SCHOOL OF
COMPUTING

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CH.SC.U4CSE24227

Week – 3

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Design and Analysis of Algorithm(23CSE211)

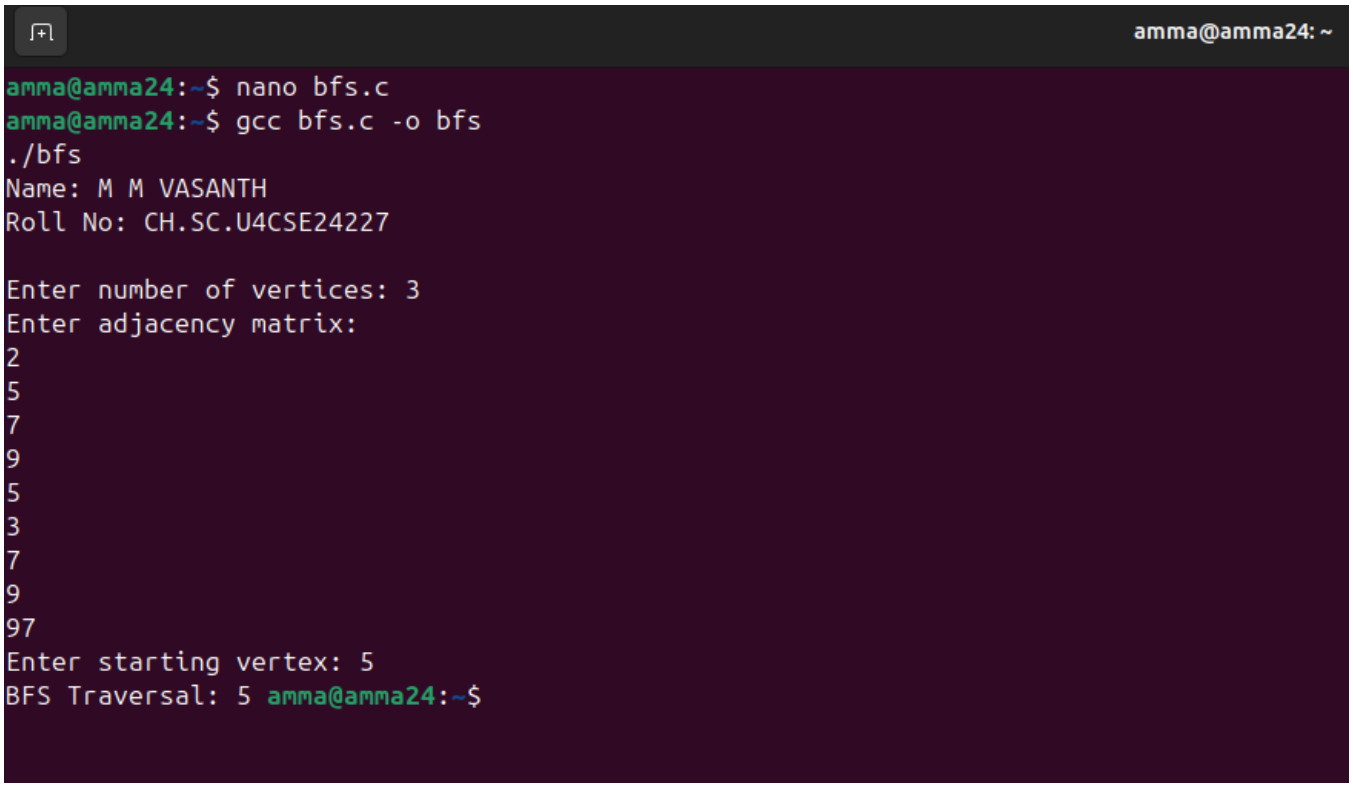
1. BREADTH – FIRST SEARCH(BFS)

Code:

```
#include <stdio.h>
int queue[20], front = -1, rear = -1;
int visited[20], adj[20][20], n;
void bfs(int start) {
    int i;
    printf("BFS Traversal: ");
    queue[++rear] = start;
    visited[start] = 1;
    while (front != rear) {
        start = queue[++front];
        printf("%d ", start);
        for (i = 0; i < n; i++) {
            if (adj[start][i] == 1 && visited[i] == 0) {
                queue[++rear] = i;
                visited[i] = 1;
            }
        }
    }
}
int main() {
    int i, j, start;
    printf("Name: M M VASANTH\n");
    printf("Roll No: CH.SC.U4CSE24227\n\n");
    printf("Enter number of vertices: ");
    scanf("%d", &n);
    printf("Enter adjacency matrix:\n");
    for (i = 0; i < n; i++)
        for (j = 0; j < n; j++)
            scanf("%d", &adj[i][j]);
    for (i = 0; i < n; i++)
```

```
        visited[i] = 0;
    printf("Enter starting vertex: ");
    scanf("%d", &start);
    bfs(start);
    return 0;
}
```

Output:



⍰ Time Complexity: O(N^2)

Since the graph is represented using an Adjacency Matrix (adj[n][n]), for every vertex we visit (dequeued), we must iterate through all N potential neighbors in the inner for loop to check for connections. Doing this for all N vertices results in N * N operations.

⍰ Space Complexity: O(N)

The queue array stores the vertices to be visited. In the worst case, the queue might store all vertices of the graph, making the space complexity proportional to the number of vertices N.

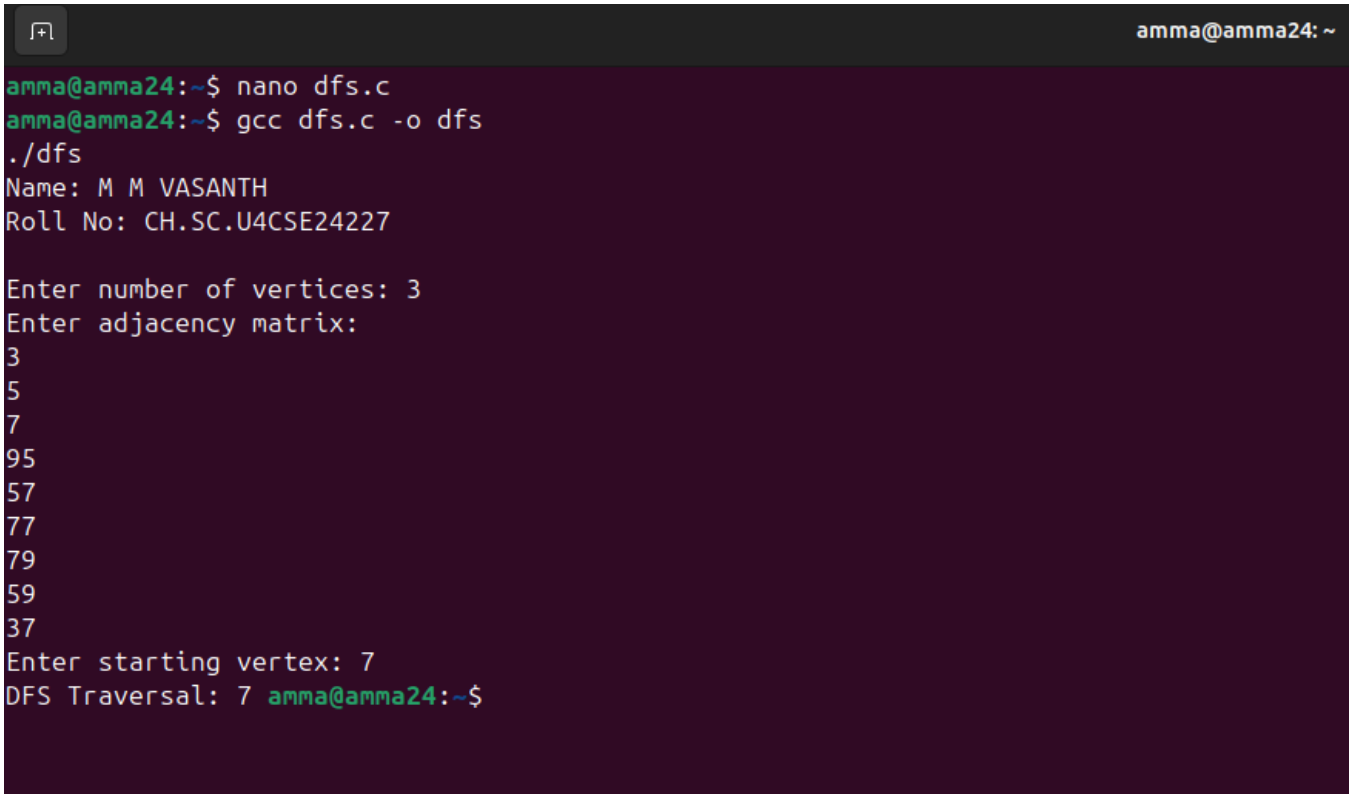
2. DEPTH – FIRST SEARCH(DFS)

Code:

```
#include <stdio.h>
int visited[20], adj[20][20], n;
void dfs(int start) {
    int i;
    printf("%d ", start);
    visited[start] = 1;
    for (i = 0; i < n; i++) {
        if (adj[start][i] == 1 && visited[i] == 0) {
            dfs(i);
        }
    }
}
int main() {
    int i, j, start;
    printf("Name: M M VASANTH\n");
    printf("Roll No: CH.SC.U4CSE24227\n\n");
    printf("Enter number of vertices: ");
    scanf("%d", &n);
    printf("Enter adjacency matrix:\n");
    for (i = 0; i < n; i++)
        for (j = 0; j < n; j++)
            scanf("%d", &adj[i][j]);
    for (i = 0; i < n; i++)
```

```
        visited[i] = 0;
    printf("Enter starting vertex: ");
    scanf("%d", &start);
    printf("DFS Traversal: ");
    dfs(start);
    return 0;
}
```

Output:



Time Complexity: O(N^2)

Similar to BFS, this implementation uses an Adjacency Matrix. The recursive function is called for every vertex. Inside each call, the for loop scans the entire row of the matrix (size N) to find adjacent nodes. Thus, the total time complexity is O(N^2).

Space Complexity: O(N)

The space is used by the Recursion Stack. In the worst-case scenario (e.g., a graph that is a long straight line), the recursion depth can go up to N, occupying O(N) stack memory.