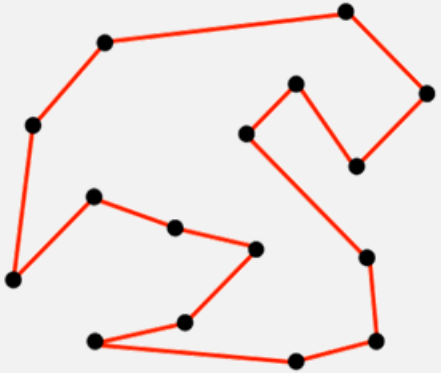
Traveling Salesman Problem (TSP)

Input



Output

$$\min \sum_i \sum_j c_{ij} x_{ij}$$

$$s.t. \quad \sum_i x_{ij} = 1, \quad \forall i, j \in V, i \neq j,$$

$$\sum_j x_{ij} = 1, \quad \forall i, j \in V, i \neq j,$$

$$x_{ij} \in \{0,1\}, \quad \forall i, j \in V$$

Image Source:
http://algorist.com/problems/Traveling_Salesman_Problem.html

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Subtour elimination：

$$\min \sum_i \sum_j c_{ij} x_{ij}$$

$$s.t. \quad \sum_i x_{ij} = 1, \quad \forall i, j \in V, i \neq j,$$

$$\sum_j x_{ij} = 1, \quad \forall i, j \in V, i \neq j,$$

$$\sum_{i,j \in S} x_{ij} \leq |S| - 1, \quad 2 \leq |S| \leq n - 1,$$

$$x_{ij} \in \{0,1\}, \quad \forall i, j \in V$$

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Miller-Tucker-Zemlin (MTZ):

$$\min \sum_i \sum_j c_{ij} x_{ij}$$

$$s.t. \quad \sum_i x_{ij} = 1, \quad \forall i, j \in V, i \neq j,$$

$$\sum_j x_{ij} = 1, \quad \forall i, j \in V, i \neq j,$$

$$u_i - M\left(1 - x_{ij}\right) \leq u_j, \quad \forall i, j \in V, i \neq j,$$

$$x_{ij} \in \{0,1\}, \quad \forall i, j \in V$$

$$u_i \geq 0, \quad \forall i \in V$$

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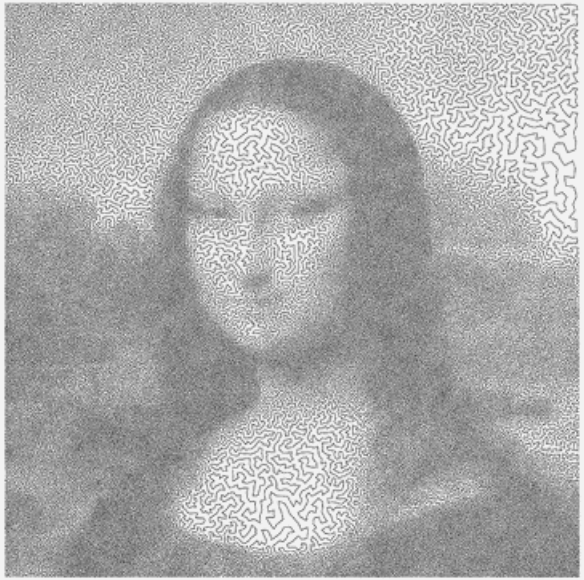
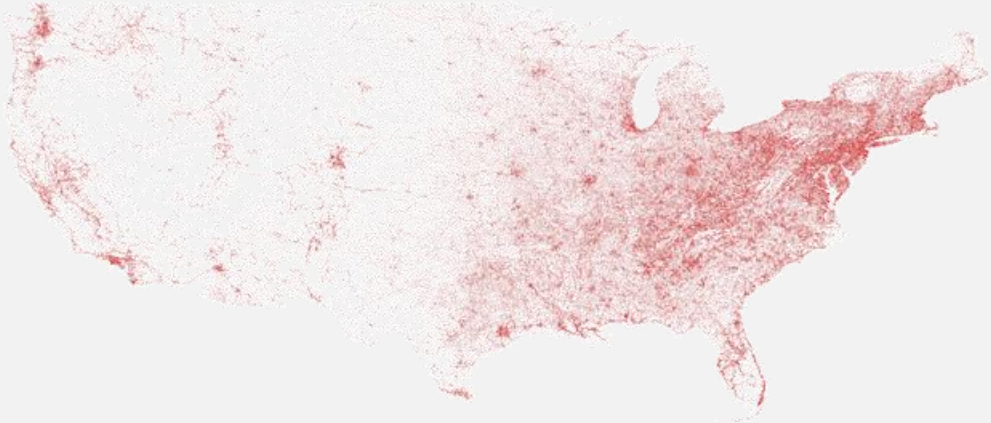
Heuristic：





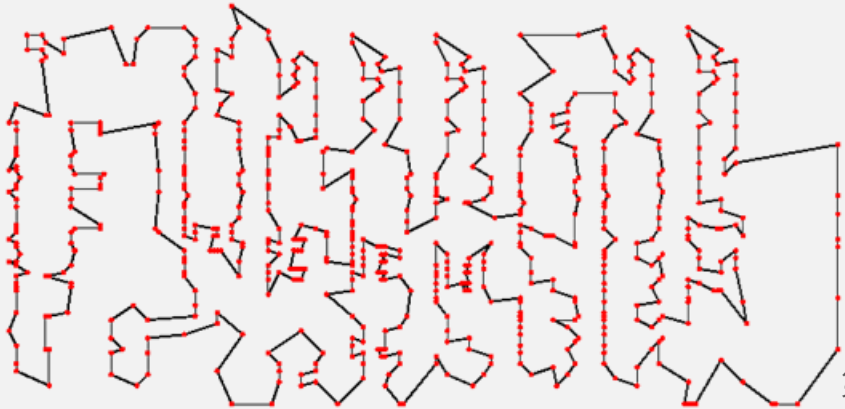


Image Source：
https://www.math.uwaterloo.ca/tsp/data/index.html

Extensive：
LKH (Keld Helsgaun) (ruc.dk)
Jupyter Notebook Viewer (nbviewer.org)
119,614 Stars (HYG Database) (uwaterloo.ca)