("%d\n", array[c]);
  return 0;
}
```



3.insertion sort :

```
#include <math.h>

#include <stdio.h>

void insertionSort(int arr[], int n)

{

        int i, key, j;

        for (i = 1; i < n; i++)

        {

                key = arr[i];

                j = i - 1;

                while (j >= 0 && arr[j] > key)

                {

                        arr[j + 1] = arr[j];

                        j = j - 1;

                }

                arr[j + 1] = key;

        }

}
```

```
void printArray(int arr[], int n)
{
        int i;
        for (i = 0; i < n; i++)
                printf("%d ", arr[i]);
        printf("\n");
}
int main()
{
        int arr[] = {12, 11, 13, 5, 6};
        int n = sizeof(arr) / sizeof(arr[0]);
        insertionSort(arr, n);
        printArray(arr, n);
        return 0;
}
```

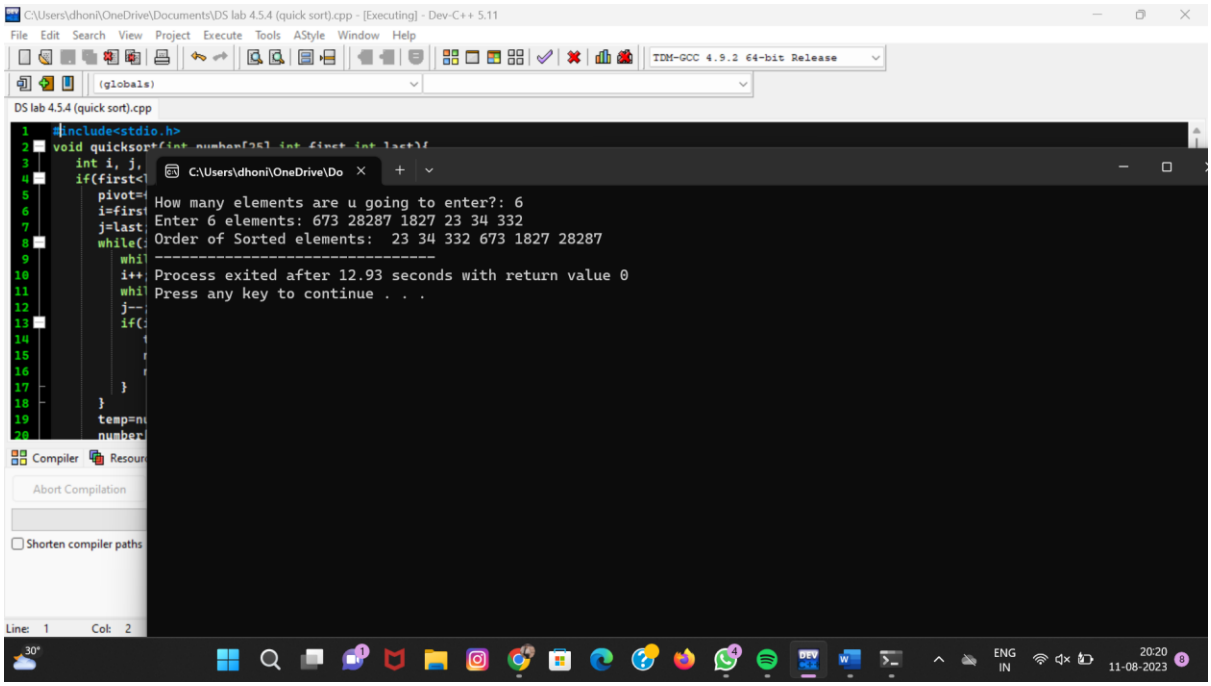


4.quick sort :

```
#include<stdio.h>
void quicksort(int number[25],int first,int last){
   int i, j, pivot, temp;
```

```
  if(first<last){
    pivot=first;
    i=first;
    j=last;
    while(i<j){
      while(number[i]<=number[pivot]&&i<last)
      i++;
      while(number[j]>number[pivot])
      j--;
      if(i<j){
        temp=number[i];
        number[i]=number[j];
        number[j]=temp;
      }
    }
    temp=number[pivot];
    number[pivot]=number[j];
    number[j]=temp;
    quicksort(number,first,j-1);
    quicksort(number,j+1,last);
  }
}
int main(){
  int i, count, number[25];
  printf("How many elements are u going to enter?: ");
  scanf("%d",&count);
  printf("Enter %d elements: ", count);
  for(i=0;i<count;i++)
  scanf("%d",&number[i]);
  quicksort(number,0,count-1);
  printf("Order of Sorted elements: ");
```

```
  for(i=0;i<count;i++)
  printf(" %d",number[i]);
  return 0;
}
```

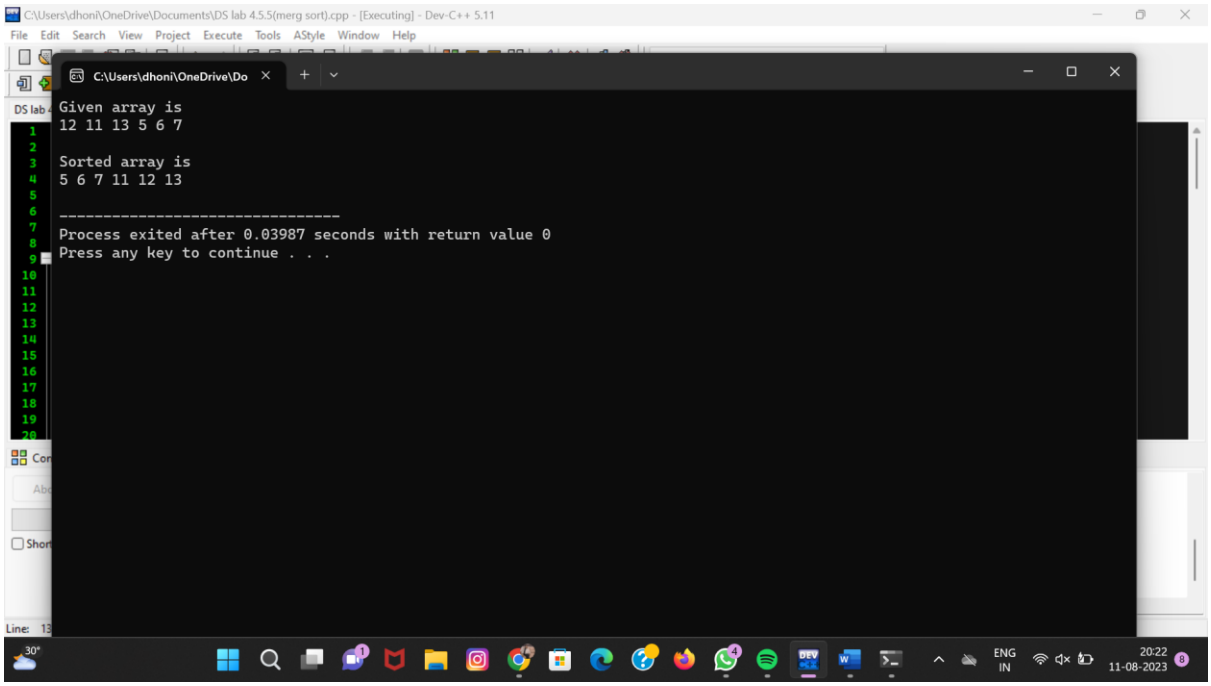


5. Merge sort:

```
#include <stdio.h>
#include <stdlib.h>
void merge(int arr[], int l, int m, int r)
{
        int i, j, k;
        int n1 = m - l + 1;
        int n2 = r - m;
        int L[n1], R[n2];
        for (i = 0; i < n1; i++)
                L[i] = arr[l + i];
        for (j = 0; j < n2; j++)
                R[j] = arr[m + 1 + j];
        i = 0;
```

```
	j = 0;
	k = l;
	while (i < n1 && j < n2) {
		if (L[i] <= R[j]) {
			arr[k] = L[i];
			i++;
		}
		else {
			arr[k] = R[j];
			j++;
		}
		k++;
	}
	while (i < n1) {
		arr[k] = L[i];
		i++;
		k++;
	}
	while (j < n2) {
		arr[k] = R[j];
		j++;
		k++;
	}
}
void mergeSort(int arr[], int l, int r)
{
	if (l < r) {
		int m = l + (r - l) / 2;
		mergeSort(arr, l, m);
		mergeSort(arr, m + 1, r);
```

```
                merge(arr, l, m, r);
        }
}
void printArray(int A[], int size)
{
        int i;
        for (i = 0; i < size; i++)
                printf("%d ", A[i]);
        printf("\n");
}
int main()
{
        int arr[] = { 12, 11, 13, 5, 6, 7 };
        int arr_size = sizeof(arr) / sizeof(arr[0]);
        printf("Given array is \n");
        printArray(arr, arr_size);
        mergeSort(arr, 0, arr_size - 1);
        printf("\nSorted array is \n");
        printArray(arr, arr_size);
        return 0;
}
```


C:\Users\dhoni\OneDrive\Documents\DS lab 4.5.5(merg sort).cpp - [Executing] - Dev-C++ 5.11
File Edit Search View Project Execute Tools AStyle Window Help
C:\Users\dhoni\OneDrive\Do
Given array is
12 11 13 5 6 7
Sorted array is
5 6 7 11 12 13
Process exited after 0.03987 seconds with return value 0
Press any key to continue . . .
ENG
IN
20:22
11-08-2023