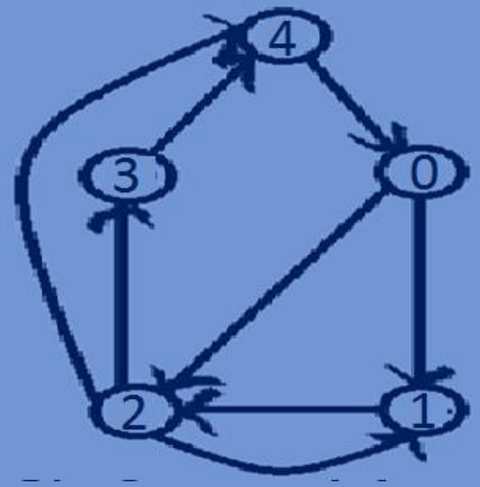
Data Structures

Breadth First traversal of a Graph

Adjacency List

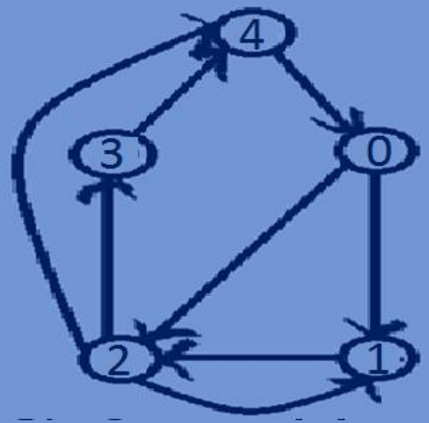
Breadth First Traversal of a graph:

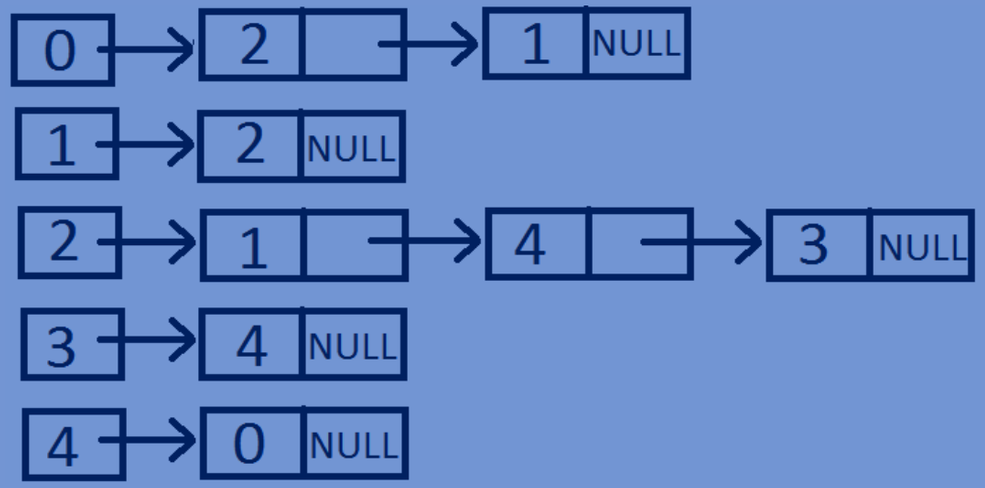
- BFS is an algorithm for traversing all the vertices of a graph in level order fashion.
- Unlike trees,graphs may have cycles so there may be possibility that we visit The same vertex more than once.To avoid visiting the node more than once We use a visited array which keeps track of the visited vertices,if we visit a vertex then we mark it as visited.A vertex that has already been marked will not be selected for traversal.



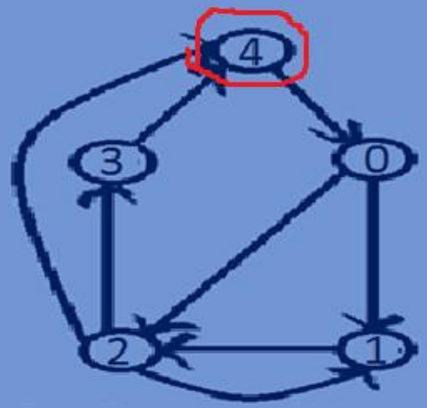
4->0->2->1->3

Breadth First Traversal of a graph:



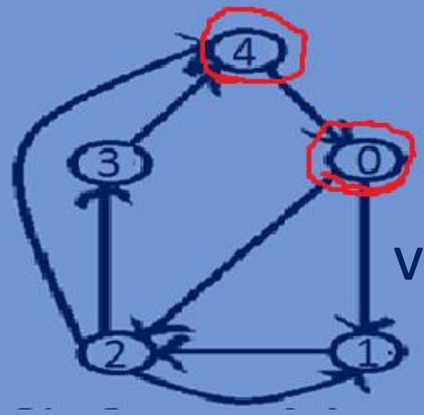


visited={0,0,0,0,0}



visited[4]=1

4

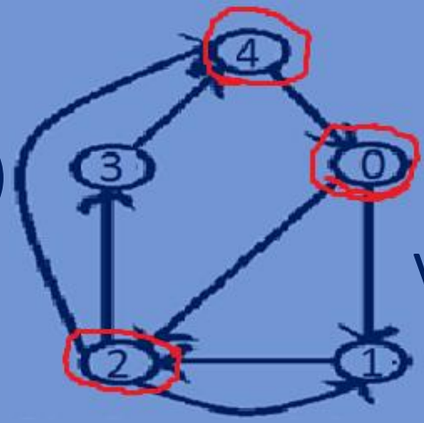


print(4)

dequeue(4)

visited[0]=1

0

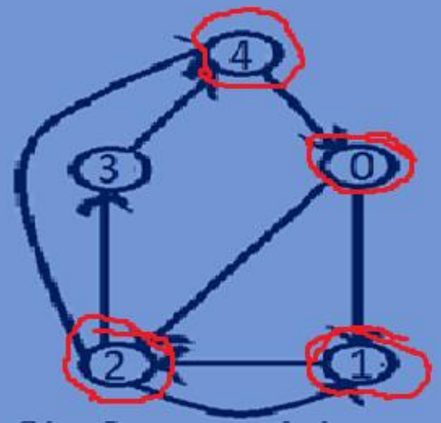


print(0)

dequeue(0)

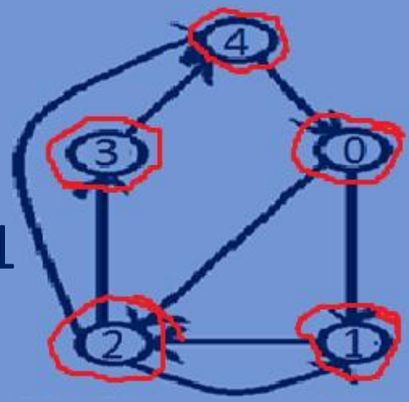
visited[2]=1

2



visited[1]=1

2 1



print(2)

dequeue(2)

visited[3]=1

1 3

print(1)

dequeue(1)

print(3)

dequeue(3)

Function for Depth First traversal of a graph:

```
//BFS traversal of a graph
void BFSTraversal(Graph *graph,int visited[],int startvertex){
    lin_list *queue=NULL;//creating a linked list(queue)
    //mark the current node as visited and enqueue it.
    visited[startvertex]=1;
    queue=enqueue(queue,startvertex);
    while(queue){
        int vertex=queue->data;
        printf("->%d",vertex);
        queue=dequeue(queue);
        Node *head=graph->array[vertex].Head;
        //visit all the adjacent vertices of the current vertex and mark
them visited and enqueue them.
        while(head){
            if(visited[head->dest]==0){
                visited[head->dest]=1;
                queue=enqueue(queue,head->dest);
            }
            head=head->next;
        }
    }
}
```

Whole program:

```c
#include<stdio.h>
#include<stdlib.h>
//creating a node.
typedef struct lin_list{
    int data;
    struct lin_list *next;
}lin_list;
//Structure for representing a NODE in the Adjacency List
typedef struct Node{
    int dest;
    int weight;
    struct Node *next;
}Node;
//structure for representing an adjacency liat
typedef struct List{
    Node *Head;
}List;
```

```
// A structure to represent a graph - here graph is an array of Adjacency
lists
// size of the array will be  equal to the number of vertices in graph
typedef struct Graph{
    int totVertices;
    List *array;
}Graph;
//function To create a new node in the adjacency list
Node *createNewNode(int dest,int weight){
    Node *newnode=(Node*)malloc(sizeof(Node));
    newnode->dest=dest;
    newnode->weight=weight;
    newnode->next=NULL;
    return newnode;
}
//Function To creates a graph of n vertices
Graph *createGraph(int n){
    Graph *graph=(Graph*)malloc(sizeof(Graph));
    graph->totVertices=n;
    graph->array=(List*)malloc(n*sizeof(List));
    //Initialise each adjacency list as empty by making head as NULL
    for(int i=0;i<n;i++){
        graph->array[i].Head=NULL;
    }
```

```
    return graph;
}
//function for Adding an edge to a directed graph
void addedge(Graph *graph,int src,int dest,int weight){
    Node *newnode=createNewNode(dest,weight);
    newnode->next=graph->array[src].Head;
    graph->array[src].Head=newnode;
}
//Function for printing Adjacency list corresponding to each vertex
void printGraph(Graph *graph){
    for(int i=0;i<graph->totVertices;i++){
        Node *Headnode=graph->array[i].Head;
        printf("connected vertices of vertex %d are:head",i);
        while(Headnode){
            printf("->%d",Headnode->dest);
            Headnode=Headnode->next;
        }
        printf("\n");
    }
}
//adding a newnode at the end of a linked list
lin_list *enqueue(lin_list *head,int data){
    lin_list *newnode=(lin_list*)malloc(sizeof(lin_list));
    newnode->data=data;
```

```
    newnode->next=NULL;
    lin_list *temp=head;
    if(head==NULL){
        head=newnode;
    }
    else {
        while (temp->next != NULL) {
            temp = temp->next;
        }
        temp->next = newnode;
    }
    return head;
}
//popping of first node from linked list
lin_list *dequeue(lin_list *head){
    lin_list *temp=head;
    head=head->next;
    free(temp);
    return head;
}
//BFS traversal of a graph
void BFSTraversal(Graph *graph,int visited[],int startvertex){
    lin_list *queue=NULL;//creating a linked list(queue)
    //mark the current node as visited and enqueue it.
```

```
    visited[startvertex]=1;
    queue=enqueue(queue,startvertex);
    while(queue){
        int vertex=queue->data;
        printf("->%d",vertex);
        queue=dequeue(queue);
        Node *head=graph->array[vertex].Head;
        //visit all the adjacent vertices of the current vertex and mark
them visited and enqueue them.
        while(head){
            if(visited[head->dest]==0){
                visited[head->dest]=1;
                queue=enqueue(queue,head->dest);
            }
            head=head->next;
        }
    }
}
//main function
int main(){
    int n=5,visited[5]={0};//making all the vertices as not visited
    Graph *graph=createGraph(n);
    addedge(graph,0,1,2);
    addedge(graph,0,2,1);
```

```
    addedge(graph,1,2,3);
    addedge(graph,2,3,1);
    addedge(graph,2,4,7);
    addedge(graph,2,1,1);
    addedge(graph,3,4,5);
    addedge(graph,4,0,4);printf("\n");
    printGraph(graph);
    BFSTraversal(graph,visited,4);
    return 0;
}
```

Output:

connected vertices of vertex 0 are:head->2->1

connected vertices of vertex 1 are:head->2

connected vertices of vertex 2 are:head->1->4->3

connected vertices of vertex 3 are:head->4

connected vertices of vertex 4 are:head->0

->4->0->2->1->3