**Q4: Approximation Algorithms for NP-Complete Problems**: Implement an **approximation algorithm** for solving the **traveling salesman problem**. Analyze how close the solution is to the optimal path and discuss the complexity of the algorithm

<!DOCTYPE html>

<html lang="en">

<head>

<meta charset="UTF-8">

<meta name="viewport" content="width=device-width, initial-scale=1.0">

<title>TSP Approximation</title>

<style>

body {

font-family: Arial, sans-serif;

margin: 20px;

}

#output {

margin-top: 20px;

font-weight: bold;

}

</style>

</head>

<body>

<h1>TSP Approximation</h1>

<div>

<label for="locations">Enter locations as x,y coordinates (e.g., "0,0 2,3 4,1"):</label><br>

<input type="text" id="locations" placeholder="Enter locations">

<button onclick="solveTSP()">Solve</button>

</div>

<div id="output"></div>

<script>

function parseLocations(input) {

return input.split(' ').map(coord => {

const [x, y] = coord.split(',').map(Number);

return { x, y };

});

}

function calculateDistance(a, b) {

return Math.sqrt(Math.pow(a.x - b.x, 2) + Math.pow(a.y - b.y, 2));

}

function solveTSP() {

const input = document.getElementById("locations").value.trim();

if (!input) {

alert("Please enter valid coordinates.");

return;

}

const locations = parseLocations(input);

const visited = new Array(locations.length).fill(false);

let currentLocation = locations[0];

visited[0] = true;

let route = [0];

let totalDistance = 0;

for (let i = 1; i < locations.length; i++) {

let nearest = -1;

let minDistance = Infinity;

for (let j = 0; j < locations.length; j++) {

if (!visited[j]) {

const distance = calculateDistance(currentLocation, locations[j]);

if (distance < minDistance) {

minDistance = distance;

nearest = j;

}

}

}

visited[nearest] = true;

totalDistance += minDistance;

currentLocation = locations[nearest];

route.push(nearest);

}

totalDistance += calculateDistance(currentLocation, locations[0]); // Return to start

const output = `

Approximated Route: ${route.join(' -> ')} -> 0<br>

Total Distance: ${totalDistance.toFixed(2)}

`;

document.getElementById("output").innerHTML = output;

}

</script>

</body>

</html>