

Practical 6

DAA

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Section: A1-B3

GIT LINK:

<https://github.com/mahatmemadhura4-bot/TSP-and-Bellman-Ford-Problem-DAA-Pract6>

Aim-1:

A traveling salesman is getting ready for a big sales tour. Starting at his hometown, suitcase in hand, he will conduct a journey in which each of his target cities is visited exactly once before he returns home. Given the pairwise distances between cities, what is the best order in which to visit them, so as to minimize the overall distance traveled?

Input:

Ver 1 2 3 4

1 0 10 15 20

2 5 0 9 10

3 6 13 0 12

4 8 8 9 0

Consider different starting vertex: 1, 2, 3, 4

Sample Output:

Path: 1→2→4→3→1, Cost of travelling is: 35

Code:

```
#include <stdio.h>

#include <stdlib.h>

#define INF 1000000

int minCost;

int *bestPath;

void tsp(int **dist, int *path, int *visited, int N, int pos, int count, int cost) {

    if (count==N && dist[pos][path[0]] >0) { // complete tour

        cost += dist[pos][path[0]];

        if (cost<minCost) {

            minCost = cost;

            for (int i= 0; i<= N; i++)

                bestPath[i] = path[i];

        }

        return;

    }

    for (int i= 0; i< N; i++) {

        if (!visited[i] && dist[pos][i]> 0) {

            visited[i] = 1;

            path[count] = i;

            tsp(dist, path, visited, N, i, count+ 1, cost+ dist[pos][i]);

            visited[i]= 0;

        }

    }
```

```

    }
}

int main() {
    int N;

    printf("Enter number of cities: ");
    scanf("%d", &N);

    int **dist = (int **)malloc(N * sizeof(int *));
    for (int i = 0; i < N; i++)
        dist[i] = (int *)malloc(N * sizeof(int));

    printf("Enter distance matrix:\n");
    for (int i = 0; i < N; i++)
        for (int j = 0; j < N; j++)
            scanf("%d", &dist[i][j]);

    bestPath = (int *)malloc((N + 1) * sizeof(int));

    for (int start = 0; start < N; start++) {
        minCost = INF;

        int *path = (int *)malloc((N + 1) * sizeof(int));
        int *visited = (int *)calloc(N, sizeof(int));

        path[0] = start;
        visited[start] = 1;

        tsp(dist, path, visited, N, start, 1, 0);

        printf("Starting at city %d:\n", start + 1);
    }
}

```

```

printf("Path: ");
for (int i=0; i <=N; i++)
    printf("%d%s", bestPath[i] + 1, (i< N) ? " -> " : "\n");
printf("Cost of travelling is: %d\n\n", minCost);

free(path);
free(visited);
}

for (int i= 0; i< N; i++)
    free(dist[i]);
free(dist);
free(bestPath);
return 0;
}

```

Output:

```

● PS C:\Users\Madhura\OneDrive\Desktop\C> cd "c:\U
le } ; if ($?) { .\tempCodeRunnerFile }
Enter number of cities: 4
Enter distance matrix:
0 12 13 15
23 0 45 16
34 23 0 42
23 12 10 0
Starting at city 1:
Path: 1 -> 4 -> 3 -> 2 -> 724183337
Cost of travelling is: 71

Starting at city 2:
Path: 2 -> 1 -> 4 -> 3 -> 724183337
Cost of travelling is: 71

Starting at city 3:
Path: 3 -> 2 -> 1 -> 4 -> 724183337
Cost of travelling is: 71

Starting at city 4:
Path: 4 -> 3 -> 2 -> 1 -> 724183337
Cost of travelling is: 71
○ PS C:\Users\Madhura\OneDrive\Desktop\C> 

```

Aim-2:

Construction of Single Source Shortest Path

Problem Statement:

Develop a system to optimize the delivery routes for a fleet of vehicles in a metropolitan area. The system should efficiently calculate the shortest paths between multiple pickup and delivery points, taking into account traffic congestion and road conditions.

Implement the Bellman-Ford algorithm to find the shortest path from a central depot to each delivery location while considering varying transportation costs and time constraints.

Consider the following criteria for determining connections within the same state in India:

- i. Determine the latitude and longitude of addresses within the same city. Select 6 to 8 addresses, with one designated as zero mile, and construct a fully connected graph.
- ii. Designate the zero-mile location as the pickup point.
- iii. Calculate the shortest paths between the pickup point and delivery points.

Code:

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

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

```
#include <limits.h>
```

```
typedef struct {
```

```
    int src, dest, weight;
```

```
}Edge;
```

```
void bellmanFord(Edge edges[], int V, int E, int src) {
```

```

int dist[V];

for (int i= 0;i <V; i++)
    dist[i] = INT_MAX;
dist[src] = 0;

for (int i =1; i <=V-1; i++) {
    for (int j= 0; j< E; j++) {
        int u= edges[j].src;
        int v= edges[j].dest;
        int w= edges[j].weight;
        if (dist[u] != INT_MAX && dist[u]+w<dist[v])
            dist[v]=dist[u] + w;
    }
}

for (int j=0; j<E; j++) {
    int u= edges[j].src;
    int v= edges[j].dest;
    int w= edges[j].weight;
    if (dist[u] != INT_MAX && dist[u] + w < dist[v]) {
        printf("Graph contains negative weight cycle\n");
        return;
    }
}

printf("\nShortest distances from pickup point (0):\n");
for (int i= 0; i< V; i++) {
    printf("To address %d: ", i);

```

```

        if (dist[i]==INT_MAX)
            printf("Unreachable\n");
        else
            printf("%d\n", dist[i]);
    }
}

```

```

int main() {
    int V;

    printf("Enter number of addresses (including pickup point): ");
    scanf("%d", &V);

    int E=V*(V-1);
    Edge edges[E];
    int k=0;

    printf("Enter travel times between addresses (matrix format, 0 for same address):\n");
    int travelTime[V][V];
    for (int i = 0; i < V; i++) {
        for (int j = 0; j < V; j++) {
            scanf("%d", &travelTime[i][j]);
        }
    }

    for (int i= 0; i< V; i++) {
        for (int j= 0; j< V; j++) {
            if (i!= j) {
                edges[k].src = i;
                edges[k].dest = j;
                edges[k].weight = travelTime[i][j];
            }
        }
    }
}

```

```

        k++;
    }
}

}

int pickupPoint;

printf("Enter the pickup point index (0 to %d): ", V-1);

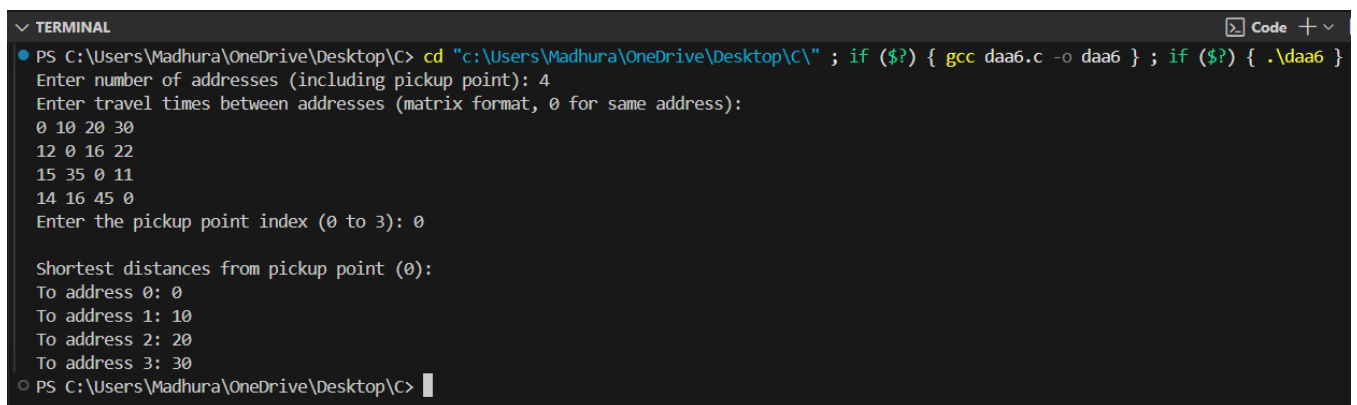
scanf("%d", &pickupPoint);

bellmanFord(edges, V, E, pickupPoint);


return 0;
}

```

Output:



```

▼ TERMINAL
● PS C:\Users\Madhura\OneDrive\Desktop\C> cd "c:\Users\Madhura\OneDrive\Desktop\C\" ; if ($?) { gcc daa6.c -o daa6 } ; if ($?) { .\daa6 }
Enter number of addresses (including pickup point): 4
Enter travel times between addresses (matrix format, 0 for same address):
0 10 20 30
12 0 16 22
15 35 0 11
14 16 45 0
Enter the pickup point index (0 to 3): 0

Shortest distances from pickup point (0):
To address 0: 0
To address 1: 10
To address 2: 20
To address 3: 30
○ PS C:\Users\Madhura\OneDrive\Desktop\C>

```


Leetcode Submission:

leetcode.com/problems/find-the-shortest-superstring/

Problem List

Description | Accepted x | Editorial | Solutions | Submissions

All Submissions

Accepted 85 / 85 testcases passed
Madhura456Mahatma submitted at Oct 08, 2025 19:55

Runtime 22 ms | Beats: 100.00%
[Analyze Complexity](#)

Memory 8.51 MB | Beats: 66.67%
[Analyze Complexity](#)

Test Case	Runtime (ms)
1	23ms
2	25ms
3	43ms
4	45ms
5	47ms

Code Editor:

```
int getOverlap(char *a, char *b) {
    int m = strlen(a), n = strlen(b);
    int len;
    for (len = min(m, n); len > 0; len--) {
        if (strncmp(a + m - len, b, len) == 0)
            return len;
    }
    return 0;
}

char* shortestSuperstring(char** words, int n) {
    int overlap[n][n];
    for (int i = 0; i < n; i++)
        for (int j = 0; j < n; j++)
            overlap[i][j] = (i != j) ? getOverlap(words[i], words[j]) : 0;

    int fullMask = (1 << n) - 1;
    int dp[1 << n][n];
    int parent[1 << n][n];
}
```

Testcase | Test Result

Accepted Runtime: 0 ms

Case 1 Case 2

Input

```
words = ["Hello","World","Blackboard"]
```

Problem List

Description

Accepted

Editorial

Solutions

Submissions

All Submissions

Accepted

85 / 85 testcases passed

Madhura456Mahatme

submitted at Oct 08, 2025 19:55

Editorial

Solution

Runtime

22 ms Beats 100.00%

Analyze Complexity

Memory

8.51 MB Beats 66.67%

Test Case	Runtime (ms)
1	23ms
2	25ms
3	43ms
4	45ms
5	47ms

Code

```

1 int getOverlap(char *a, char *b) {
2     int m = strlen(a), n = strlen(b);
3     int len;
4     for (len=(m < n ? m : n); len > 0; len--) {
5         if (strncmp(a+m-len, b, len) == 0)
6             return len;
7     }
8     return 0;
9 }

```

Saved

Testcase

Test Result

Accepted Runtime: 0 ms

Case 1 Case 2

Input

words = ["alex", "loves", "leetcode"]

Output

leetcode loves alex

Expected

alex loves leetcode

Contribute a testcase