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**Assignment No: 4**

**Problem Statement:**

Write a program to solve the travelling salesman problem and to print the path

and the cost using LC Branch and Bound.

**Program:**

#include <iostream>

#include <climits>

using namespace std;

#define N 5 // Number of cities

// Matrix representation of the graph

int M[N][N] = {

{0, 20, 30, 10, 11},

{15, 0, 16, 4, 2},

{3, 5, 0, 2, 4},

{14, 6, 18, 0, 3},

{16, 4, 7, 16, 0}};

int cost = INT\_MAX; // Initialize cost as maximum value

int best\_path[N]; // Array to store the best path

// Function to solve the TSP problem using Branch and Bound

void tsp\_branch\_and\_bound(int path[N], bool visited[N], int bound, int level)

{

// If all cities have been visited

if (level == N)

{

// Calculate the cost of the current path

int current\_cost = bound + M[path[N - 1]][path[0]];

// If the current cost is less than the minimum cost found so far

if (current\_cost < cost)

{

// Update the minimum cost and the best path

cost = current\_cost;

copy(path, path + N, best\_path);

}

return;

}

// For each city

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

{

// If the city has not been visited yet

if (!visited[i])

{

// Calculate the bound for the next level

int new\_bound = bound + M[path[level - 1]][i];

// If the new bound is less than the minimum cost found so far

if (new\_bound < cost)

{

// Mark the city as visited and go to the next level

path[level] = i;

visited[i] = true;

tsp\_branch\_and\_bound(path, visited, new\_bound, level + 1);

// Backtrack: mark the city as not visited for future iterations

visited[i] = false;

}

}

}

}

int main(){

int path[N]; // Array to store the current path

bool visited[N] = {false}; // Boolean array to keep track of visited cities

path[0] = 0; // Start from city 0

visited[0] = true; // Mark city 0 as visited

tsp\_branch\_and\_bound(path, visited, 0, 1); // Call the TSP function

cout << "Min Cost: " << cost << endl; // Print the minimum cost

cout << "Best Path: "; // Print the best path

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

{

cout << best\_path[i] << " --> ";

}

cout << best\_path[0] << endl; // Print the starting city to complete the cycle

return 0;

}

**Output:**

Min Cost: 28

Best Path: 0 --> 3 --> 1 --> 4 --> 2 --> 0