Task 5: Breadth-First Search (BFS) Implementation

For a given undirected graph, implement BFS to traverse the graph starting from a given node and print each node in the order it is visited.

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

#define MAX_VERTICES 100

// Structure representing a node in the adjacency list
struct Node {
   int dest;
   struct Node* next;
};

// Structure representing the adjacency list for each vertex
```

```
struct AdjList {
    struct Node* head;
};

// Structure representing the graph
struct Graph {
    int numVertices;
    struct AdjList* array;
};

// Function to create a new node
struct Node* createNode(int dest) {
    struct Node* newNode = (struct Node*)malloc(sizeof(struct Node));
    newNode->dest = dest;
    newNode->next = NULL;
    return newNode;
}

// Function to create a graph with a given number of vertices
```

```
struct Graph* createGraph(int numVertices) {
    struct Graph* graph = (struct Graph*)malloc(sizeof(struct Graph));
    graph->numVertices = numVertices;
    graph->array = (struct AdjList*)malloc(numVertices * sizeof(struct AdjList));
    for (int i = 0; i < numVertices; ++i)
        graph->array[i].head = NULL;
    return graph;
}

// Function to add an edge to the graph
void addEdge(struct Graph* graph, int src, int dest) {
    // Add an edge from src to dest
    struct Node* newNode = createNode(dest);
    newNode->next = graph->array[src].head;
    graph->array[src].head = newNode;

    // Add an edge from dest to src since the graph is undirected
    newNode = createNode(src);
    newNode->next = graph->array[dest].head;
    graph->array[dest].head = newNode;
}

// Function to perform Breadth-First Search (BFS)
void BFS(struct Graph* graph, int start) {
    bool* visited = (bool*)malloc(graph->numVertices *
sizeof(bool));
    for (int i = 0; i < graph->numVertices; ++i)
        visited[i] = false;

    // Create a queue for BFS
    int queue[MAX_VERTICES];
    int front = 0, rear = 0;

    // Mark the current node as visited and enqueue it
    visited[start] = true;
    queue[rear++] = start;

    while (front != rear) {
        // Dequeue a vertex from the queue and print it
        int currentVertex = queue[front++];
        printf("%d ", currentVertex);

        // Get all adjacent vertices of the dequeued vertex currentVertex
        // If an adjacent vertex has not been visited, then mark it visited
        // and enqueue it
        struct Node* temp = graph->array[currentVertex].head;
        while (temp != NULL) {
            int adjVertex = temp->dest;
            if (!visited[adjVertex]) {
                visited[adjVertex] = true;
                queue[rear++] = adjVertex;
            }
            temp = temp->next;
        }
    }
    printf("\n");
```

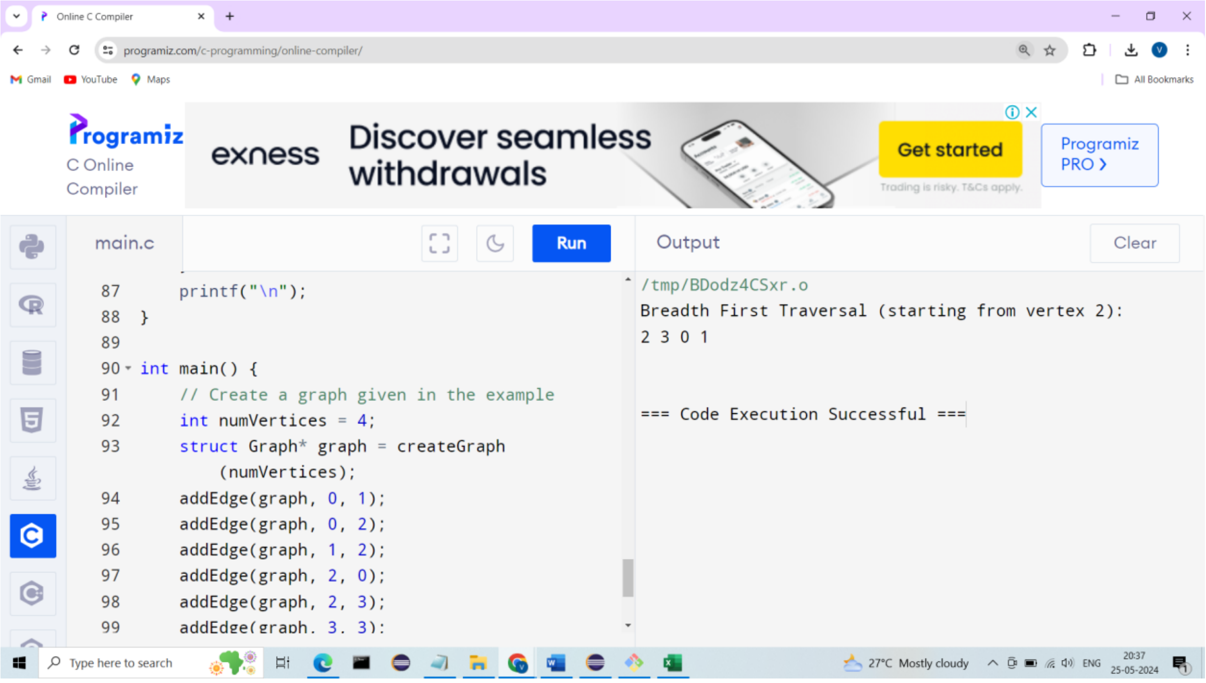
```
}

int main() {
    // Create a graph given in the example
    int numVertices = 4;
    struct Graph* graph = createGraph(numVertices);
    addEdge(graph, 0, 1);
    addEdge(graph, 0, 2);
    addEdge(graph, 1, 2);
    addEdge(graph, 2, 0);
    addEdge(graph, 2, 3);
    addEdge(graph, 3, 3);

    printf("Breadth First Traversal (starting from vertex 2):\n");
    BFS(graph, 2);

    return 0;
}
```

Output: -



```
    printf("\n");
}

int main() {
    // Create a graph given in the example
    int numVertices = 4;
    struct Graph* graph = createGraph
        (numVertices);
    addEdge(graph, 0, 1);
    addEdge(graph, 0, 2);
    addEdge(graph, 1, 2);
    addEdge(graph, 2, 0);
    addEdge(graph, 2, 3);
    addEdge(graph, 3, 3);
```

```
/tmp/BDodz4CSxr.o
Breadth First Traversal (starting from vertex 2):
2 3 0 1


=== Code Execution Successful ===
```