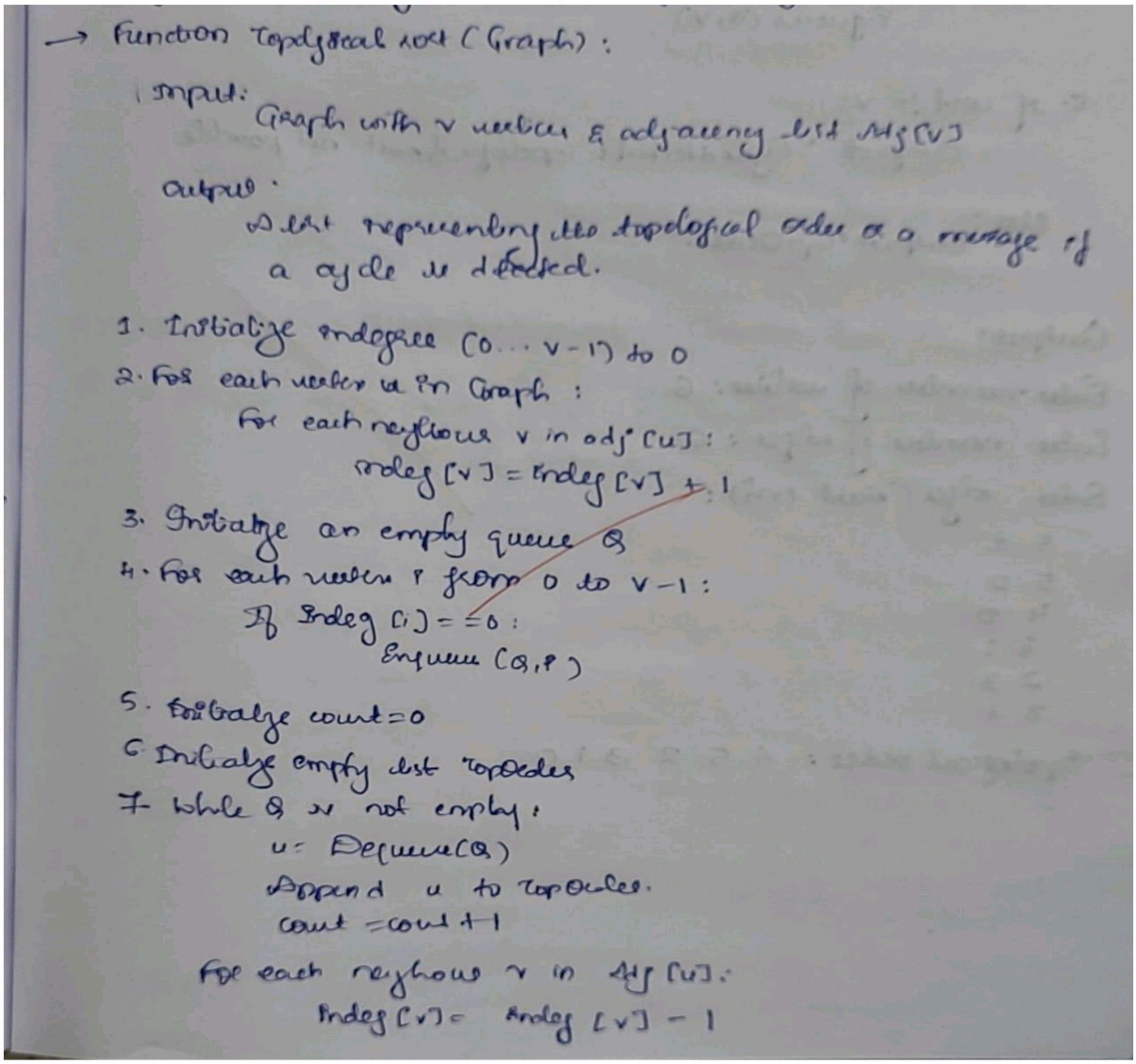
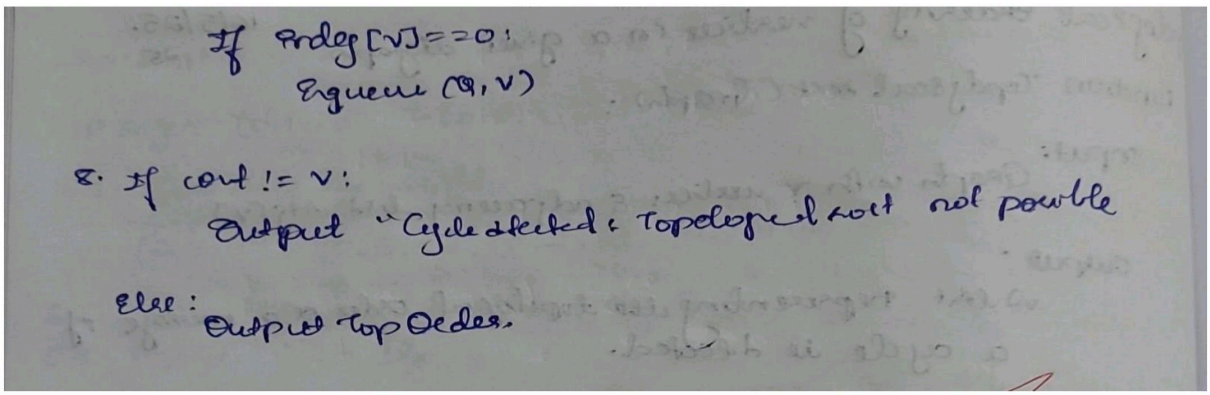
PROGRAM 4

Write program to obtain the Topological ordering of vertices in a given digraph.

ALGORITHM





CODE

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

#define MAX 100

int adj[MAX][MAX];     // adjacency matrix
int indegree[MAX];     // array to store indegree of vertices
int queue[MAX];        // queue for BFS
int front = -1, rear = -1;

// Add edge from u -> v
void addEdge(int u, int v) {
    adj[u][v] = 1;
    indegree[v]++;
}

// Enqueue
void enqueue(int value) {
    if (rear == MAX - 1)
        return;
    if (front == -1)
        front = 0;
    queue[++rear] = value;
}

// Dequeue
int dequeue() {
    if (front == -1 || front > rear)
        return -1;
```

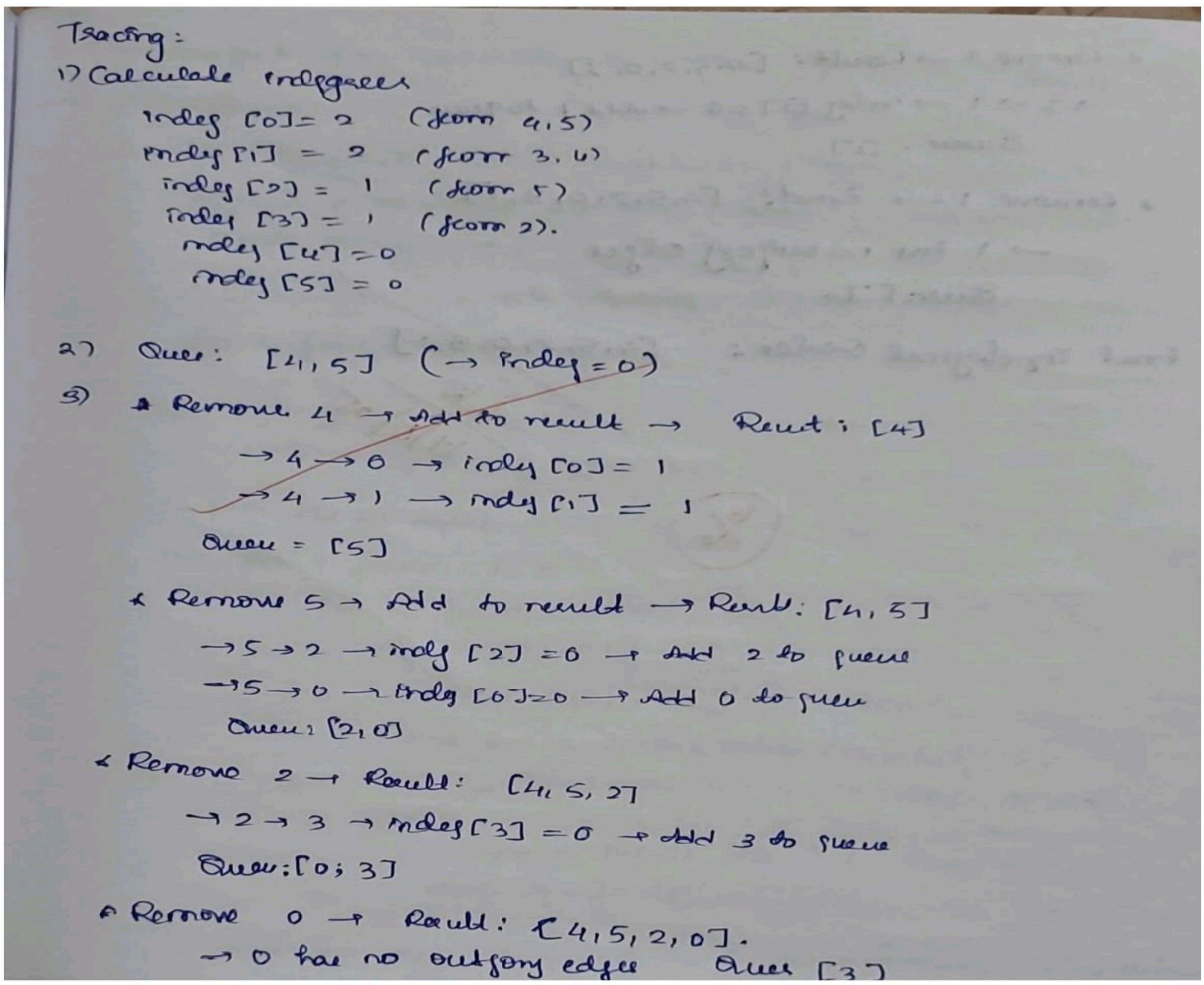
```
    return queue[front++];
}

// Topological Sort using Kahn's Algorithm
void topologicalSort(int n) {
    // Enqueue vertices with 0 indegree
    for (int i = 0; i < n; i++)
        if (indegree[i] == 0)
            enqueue(i);

    int count = 0;
    int topoOrder[MAX];

    while (front <= rear) {
        int u = dequeue();
        topoOrder[count++] = u;

        for (int v = 0; v < n; v++) {
            if (adj[u][v]) {
                indegree[v]--;
                if (indegree[v] == 0)
                    enqueue(v);
            }
        }
    }

    if (count != n) {
        printf("Cycle detected! Topological sort not possible.\n");
    } else {
        printf("Topological Order: ");
```

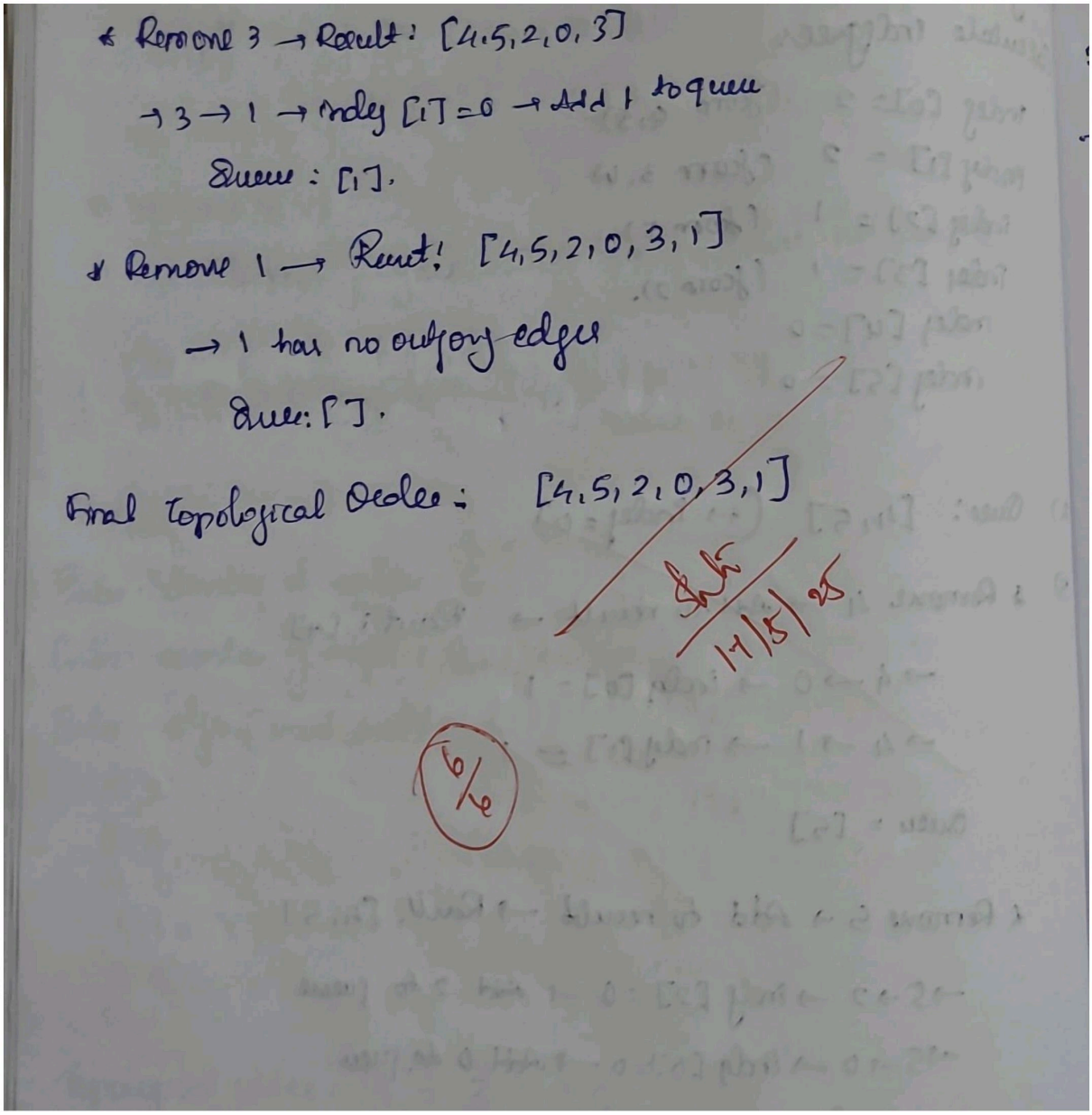
```
        for (int i = 0; i < count; i++)
            printf("%d ", topoOrder[i]);
        printf("\n");
    }
}

int main() {
    int n, e, u, v;

    printf("Enter number of vertices: ");
    scanf("%d", &n);
    printf("Enter number of edges: ");
    scanf("%d", &e);

    printf("Enter edges (from to):\n");
    for (int i = 0; i < e; i++) {
        scanf("%d %d", &u, &v);
        addEdge(u, v);
    }

    topologicalSort(n);

    return 0;
}
```

OUTPUT

```
Enter number of vertices: 6
Enter number of edges: 6
Enter edges (from to):
5 2
5 0
4 0
4 1
2 3
3 1
Topological Order: 4 5 0 2 3 1
```

TRACING

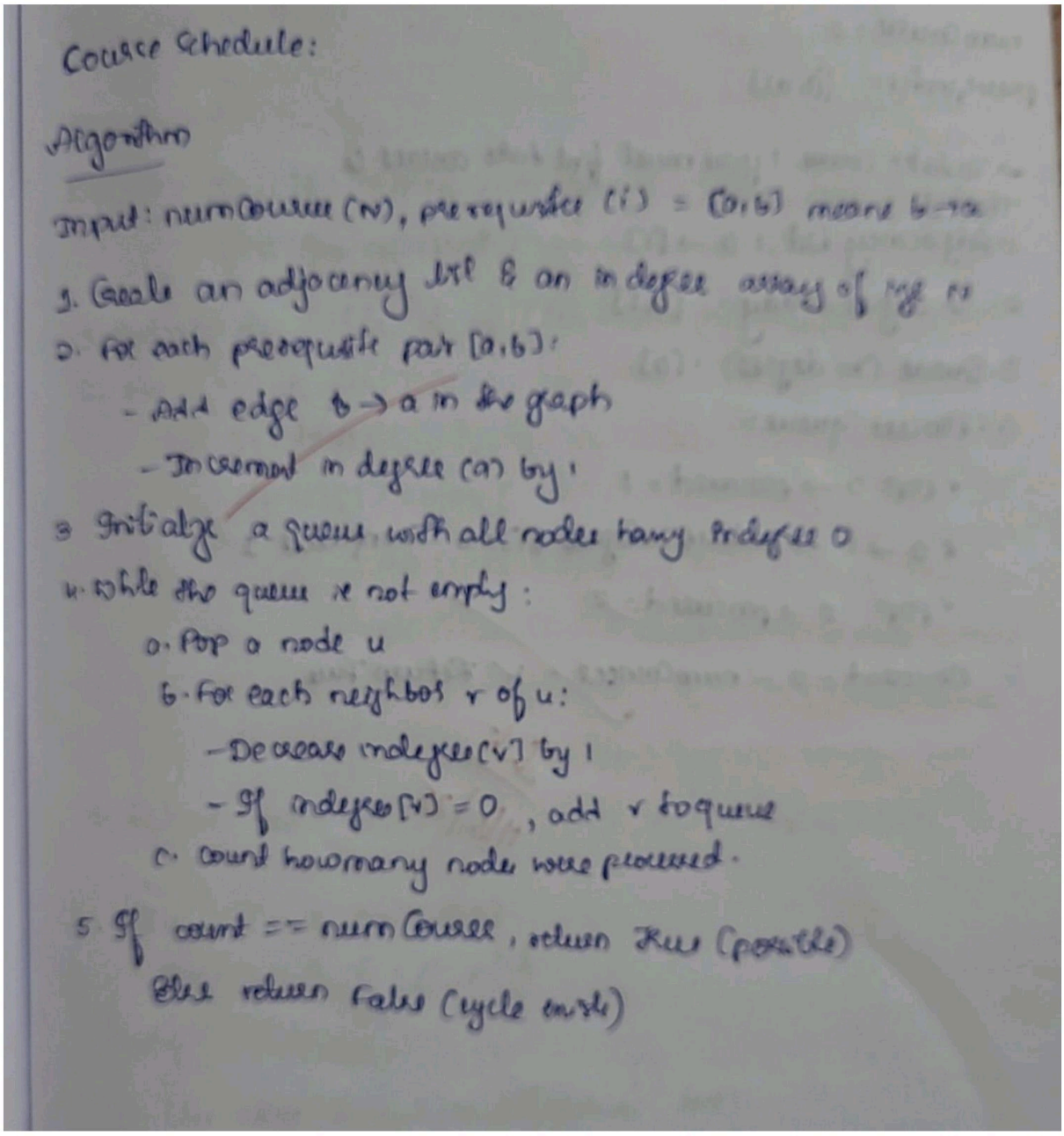



* Remove 3 → Result: [4,5,2,0,3]
→ 3 → 1 → indeg[1] = 0 → Add 1 to queue
Queue: [1].
* Remove 1 → Result: [4,5,2,0,3,1]
→ 1 has no outgoing edges
Queue: [].
Final topological order: [4,5,2,0,3,1]
Sahil
17/5/25
6/6

LEETCODE 3

COURSE SCHEDULE

ALGORITHM



CODE

```
bool canFinish(int numCourses, int** prerequisites, int prerequisitesSize, int*
prerequisitesColSize){
    // Build graph using adjacency list
    int* adj[numCourses];
```

```
int adjSize[numCourses];
int indegree[numCourses];

for (int i = 0; i < numCourses; i++) {
    adj[i] = (int*)malloc(sizeof(int) * numCourses); // worst case
    adjSize[i] = 0;
    indegree[i] = 0;
}

// Fill graph and indegree
for (int i = 0; i < prerequisitesSize; i++) {
    int to = prerequisites[i][0];
    int from = prerequisites[i][1];
    adj[from][adjSize[from]++] = to;
    indegree[to]++;
}

// Queue for BFS
int* queue = (int*)malloc(sizeof(int) * numCourses);
int front = 0, rear = 0;

// Push all courses with 0 indegree
for (int i = 0; i < numCourses; i++) {
    if (indegree[i] == 0)
        queue[rear++] = i;
}

int visited = 0;

while (front < rear) {
```

```
        int curr = queue[front++];
        visited++;

        for (int i = 0; i < adjSize[curr]; i++) {
            int neighbor = adj[curr][i];
            indegree[neighbor]--;
            if (indegree[neighbor] == 0)
                queue[rear++] = neighbor;
        }
    }

    free(queue);
    for (int i = 0; i < numCourses; i++) {
        free(adj[i]);
    }

    return visited == numCourses;
}
```

OUTPUT:

Accepted Runtime: 0 ms

• Case 1 • Case 2

Input

numCourses =

2

prerequisites =

[[1,0]]

Output

true

Expected

true

• Case 1 • Case 2

Input

numCourses =

2

prerequisites =

[[1,0],[0,1]]

Output

false

Expected

false

TRACING