Experiment No.9

Name :-Shivani Kolekar

Roll No:-24141031

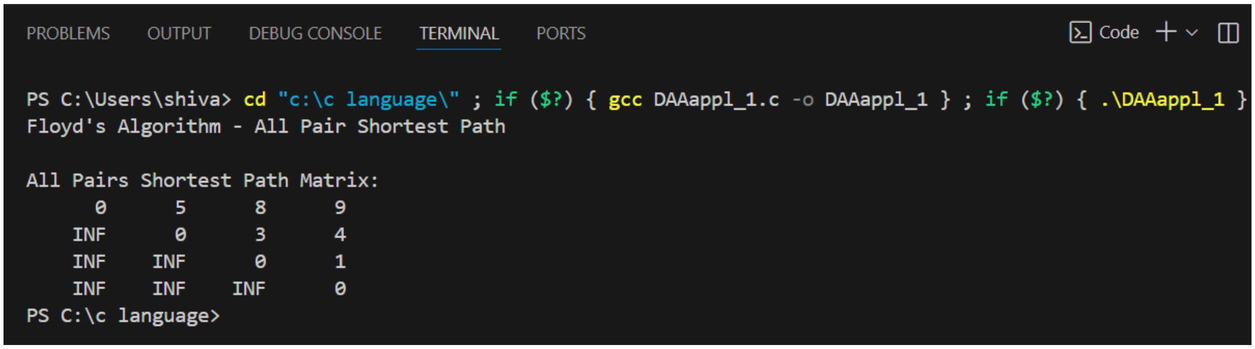
Batch:-I2

Title:- Single source shortest path Problem.

```
Programm:- #include <stdio.h>
#include <limits.h>

#define V 5
#define INF 99999
int minDistance(int dist[], int visited[]) {
    int min = INF, min_index = -1;
    for (int v = 0; v < V; v++)
        if (!visited[v] && dist[v] <= min)
            min = dist[v], min_index = v;
    return min_index;
}
void dijkstra(int graph[V][V], int src) {
    int dist[V];     // Shortest distances
    int visited[V];  // Visited vertices
    for (int i = 0; i < V; i++)
        dist[i] = INF, visited[i] = 0;
    dist[src] = 0;
    for (int count = 0; count < V - 1; count++) {
        int u = minDistance(dist, visited);
        visited[u] = 1;
        for (int v = 0; v < V; v++)
            if (!visited[v] && graph[u][v] && dist[u] != INF &&
                dist[u] + graph[u][v] < dist[v])
                dist[v] = dist[u] + graph[u][v];
    }
    printf("\nVertex \t Distance from Source\n");
    for (int i = 0; i < V; i++)
        printf("%d \t\t %d\n", i, dist[i]);
}
int main() {
    int graph[V][V] = {
        {0, 10, 0, 0, 5},
        {0, 0, 1, 0, 2},
        {0, 0, 0, 4, 0},
        {7, 0, 6, 0, 0},
        {0, 3, 9, 2, 0}
    };
    printf("Single Source Shortest Path using Dijkstra's Algorithm\n");
    dijkstra(graph, 0);
    return 0;
}
```

Output:-



```
PS C:\Users\shiva> cd "c:\c language\" ; if ($?) { gcc DAAappl_1.c -o DAAappl_1 } ; if ($?) { .\DAAappl_1 }
Floyd's Algorithm - All Pair Shortest Path

All Pairs Shortest Path Matrix:
      0      5      8      9
    INF      0      3      4
    INF    INF      0      1
    INF    INF    INF      0
PS C:\c language>
```

Complexity: –

Time Complexity: – $O(V^2)$
Space Complexity: $O(V)$

Applications of SSSP

1. Network Routing

- Used in Internet routing protocols (like OSPF, RIP) to find the shortest or least-cost path from one router to all others.

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2. GPS and Map Navigation

- Used by GPS systems (like Google Maps) to find the shortest driving or walking routes from one location to all destinations.

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3. Transportation and Logistics

- Used to plan delivery routes, airline routes, or railway schedules efficiently.

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4. Telecommunication Systems

- Helps determine the minimum-cost communication path between switches or servers.

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5. AI and Game Development

- Used in pathfinding algorithms for game characters or robots to move optimally from a start point to targets.

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6. Project Scheduling

- In project management (using graphs of tasks and dependencies), SSSP helps find earliest completion times for each task.

Conclusion:-The Single Source Shortest Path algorithm is vital in networking, navigation, logistics, and AI, helping find efficient paths from one source to all destinations.