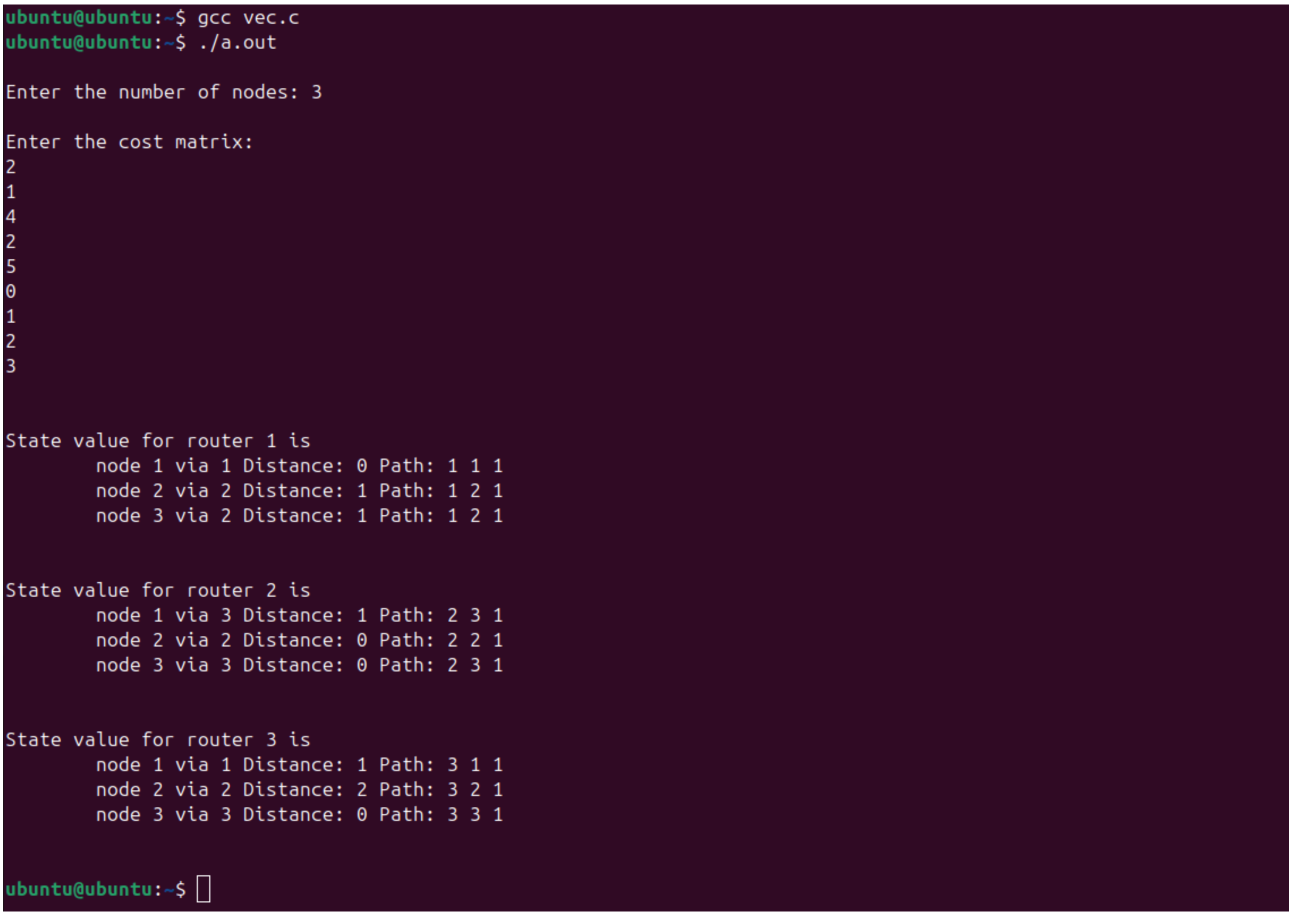
Routing protocols Distance vector and Link state routing

```
#include <stdio.h>

struct node {
    unsigned dist[20];
    unsigned from[20];
    unsigned path[20][20];
} rt[10];

int main() {
    int dmat[20][20];
    int n, i, j, k, count = 0;
    printf("\nEnter the number of nodes: ");
    scanf("%d", &n);
    printf("\nEnter the cost matrix:\n");

    for(i = 0; i < n; i++) {
        for(j = 0; j < n; j++) {
            scanf("%d", &dmat[i][j]);
            if (i == j) {
                dmat[i][j] = 0;
            }
            rt[i].dist[j] = dmat[i][j];
            rt[i].from[j] = j;
            rt[i].path[j][0] = i;
            rt[i].path[j][1] = j;
        }
    }

    do {
        count = 0;
        for(i = 0; i < n; i++) {
            for(j = 0; j < n; j++) {
                for(k = 0; k < n; k++) {
                    if(rt[i].dist[j] > dmat[i][k] + rt[k].dist[j]) {
                        rt[i].dist[j] = dmat[i][k] + rt[k].dist[j];
                        rt[i].from[j] = k;
                        count++;


                        for(int l = 0; l < n; l++) {
                            rt[i].path[j][l] = rt[i].path[k][l];
                        }
                        rt[i].path[j][n] = j;

                    }
                }
            }
        }
    } while(count != 0);
    for(i = 0; i < n; i++) {
        printf("\n\nState value for router %d is\n", i + 1);
        for(j = 0; j < n; j++) {
            printf("\tnode %d via %d Distance: %d Path: ", j + 1, rt[i].from[j] + 1, rt[i].dist[j]);

            // Print the path
            for(k = 0; k < n; k++) {
                if(rt[i].path[j][k] != -1) {
                    printf("%d ", rt[i].path[j][k] + 1);

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

    printf("\n\n");
    return 0;
}
```

output:

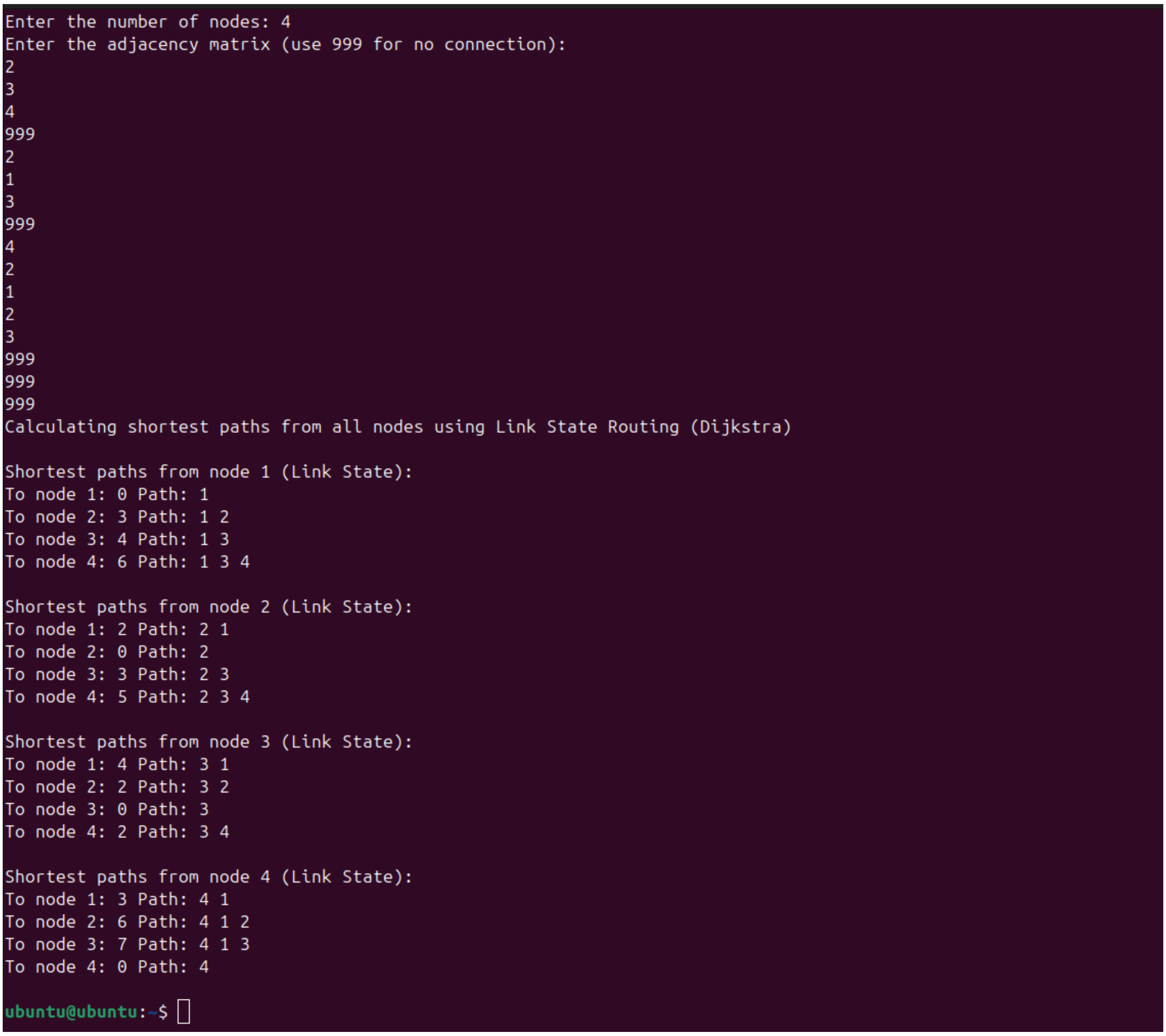


```
ubuntu@ubuntu:~$ gcc vec.c
ubuntu@ubuntu:~$ ./a.out

Enter the number of nodes: 3

Enter the cost matrix:
2
1
4
2
5
0
1
2
3


State value for router 1 is
        node 1 via 1 Distance: 0 Path: 1 1 1
        node 2 via 2 Distance: 1 Path: 1 2 1
        node 3 via 2 Distance: 1 Path: 1 2 1


State value for router 2 is
        node 1 via 3 Distance: 1 Path: 2 3 1
        node 2 via 2 Distance: 0 Path: 2 2 1
        node 3 via 3 Distance: 0 Path: 2 3 1


State value for router 3 is
        node 1 via 1 Distance: 1 Path: 3 1 1
        node 2 via 2 Distance: 2 Path: 3 2 1
        node 3 via 3 Distance: 0 Path: 3 3 1


ubuntu@ubuntu:~$ 
```

Link state routing

```
#include <stdio.h>
#include <limits.h>
#define MAX_NODES 10
#define INF INT_MAX

void dijkstra(int graph[MAX_NODES][MAX_NODES], int n, int startNode) {
    int distance[MAX_NODES], visited[MAX_NODES] = {0}, prev[MAX_NODES], count = 0,
minDistance, nextNode;

    for (int i = 0; i < n; i++) {
        distance[i] = graph[startNode][i];
        if (graph[startNode][i] != INF) {
            prev[i] = startNode;
        } else {
            prev[i] = -1;
        }
    }

    distance[startNode] = 0;
    visited[startNode] = 1;
    count = 1;

    while (count < n) {
        minDistance = INF;
        for (int i = 0; i < n; i++) {
            if (distance[i] < minDistance && !visited[i]) {
                minDistance = distance[i];
                nextNode = i;
            }
        }
        visited[nextNode] = 1;

        // Update distances and predecessors
        for (int i = 0; i < n; i++) {
            if (!visited[i] && (minDistance + graph[nextNode][i] < distance[i]) &&
graph[nextNode][i] != INF) {
                distance[i] = minDistance + graph[nextNode][i];
                prev[i] = nextNode;

            }
        }
        count++;
    }

    printf("Shortest paths from node %d (Link State):\n", startNode + 1);
    for (int i = 0; i < n; i++) {
        printf("To node %d: %d Path: ", i + 1, distance[i]);
        int path[MAX_NODES], pathIndex = 0;
        int currentNode = i;
        while (currentNode != startNode) {
            path[pathIndex++] = currentNode;
            currentNode = prev[currentNode];
        }
        path[pathIndex] = startNode;

        // Print the path in correct order
        for (int j = pathIndex; j >= 0; j--) {
            printf("%d ", path[j] + 1);
        }
        printf("\n");
    }
}

int main() {
    int graph[MAX_NODES][MAX_NODES], n;
    printf("Enter the number of nodes: ");
    scanf("%d", &n);
    printf("Enter the adjacency matrix (use 999 for no connection):\n");

    for (int i = 0; i < n; i++) {
        for (int j = 0; j < n; j++) {
            scanf("%d", &graph[i][j]);
            if (graph[i][j] == 999) graph[i][j] = INF;
        }
    }

    printf("Calculating shortest paths from all nodes using Link State Routing (Dijkstra)\n\n");
    for (int i = 0; i < n; i++) {
        dijkstra(graph, n, i);
        printf("\n");
    }

    return 0;
}
```

output:



```
Enter the number of nodes: 4
Enter the adjacency matrix (use 999 for no connection):
2
3
4
999
2
1
3
999
4
2
1
2
3
999
999
999
Calculating shortest paths from all nodes using Link State Routing (Dijkstra)

Shortest paths from node 1 (Link State):
To node 1: 0 Path: 1
To node 2: 3 Path: 1 2
To node 3: 4 Path: 1 3
To node 4: 6 Path: 1 3 4

Shortest paths from node 2 (Link State):
To node 1: 2 Path: 2 1
To node 2: 0 Path: 2
To node 3: 3 Path: 2 3
To node 4: 5 Path: 2 3 4

Shortest paths from node 3 (Link State):
To node 1: 4 Path: 3 1
To node 2: 2 Path: 3 2
To node 3: 0 Path: 3
To node 4: 2 Path: 3 4

Shortest paths from node 4 (Link State):
To node 1: 3 Path: 4 1
To node 2: 6 Path: 4 1 2
To node 3: 7 Path: 4 1 3
To node 4: 0 Path: 4

ubuntu@ubuntu:~$ 
```