Experiment No. : 6

Title: Graph Traversal using appropriate data structure

Batch: B-1 **Roll No.: 16010422234** **Name: Chandana Ramesh Galgali**

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Aim: Implement a menu driven program to represent a graph and traverse it using BFS technique.

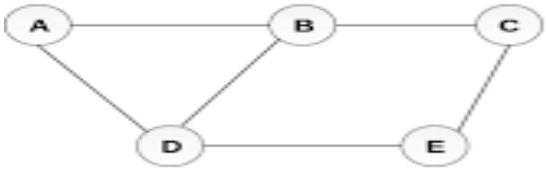
Resources Used: C/ C++ editor and compiler.

Theory:

Graph

Given an undirected graph G= (V,E) and a vertex V in V(G), then we are interested in visiting all vertices in G that are reachable from V i.e. all vertices connected to V. There are two techniques of doing it namely Depth First Search (DFS) and Breadth First Search(BFS).

Graph Representation using Adjacency Matrix



Undirected Graph

	A	B	C	D	E
A	0	1	0	1	0
B	1	0	1	1	0
C	0	1	0	0	1
D	1	1	0	0	1
E	0	0	1	1	0

Adjacency Matrix

Depth First Search

The procedure of performing DFS on an undirected graph can be as follows :
The starting vertex v is visited. Next an unvisited vertex w adjacent to v is selected and a depth first search from w is initiated. When a vertex u is reached such that all its adjacent vertices have been visited, we back up to the last vertex visited which has an unvisited vertex w adjacent to it and initiate a depth first search from w. the search terminates when no unvisited vertex can be reached from any of the visited ones. Given an undirected graph G=(V,E) with n vertices and an array visited[n] initially set to false, this algorithm, dfs (v) visits all vertices reachable from v. Visited is a global array.

Breadth First Search

Starting at vertex v and making it as visited, BFS visits next all unvisited vertices adjacent to v. then unvisited vertices adjacent to there vertices are visited and so on. A breadth first search of G is carried out beginning at vertex v as bfs (v). All vertices visited are marked as visited [i]=true. The graph G and array visited are global and visited is initialized to false. Initialize, addqueue, emptyqueue, deletequeue are the functions to handle operations on queue.

Algorithm :

Implement the static linear queue ADT, Represent the graph using adjacency matrix and implement following pseudo code for BFS.

Pseudo Code: bfs (v)

initialize queue q

visited [v] = true

addqueue(q,v)

while not emptyqueue

v=deletequeue(q)

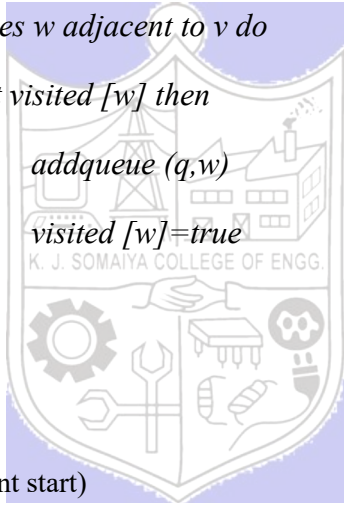
add v into bfs sequence

for all vertices w adjacent to v do

if not visited [w] then

addqueue (q,w)

visited [w]=true



Results:

```
#include <stdio.h>
#define MAX 20

void bfs(int adj[][MAX],int visited[],int start)
{
   int queue[MAX],rear = -1,front = -1, i;
   queue[++rear] = start;
   visited[start] = 1;
   while(rear != front)
   {
      start = queue[++front];
      if(start == 4)
      {
         printf("5\t");
      }
      else
      {
         printf("%c \t",start + 65);
      }
      for(i = 0; i < MAX; i++)
```

```
        {
            if(adj[start][i] == 1 && visited[i] == 0)
            {
                queue[++rear] = i;
                visited[i] = 1;
            }
        }
    }
}
int main()
{
    int visited[MAX] = {0};
    int adj[MAX][MAX], i, j;
    printf("\nEnter the adjacency matrix: ");
    for(i = 0; i < MAX; i++)
    {
        for(j = 0; j < MAX; j++)
        {
            scanf("%d ", &adj[i][j]);
        }
        bfs(adj,visited,0);
        printf("\n");
    }
    return 0;
}
```



```
C:\Users\exam\Desktop\234-chandana\exp-6-new\bin\Debug\exp-6-new.exe
Enter the adjacency matrix: 0 1 0 1 0
1 0 1 1 0
0 1 0 0 1
1 1 0 0 1
0 0 1 1 0
A       B       D       F       H       I       L       O       P
 Q       T       M       K       S       5
         N       R
```

A program depicting the BFS using adjacency matrix and capable of handling all possible boundary conditions and the same is reflected clearly in the output.

Outcomes: Apply linear and non-linear data structure in application development.

Conclusion: The experiment was successful in implementing a menu-driven program to represent a graph and traverse it using the BFS technique. The program exhibited the desired behavior and functionality, allowing the user to interact with the graph and perform BFS traversal.

Grade: AA / AB / BB / BC / CC / CD /DD

Signature of faculty in-charge with date

References:

Books/ Journals/ Websites:

- Y. Langsam, M. Augenstin and A. Tannenbaum, “Data Structures using C”, Pearson Education Asia, 1st Edition, 2002.
- Vlab on BFS