

Problem: Heuristic Methods for TSP

In this report, you will design heuristic methods to construct “good” solutions to the Traveling Salesman Problem where the nodes are points in the Euclidean plane and all distances are the standard Euclidean distance. This assignment is a combination algorithm and visualization assignment: every solution must be presented graphically. You should use some sort of plotting functionality to draw the best tour you can find using your techniques.

You must implement one of each type of algorithm: **Initial Heuristic** and **Local Heuristic**. You will produce an initial tour using your initial heuristic and then improve it using your local heuristic.

- **Initial Heuristics**

- Nearest Neighbor
- Farthest Insertion
- Nearest Insertion
- Cheapest Insertion
- Christofides’ Heuristic

- **Local Heuristics**

- 2opt (2-switches)
- 3opt (3-switches)
- Lin-Kernighan (δ -paths)

Special Bonus Assignment: If you implement an algorithm to produce Held-Karp Lower Bounds, then you will receive up to 10 extra points (out of the 30 total points). If you use such lower bounds, report the vector $\mathbf{y} = (y_v)_{v \in V}$ and the 1-tree given by the lower bound. Plot the 1-tree and write the vertex values y_v on the nodes. Report the relative difference between your upper and lower bounds.

Questions to Answer in Your Report

- Q1.** Which heuristics did you use?
- Q2.** How specifically did you select which choices to make?
- Q3.** What was the most difficult part of this assignment?

Problem Instances.

The four problem instances are available online. The files provide lists of points in the integer lattice.