ASSIGNMENT 4

AIM:

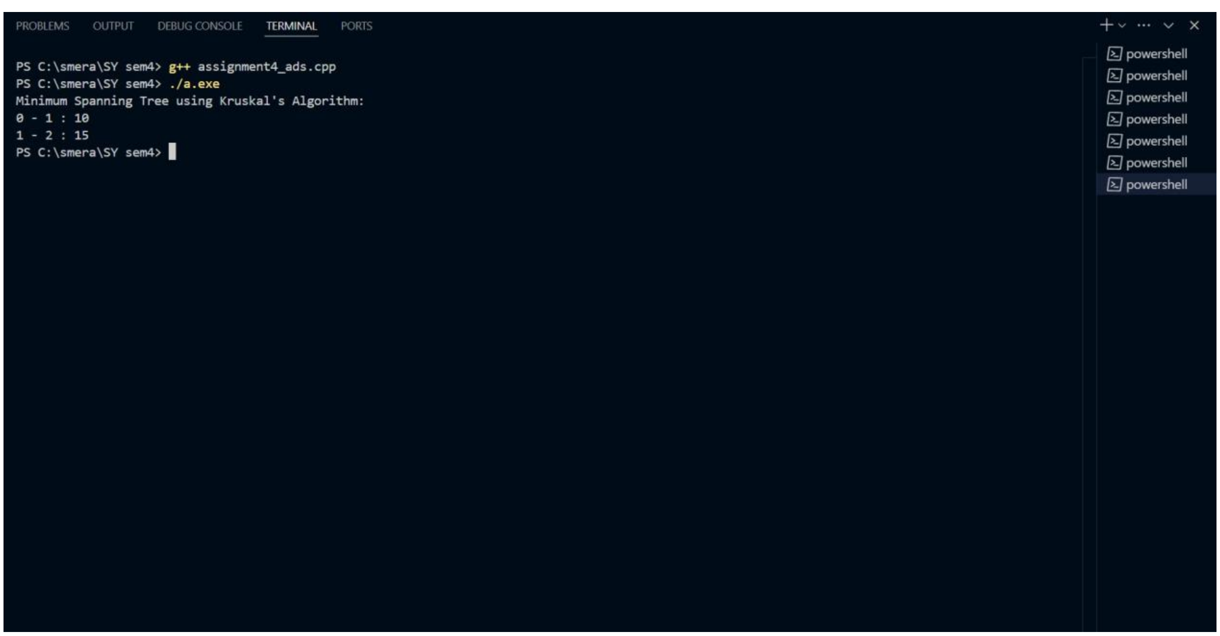
Represent a graph of your college campus using adjacency list /adjacency matrix. Nodes should represent the various departments and links should represent the distance between them. Find a minimum spanning tree using Kruskal’s algorithm or using Prim’s algorithm.

SOURCE CODE:

```
#include <iostream>
#include <climits> // For INT_MAX
using namespace std;

#define V 5 // Number of vertices

int graph[V][V] = {
    {0, 2, 0, 6, 0},
    {2, 0, 3, 8, 5},
    {0, 3, 0, 0, 7},
    {6, 8, 0, 0, 9},
    {0, 5, 7, 9, 0}
};

// Function to find the vertex with minimum key value
int minKey(int key[], bool mstSet[]) {
    int min = INT_MAX, index;

    for (int v = 0; v < V; v++) {
        if (!mstSet[v] && key[v] < min) {
            min = key[v];
            index = v;
        }
    }

    return index;
}

// Function to construct and print MST using Prim's algorithm
void primMST() {
    int parent[V]; // Array to store constructed MST
    int key[V];    // Key values used to pick minimum weight edge
    bool mstSet[V]; // To represent set of vertices included in MST

    // Initialize all keys as infinite and mstSet[] as false
    for (int i = 0; i < V; i++) {
        key[i] = INT_MAX;
        mstSet[i] = false;
    }
```

```
    // Start from first vertex
    key[0] = 0;      // Make key 0 so that this vertex is picked first
    parent[0] = -1;  // First node is always root of MST

    // Construct MST
    for (int count = 0; count < V - 1; count++) {
        int u = minKey(key, mstSet); // Pick the minimum key vertex
        mstSet[u] = true;            // Include u in MST

        // Update key and parent of the adjacent vertices
        for (int v = 0; v < V; v++) {
            // Update only if graph[u][v] is non-zero, v is not in MST,
            // and the edge weight is less than current key[v]
            if (graph[u][v] && !mstSet[v] && graph[u][v] < key[v]) {
                parent[v] = u;
                key[v] = graph[u][v];
            }
        }
    }

    // Print the constructed MST
    cout << "Edge \tWeight\n";
    for (int i = 1; i < V; i++) {
        cout << parent[i] << " - " << i << "\t" << graph[i][parent[i]] << endl;
    }
}

int main() {
    primMST();
    return 0;
}
```

OUTPUT:



CONCLUSION:

The implementation of graph representation for a college campus and the application of Minimum Spanning Tree (MST) algorithms such as Kruskal’s or Prim’s help in optimizing campus connectivity. By efficiently connecting various departments with minimal total distance, this approach reduces infrastructure costs and ensures effective planning. The use of MST algorithms demonstrates how graph theory can be applied in real-world scenarios like network design, transportation planning, and resource management. This study highlights the importance of graph algorithms in solving complex connectivity problems efficiently.