Name: Maurya Patel
Enrollment-No: 22162101014
Batch: 51

Institute of Computer Technology
B. Tech Computer Science and Engineering

Sub: Algorithm Analysis and Design

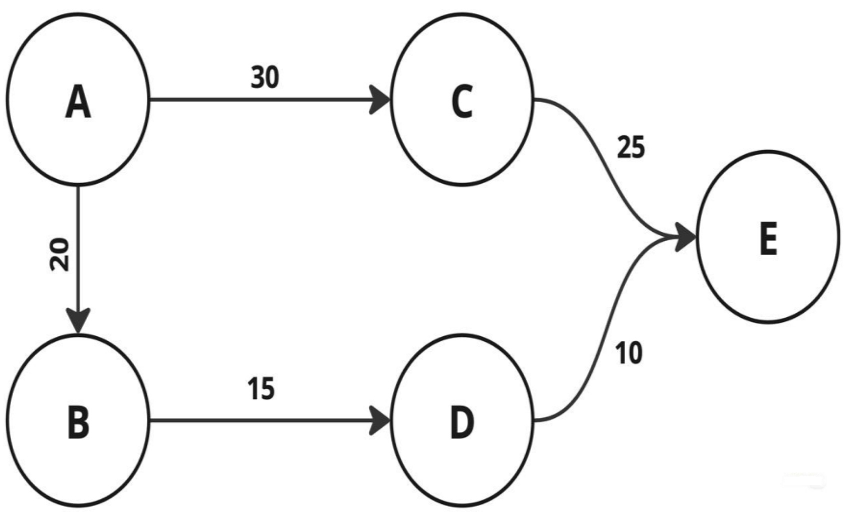
<u>Practical 11</u>

AIM:

A government official needs to visit several cities within a state. To minimize travel costs, they want to find the shortest path between their starting city and each destination city.

Task:

Given a graph representing the cities and their connecting roads, determine the minimum cost path from a given starting city to all other cities.



Input:

Enter total number of nodes: 5

Enter the node from where you want to calculate the distance: A

Enter Data (Weight):

	A	*B*	*C*	*D*	*E*
A	0	20	30	∞	∞
B	∞	0	∞	15	∞
C	∞	∞	0	∞	25
D	∞	∞	∞	0	10
E	∞	∞	∞	∞	0

Output:

	A	*B*	*C*	*D*	*E*
A	0	20	30	35	45
B	∞	0	∞	15	25
C	∞	∞	0	∞	25
D	∞	∞	∞	0	10
E	∞	∞	∞	∞	0

OR

Source	**Destination**	**Cost**
A	A	0
	B	20
	C	30
	D	35
	E	45

Code:

```
import sys

def dijkstra(graph, start_node):
    n = len(graph)
    visited = [False] * n
    distance = [sys.maxsize] * n
    distance[start_node] = 0

    for _ in range(n):
        min_distance = sys.maxsize
        min_index = -1

        for i in range(n):
            if not visited[i] and distance[i] < min_distance:
                min_distance = distance[i]
                min_index = i

        visited[min_index] = True

        for j in range(n):
            if graph[min_index][j] != float('inf') and not visited[j]:
                new_dist = distance[min_index] + graph[min_index][j]
                if new_dist < distance[j]:
                    distance[j] = new_dist

    return distance

def print_distances(distance, cities):
    print("Source\tDestination\tCost")
    for i in range(len(cities)):
        if distance[i] == sys.maxsize:
            print(f"{cities[0]}\t{cities[i]}\t\t∞")
        else:
            print(f"{cities[0]}\t{cities[i]}\t\t{distance[i]}")

# Define the cities and graph as an adjacency matrix
cities = ['A', 'B', 'C', 'D', 'E']
graph = [
    [0, 20, 30, float('inf'), float('inf')],
    [float('inf'), 0, float('inf'), 15, 25],
    [float('inf'), float('inf'), 0, float('inf'), 25],
    [float('inf'), float('inf'), float('inf'), 0, 10],
    [float('inf'), float('inf'), float('inf'), float('inf'), 0]
```

```
]

# Set the starting city
start_city = 'A'
start_node = cities.index(start_city)

# Run Dijkstra's algorithm and print the distances
distances = dijkstra(graph, start_node)
print_distances(distances, cities)
```

Output: