LAB 7

1. 8) Write a program
a) To construct a binary Search tree.
b) To traverse the tree using all the methods i.e., in-order, preorder and post order
c) To display the elements in the tree.

```
#include <stdio.h>
#include <stdlib.h>

struct node {
  int data;
  struct node *left, *right;
};

// Create a node
struct node *newNode(int item) {
  struct node *temp = (struct node *)malloc(sizeof(struct node));
  temp->data = item;
  temp->left = temp->right = NULL;
  return temp;
}

// Inorder Traversal
void inorder(struct node *root) {
  if (root != NULL) {
    // Traverse left
    inorder(root->left);

    // Traverse root
    printf("%d -> ", root->data);

    // Traverse right
    inorder(root->right);
  }
}

// Preorder Traversal
void preorder(struct node *root) {
  if (root != NULL) {
    // Traverse root
    printf("%d -> ", root->data);
```

```
    // Traverse left
    preorder(root->left);
    // Traverse right
    preorder(root->right);
  }
}

// Postorder Traversal
void postorder(struct node *root) {
  if (root != NULL) {
    // Traverse left
    postorder(root->left);
    // Traverse right
    postorder(root->right);
    // Traverse root
    printf("%d -> ", root->data);
  }
}

// Insert a node
struct node *insert(struct node *node, int data) {
  // Return a new node if the tree is empty
  if (node == NULL) return newNode(data);

  // Traverse to the right place and insert the node
  if (data < node->data)
    node->left = insert(node->left, data);
  else
    node->right = insert(node->right, data);

  return node;
}


// Driver code
int main() {
  struct node *root = NULL;
  root = insert(root, 9);
  root = insert(root, 1);
  root = insert(root, 2);
  root = insert(root, 5);
  root = insert(root, 22);
  root = insert(root, 11);
  root = insert(root, 14);
```

```
  root = insert(root, 4);

  printf("\nInorder traversal: \n");
  inorder(root);

  printf("\nPreorder traversal: \n");
  preorder(root);

  printf("\nPostorder traversal: \n");
  postorder(root);

}
```

OUTPUT:

```
Inorder traversal:
1 -> 2 -> 4 -> 5 -> 9 -> 11 -> 14 -> 22 ->
Preorder traversal:
9 -> 1 -> 2 -> 5 -> 4 -> 22 -> 11 -> 14 ->
Postorder traversal:
4 -> 5 -> 2 -> 1 -> 14 -> 11 -> 22 -> 9 ->
Process returned 0 (0x0)   execution time : 0.030 s
Press any key to continue.
```

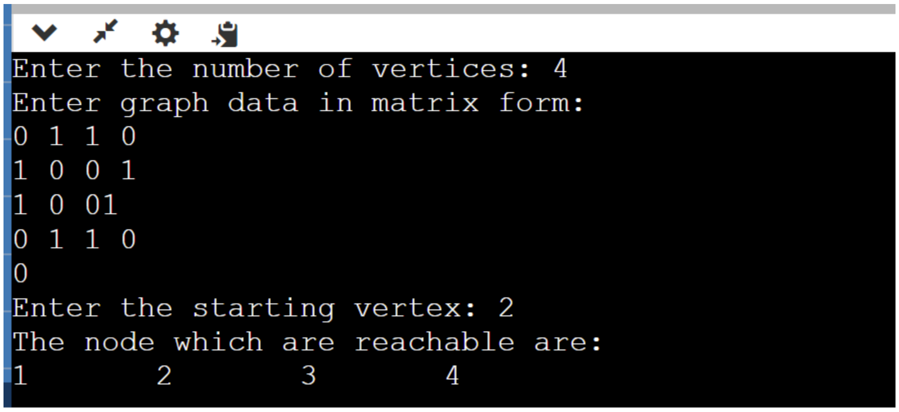
2. 9a) Write a program to traverse a graph using BFS method.
9b) Write a program to check whether given graph is connected or not using DFS method.

a) BFS

```
#include <stdio.h>
 int n, i, j, visited[10], queue[10], front = -1, rear = -1;
int adj[10][10];

void bfs(int v)
{
   for (i = 1; i <= n; i++)
       if (adj[v][i] && !visited[i])
           queue[++rear] = i;
   if (front <= rear)
   {
       visited[queue[front]] = 1;
       bfs(queue[front++]);
   }
}

void main()
{
   int v;
   printf("Enter the number of vertices: ");
   scanf("%d", &n);
   for (i = 1; i <= n; i++)
```

```
    {
        queue[i] = 0;
        visited[i] = 0;
    }
    printf("Enter graph data in matrix form:    \n");
    for (i = 1; i <= n; i++)
        for (j = 1; j <= n; j++)
            scanf("%d", &adj[i][j]);
    printf("Enter the starting vertex: ");
    scanf("%d", &v);
    bfs(v);
    printf("The node which are reachable are:    \n");
    for (i = 1; i <= n; i++)
        if (visited[i])
            printf("%d\t", i);
        else
            printf("BFS is not possible. Not all nodes are reachable");

}
```

OUTPUT:



```
Enter the number of vertices: 4
Enter graph data in matrix form:
0 1 1 0
1 0 0 1
1 0 01
0 1 1 0
0
Enter the starting vertex: 2
The node which are reachable are:
1       2       3       4
```

b) DFS

```
#include<stdio.h>

#include<conio.h>

int a[20][20], reach[20], n;

void dfs(int v) {

   int i;

   reach[v] = 1;

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

      if (a[v][i] && !reach[i]) {

         printf("\n %d->%d", v, i);

         dfs(i);

      }

}


int main(int argc, char **argv) {

   int i, j, count = 0;

   printf("\n Enter number of vertices:");

   scanf("%d", &n);

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

```
        reach[i] = 0;
        for (j = 1; j <= n; j++)
            a[i][j] = 0;
    }
    printf("\n Enter the adjacency matrix:\n");
    for (i = 1; i <= n; i++)
        for (j = 1; j <= n; j++)
            scanf("%d", &a[i][j]);
    dfs(1);
    printf("\n");
    for (i = 1; i <= n; i++) {
        if (reach[i])
            count++;
    }
    if (count == n)
        printf("\n Graph is connected");
    else
        printf("\n Graph is not connected");
    return 0;
}
```

OUTPUT:

```
Enter number of vertices:4

Enter the adjacency matrix:
0 1 1 1
0 0 0 1
0 0 0 0
0 0 1 0

1->2
2->4
4->3

Graph is connected
```

```
Enter number of vertices:4

Enter the adjacency matrix:
1 0 0 0
0 0 0 0
0 0 1 1
0 0 1 1


Graph is not connected
```

HACKERRANK QUESTION: (Reverse Doubly Linked List - B1)

```
DoublyLinkedListNode* reverse(DoublyLinkedListNode* llist) {
    DoublyLinkedListNode* temp = llist;
    DoublyLinkedListNode* curr = temp;
    DoublyLinkedListNode* prev = NULL;
    DoublyLinkedListNode* nextOne = NULL;

    while(curr != NULL) {
```

```
        nextOne = curr->next;
        curr->next = prev;
        prev = curr;
        curr = nextOne;
    }
    return prev;
}
```

HACKERRANK QUESTION: (Trees - B1)

Code:

```c
/**
 * Definition for a binary tree node.
 * struct TreeNode {
 *     int val;
 *     struct TreeNode *left;
 *     struct TreeNode *right;
 * };
 */

void findLeaves(struct TreeNode* node, int** leafValues, int* size, int*
capacity) {
    if (node == NULL) {
        return;
    }

    if (node->left == NULL && node->right == NULL) {
        if (*size >= *capacity) {
            *capacity *= 2;
            *leafValues = (int*) realloc(*leafValues, *capacity * sizeof(int));
        }
        (*leafValues)[(*size)++] = node->val;
    }

    findLeaves(node->left, leafValues, size, capacity);
    findLeaves(node->right, leafValues, size, capacity);
}
```

```c
bool leafSimilar(struct TreeNode* root1, struct TreeNode* root2) {
    int *leaves1 = (int*) malloc(sizeof(int) * 10);
    int size1 = 0, capacity1 = 10;

    int *leaves2 = (int*) malloc(sizeof(int) * 10);
    int size2 = 0, capacity2 = 10;

    findLeaves(root1, &leaves1, &size1, &capacity1);
    findLeaves(root2, &leaves2, &size2, &capacity2);

    if (size1 != size2) {
        free(leaves1);
        free(leaves2);
        return false;
    }

    for (int i = 0; i < size1; i++) {
        if (leaves1[i] != leaves2[i]) {
            free(leaves1);
            free(leaves2);
            return false;
        }
    }

    free(leaves1);
    free(leaves2);
    return true;
}
```

Output:

Testcase | >_ Test Result

Accepted Runtime: 3 ms

• Case 1 • Case 2

Input

root1 =

```
[3,5,1,6,2,9,8,null,null,7,4]
```

root2 =

```
[3,5,1,6,7,4,2,null,null,null,null,null,null,9,8]
```

Output