

Input:

5
0.0 0.0
2.0 3.0
4.0 0.0
4.0 3.0
6.0 1.0

Output:

Hill Climbing:

Route: 1->3->5->4->2->1

Total Distance: 14.67

Simulated Annealing:

Route: 1->2->4->5->3->1

Total Distance: 14.67

Output Description:

Both Hill Climbing and Simulated Annealing achieved the same total distance of 14.67 in this scenario, but their routes are different.

Hill Climbing followed a greedy method, improving the solution step by step and stopping once no better neighbors were found, resulting in the route 1 -> 3 -> 5 -> 4 -> 2 -> 1.

Simulated Annealing used probabilistic exploration, accepting worse moves to escape local minima, leading to the route 1 -> 2 -> 4 -> 5 -> 3 -> 1.

Why Hill Climbing Gets Stuck:

Only explores immediate neighbors.

Cannot backtrack or explore worse routes, leading to failure.

How Simulated Annealing Escapes Local Minima:

Temporarily accepts worse solutions, allowing it to escape traps.

Balances exploration (at high temperatures) and exploitation (at low temperatures).

Result, limitation and improvement:**Results:**

Hill Climbing quickly finds good solutions but can get stuck in local minima, leading to suboptimal solutions. Where, Simulated Annealing explores more thoroughly and escapes local minima, usually producing better solutions over time.

Limitations:

Hill Climbing is limited by local minima and depends heavily on the starting point. While simulated Annealin is slower due to exploration, and requires careful tuning of parameters like temperature and cooling rate.

Improvements:

Hill Climbing can use random restarts or stochastic methods to explore more paths. Meanwhile, Simulated Annealing can Implement adaptive cooling or parallel runs to speed up the search and improve solution quality.