3) Topological Sorting(can be applied only in Directed acyclic graphs)

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

#define MAX 100

int n;    /*Number of vertices in the graph*/
int adj[MAX][MAX]; /*Adjacency Matrix*/
void create_graph();

int queue[MAX], front = -1,rear = -1;
void insert_queue(int v);
int delete_queue();
int isEmpty_queue();

int indegree(int v);

int main()
{
      int i,v,count,topo_order[MAX],indeg[MAX];

      create_graph();

      /*Find the indegree of each vertex*/
      for(i=0;i<n;i++)
      {
            indeg[i] = indegree(i);
```

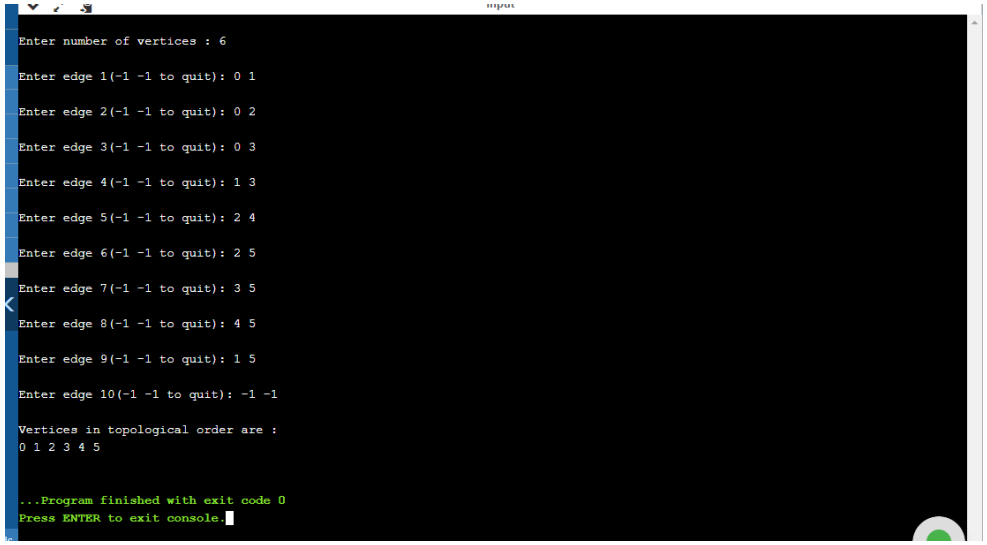
```
        if( indeg[i] == 0 )
            insert_queue(i);
}

count = 0;

while(  !isEmpty_queue( ) && count < n )
{
        v = delete_queue();
topo_order[++count] = v; /*Add vertex v to topo_order array*/
        /*Delete all edges going fron vertex v */
        for(i=0; i<n; i++)
        {
            if(adj[v][i] == 1)
            {
                adj[v][i] = 0;
                indeg[i] = indeg[i]-1;
                if(indeg[i] == 0)
                    insert_queue(i);
            }
        }
}

if( count < n )
{
        printf("\nNo topological ordering possible, graph contains cycle\n");
        exit(1);
}
```

```
    printf("\nVertices in topological order are :\n");
    for(i=1; i<=count; i++)
        printf( "%d ",topo_order[i] );
    printf("\n");

    return 0;
}/*End of main()*/

void insert_queue(int vertex)
{
    if (rear == MAX-1)
        printf("\nQueue Overflow\n");
    else
    {
        if (front == -1)  /*If queue is initially empty */
            front = 0;
        rear = rear+1;
        queue[rear] = vertex ;
    }
}/*End of insert_queue()*/

int isEmpty_queue()
{
    if(front == -1 || front > rear )
        return 1;
    else
        return 0;
}/*End of isEmpty_queue()*/
```

```
int delete_queue()
{
    int del_item;
    if (front == -1 || front > rear)
    {
        printf("\nQueue Underflow\n");
        exit(1);
    }
    else
    {
        del_item = queue[front];
        front = front+1;
        return del_item;
    }
}/*End of delete_queue() */

int indegree(int v)
{
    int i,in_deg = 0;
    for(i=0; i<n; i++)
        if(adj[i][v] == 1)
            in_deg++;
    return in_deg;
}/*End of indegree() */

void create_graph()
{
```

```
    int i,max_edges,origin,destin;

    printf("\nEnter number of vertices : ");
    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 vertices : 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): 2 4
Enter edge 6(-1 -1 to quit): 2 5
Enter edge 7(-1 -1 to quit): 3 5
Enter edge 8(-1 -1 to quit): 4 5
Enter edge 9(-1 -1 to quit): 1 5
Enter edge 10(-1 -1 to quit): -1 -1
Vertices in topological order are :
0 1 2 3 4 5
...Program finished with exit code 0
Press ENTER to exit console.