Introduction:

Travelling Salesman Problem (TSP) is a known NP-Hard problem. I.e. there is no known polynomial time solution to the TSP problem. Below is the list of possible solutions:

Solutions:

1. Naïve Solution: We try all n! paths and then select the one that has the minimum cost.
   1. Time Complexity: O(n!) = O(n^n)
2. Greedy Solution: We use Nearest Neighbor approach.
   1. Fastest approach; Doesn’t guarantee optimum solution
   2. Time Complexity: O(n)
3. Dynamic Solution:
   1. Time Complexity: O(n2\*2^n)
   2. Better than O(n!) but still exponential
4. Approximate Solution:
   1. This solutions uses the Minimum Spanning Tree to provide 2-approximate solution. Below is the algorithm:
   2. Algorithm:
      1. From the start node, build the MST using Prim’s algorithm
      2. Traverse the MST in Preorder manner
      3. The preorder traverse path is the solution
   3. Important Condition:
      1. Triangle Inequality:
         1. Triangle-Inequality states that the least distance to reach j from i is the direct path from i->j. I.e. dist(i,j) <= dist(i,k) + dist(k,j)
      2. In many practical cases triangle-inequality exists
      3. If the cost function satisfies the above condition, then the algorithm discussed above would return a tour whose cost is never more than twice the cost of an optimal tour
   4. There is another approximate solution that provides 1.5 – approximate solution called Christofides algorithm.