Graph Traversl Technique DFS (using stack)

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

#define MAX 100

#define initial 1
#define visited 2

int n;
int adj[MAX][MAX]; /*Adjacency Matrix*/
int state[MAX]; /*Can be initial or visited */

void DF_Traversal();
void DFS(int v);
void create_graph();

int stack[MAX];
int top = -1;
void push(int v);
int pop();
int isEmpty_stack();

main()
{
        create_graph();
        DF_Traversal();
```

```
}/*End of main()*/

void DF_Traversal()
{
	int v;

	for(v=0; v<n; v++)
		state[v]=initial;

	printf("\nEnter starting node for Depth First Search : ");
	scanf("%d",&v);
	DFS(v);
	printf("\n");
}/*End of DF_Traversal( )*/

void DFS(int v)
{
	int i;
	push(v);
	while(!isEmpty_stack())
	{
		v = pop();
		if(state[v]==initial)
		{
			printf("%d ",v);
			state[v]=visited;
		}
		for(i=n-1; i>=0; i--)
		{
```

```
                if(adj[v][i]==1 && state[i]==initial)
                    push(i);
            }
        }
}/*End of DFS( )*/

void push(int v)
{
        if(top == (MAX-1))
        {
            printf("\nStack Overflow\n");
            return;
        }
        top=top+1;
        stack[top] = v;

}/*End of push()*/

int pop()
{
        int v;
        if(top == -1)
        {
            printf("\nStack Underflow\n");
            exit(1);
        }
        else
        {
            v = stack[top];
```

```
            top=top-1;
            return v;
        }
}/*End of pop()*/

int isEmpty_stack( )
{
  if(top == -1)
         return 1;
  else
         return 0;
}/*End if isEmpty_stack()*/

void create_graph()
{
        int i,max_edges,origin,destin;

        printf("\nEnter number of nodes : ");
        scanf("%d",&n);
        max_edges=n*(n-1);

        for(i=1;i<=max_edges;i++)
        {
            printf("\nEnter edge %d( -1 -1 to quit ) : ",i);
            scanf("%d %d",&origin,&destin);

            if( (origin == -1) && (destin == -1) )
                break;
```

```
            if( origin >= n || destin >= n || origin<0 || destin<0)
            {
                printf("\nInvalid edge!\n");
                i--;
            }
            else
            {
                adj[origin][destin] = 1;
            }
        }
}
```

OUTPUT

```
Enter number of nodes : 6

Enter edge 1( -1 -1 to quit ) : 0 1

Enter edge 2( -1 -1 to quit ) : 0 2

Enter edge 3( -1 -1 to quit ) : 0 3

Enter edge 4( -1 -1 to quit ) : 1 3

Enter edge 5( -1 -1 to quit ) : 3 4

Enter edge 6( -1 -1 to quit ) : 4 2

Enter edge 7( -1 -1 to quit ) : 5 5

Enter edge 8( -1 -1 to quit ) : -1 -1

Enter starting node for Depth First Search : 0
0 1 3 4 2


...Program finished with exit code 0
Press ENTER to exit console.
```

Graph Traversl Technique BFS (using queue)

```
#include <stdio.h>
#include <stdlib.h>
#define SIZE 40

struct queue {
  int items[SIZE];
  int front;
  int rear;
};

struct queue* createQueue();
void enqueue(struct queue* q, int);
int dequeue(struct queue* q);
void display(struct queue* q);
int isEmpty(struct queue* q);
void printQueue(struct queue* q);

struct node {
  int vertex;
  struct node* next;
};

struct node* createNode(int);

struct Graph {
  int numVertices;
```

```
  struct node** adjLists;
  int* visited;
};

void bfs(struct Graph* graph, int startVertex) {
  struct queue* q = createQueue();

  graph->visited[startVertex] = 1;
  enqueue(q, startVertex);

  while (!isEmpty(q)) {
    printQueue(q);
    int currentVertex = dequeue(q);
    printf("Visited %d\n", currentVertex);

    struct node* temp = graph->adjLists[currentVertex];

    while (temp) {
      int adjVertex = temp->vertex;

      if (graph->visited[adjVertex] == 0) {
        graph->visited[adjVertex] = 1;
        enqueue(q, adjVertex);
      }
      temp = temp->next;
    }
  }
}
```

```
struct node* createNode(int v) {
  struct node* newNode = malloc(sizeof(struct node));
  newNode->vertex = v;
  newNode->next = NULL;
  return newNode;
}

struct Graph* createGraph(int vertices) {
  struct Graph* graph = malloc(sizeof(struct Graph));
  graph->numVertices = vertices;

  graph->adjLists = malloc(vertices * sizeof(struct node*));
  graph->visited = malloc(vertices * sizeof(int));

  int i;
  for (i = 0; i < vertices; i++) {
    graph->adjLists[i] = NULL;
    graph->visited[i] = 0;
  }

  return graph;
}

void addEdge(struct Graph* graph, int src, int dest) {
  struct node* newNode = createNode(dest);
  newNode->next = graph->adjLists[src];
  graph->adjLists[src] = newNode;

  newNode = createNode(src);
```

```
  newNode->next = graph->adjLists[dest];
  graph->adjLists[dest] = newNode;
}


struct queue* createQueue() {
  struct queue* q = malloc(sizeof(struct queue));
  q->front = -1;
  q->rear = -1;
  return q;
}


int isEmpty(struct queue* q) {
  if (q->rear == -1)
    return 1;
  else
    return 0;
}

void enqueue(struct queue* q, int value) {
  if (q->rear == SIZE - 1)
    printf("\nQueue is Full!!");
  else {
    if (q->front == -1)
      q->front = 0;
    q->rear++;
    q->items[q->rear] = value;
  }
```

```
}

int dequeue(struct queue* q) {
  int item;
  if (isEmpty(q)) {
    printf("Queue is empty");
    item = -1;
  } else {
    item = q->items[q->front];
    q->front++;
    if (q->front > q->rear) {
      printf("Resetting queue ");
      q->front = q->rear = -1;
    }
  }
  return item;
}

// Print the queue
void printQueue(struct queue* q) {
  int i = q->front;

  if (isEmpty(q)) {
    printf("Queue is empty");
  } else {
    printf("\nQueue contains \n");
    for (i = q->front; i < q->rear + 1; i++) {
      printf("%d ", q->items[i]);
    }
```

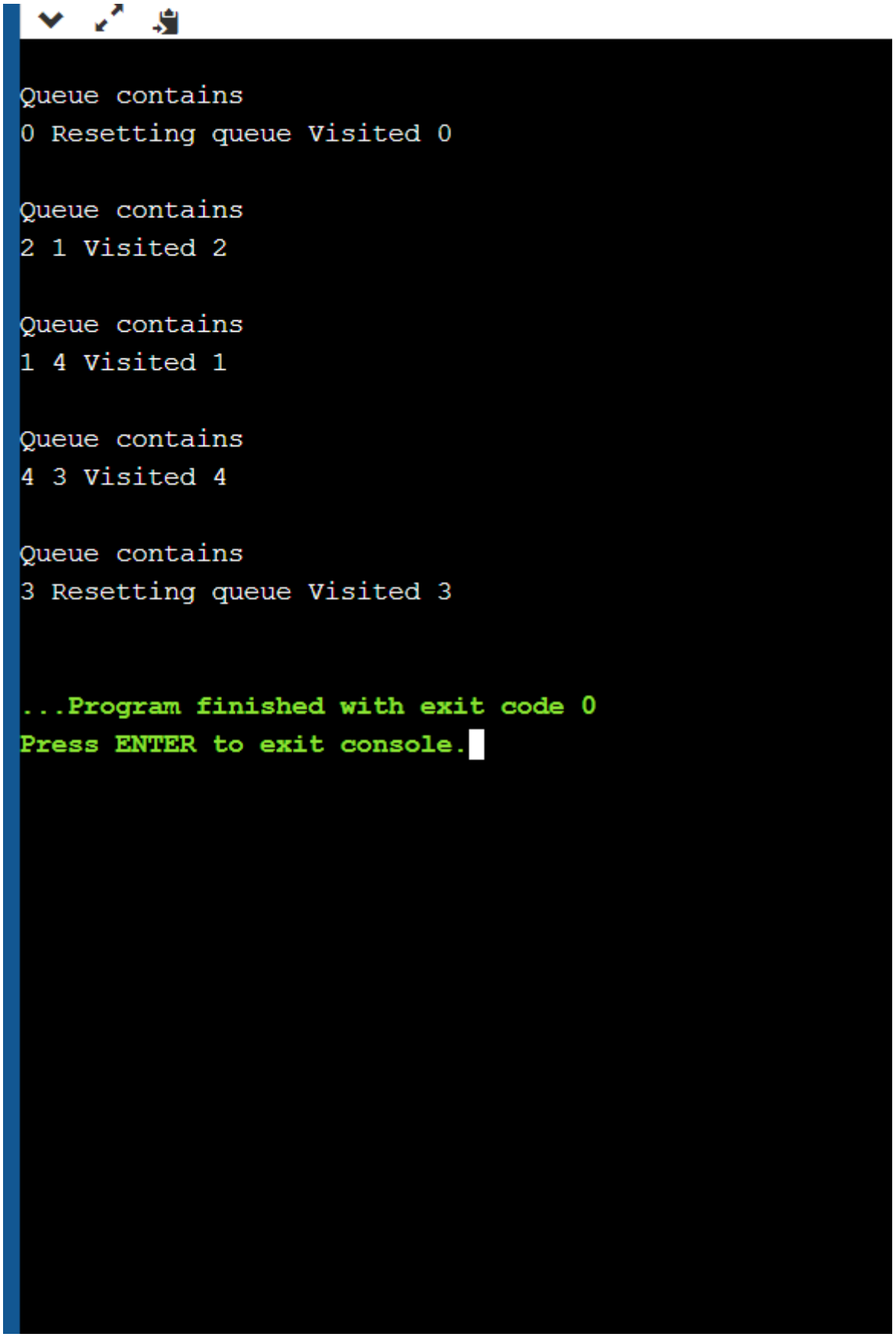
```
  }
}

int main() {
  struct Graph* graph = createGraph(6);
  addEdge(graph, 0, 1);
  addEdge(graph, 0, 2);
  addEdge(graph, 1, 2);
  addEdge(graph, 1, 4);
  addEdge(graph, 1, 3);
  addEdge(graph, 2, 4);
  addEdge(graph, 3, 4);

  bfs(graph, 0);

  return 0;
}
```

OUTPUT


Queue contains
0 Resetting queue Visited 0
Queue contains
2 1 Visited 2
Queue contains
1 4 Visited 1
Queue contains
4 3 Visited 4
Queue contains
3 Resetting queue Visited 3
...Program finished with exit code 0
Press ENTER to exit console.

program for Toplogical Sorting can be applied only directed sorting

```
#include <stdio.h>

int main(){
        int i,j,k,n,a[10][10],indeg[10],flag[10],count=0;

        printf("Enter the no of vertices:\n");
        scanf("%d",&n);

        printf("Enter the adjacency matrix:\n");
        for(i=0;i<n;i++){
                printf("Enter row %d\n",i+1);
                for(j=0;j<n;j++)
                        scanf("%d",&a[i][j]);
        }

        for(i=0;i<n;i++){
      indeg[i]=0;
      flag[i]=0;
   }

   for(i=0;i<n;i++)
      for(j=0;j<n;j++)
         indeg[i]=indeg[i]+a[j][i];

   printf("\nThe topological order is:");
```

```
    while(count<n){
        for(k=0;k<n;k++){
            if((indeg[k]==0) && (flag[k]==0)){
                printf("%d ",(k+1));
                flag [k]=1;
            }

            for(i=0;i<n;i++){
                if(a[i][k]==1)
                    indeg[k]--;
            }
        }

        count++;
    }

    return 0;
}
```

OUTPUT

```
Enter the no of vertices:
4
Enter the adjacency matrix:
Enter row 1
0
0
1
1
Enter row 2
1
1
1
0
Enter row 3
0
1
1
1
Enter row 4
0
1
1
0

The topological order is:1 2 3 4

...Program finished with exit code 0
Press ENTER to exit console.
```