Experiment No.10
Implementation of Graph traversal techniques - Depth First Search, Breadth First Search
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Experiment No. 10: Depth First Search and Breath First Search

Aim : Implementation of DFS and BFS traversal of graph.

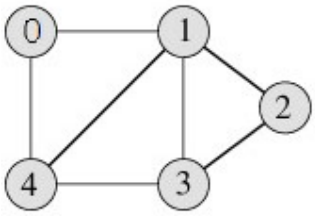
Objective:

1. Understand the Graph data structure and its basic operations.
2. Understand the method of representing a graph.
3. Understand the method of constructing the Graph ADT and defining its operations

Theory:

A graph is a collection of nodes or vertices, connected in pairs by lines referred to as edges. A graph can be directed or undirected.

One method of traversing through nodes is depth first search. Here we traverse from the starting node and proceed from top to bottom. At a moment we reach a dead end from where the further movement is not possible and we backtrack and then proceed according to left right order. A stack is used to keep track of a visited node which helps in backtracking.



	0	1	2	3	4
0	0	1	0	0	1
1	1	0	1	1	1
2	0	1	0	1	0
3	0	1	1	0	1
4	1	1	0	1	0

DFS Traversal –0 1 2 3 4

Algorithm

Algorithm: DFS_LL(V)

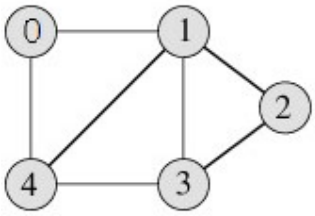
Input: V is a starting vertex

Output : A list VISIT giving order of visited vertices during traversal.

Description: linked structure of graph with gptr as pointer

1. if gptr = NULL then
   print "Graph is empty" exit
2. u=v
3. OPEN.PUSH(u)
4. while OPEN.TOP !=NULL do
   u=OPEN.POP()
   if search(VISIT,u) = FALSE then
   INSERT_END(VISIT,u)
   Ptr = gptr(u)
   While ptr.LINK != NULL do
   Vptr = ptr.LINK
   OPEN.PUSH(vptr.LABEL)
   End while
   End if
   End while
5. Return VISIT
6. Stop

BFS Traversal



	0	1	2	3	4
0	0	1	0	0	1
1	1	0	1	1	1
2	0	1	0	1	0
3	0	1	1	0	1
4	1	1	0	1	0

BFS Traversal – 0 1 4 2 3

Algorithm

Algorithm: DFS()

i=0

count=1

visited[i]=1

print("Visited vertex i")

repeat this till queue is empty or all nodes visited

repeat this for all nodes from first till last

if(g[i][j]!=0&&visited[j]!=1)

{

push(j)

}

i=pop()

print("Visited vertex i")

visited[i]=1

count++

Algorithm: BFS()

i=0

count=1

visited[i]=1

print("Visited vertex i")

repeat this till queue is empty or all nodes visited

repeat this for all nodes from first till last

```
if(g[i][j]!=0&&visited[j]!=1)
{
enqueue(j)
}

i=dequeue()
print("Visited vertex  i")
visited[i]=1
count++
```

Code:

BSF Code:

```
#include <stdio.h>

#define MAX 10

void breadth_first_search(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("\n Enter the adjacency matrix: ");

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

                for(j = 0; j < MAX; j++)

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

breadth_first_search(adj,visited,0);

        return 0;
```

```
}
```

DSF Code:

```
#include <stdio.h>

#define MAX 5

void depth_first_search(int adj[][MAX],int visited[],int start)

{

        int stack[MAX];

int top = –1, i;

printf("%c–",start + 65);

visited[start] = 1;

stack[++top] = start;

while(top ! = –1)

{
```

```
start = stack[top];

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

{

        if(adj[start][i] && visited[i] == 0)

{

stack[++top] = i;

printf("%c–", i + 65);

visited[i] = 1;

break;

}

}

                if(i == MAX)

top—;
```

```
}

}

int main()

{

        int adj[MAX][MAX];

        int visited[MAX] = {0}, i, j;

printf("\n Enter the adjacency matrix: ");

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

                for(j = 0; j < MAX; j++)

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

printf("DFS Traversal: ");

        depth_first_search(adj,visited,0);

printf("\n");
```

```
    return 0;

}
```

Output:

BSF Output:

```
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 C E
```

DSF Output:

```
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
DFS Traversal: A -> C -> E ->
```

Conclusion:

Write the graph representation used by your program and explain why you choose that.
In this experiment, we implemented Depth First Search (DFS) and Breadth First Search (BFS) traversal algorithms for a graph. We aimed to understand the basic operations of graphs, methods of representing a graph, and how to construct a Graph ADT with its operations. For DFS, we used a stack to traverse the graph from the starting node, exploring as far as possible along each branch before backtracking. This process was implemented using a stack data structure. For BFS, we employed a queue to explore all the neighbors of a node before moving on to their neighbors. This approach ensures that nodes are visited in a level-wise fashion, which can be useful in various applications

Write the applications of BFS and DFS other than finding connected nodes and explain how it is attained?
These algorithms have wide-ranging applications beyond finding connected nodes, including solving mazes, topological sorting, network analysis, and more. By understanding these traversal methods, we gain valuable insights into the structure and relationships within graphs, which are essential in various fields of computer science and artificial intelligence