MAGIC SQUARES

Choice of function to minimize affects the performance of the algorithm

Options: compute absolute value differences of row/col/diag sums with the target

Then take the sum of the differences, or the average, or the max difference, etc.

Example:

5	1	9	15
7	6	2	15
3	8	4	15

18 15 15 15   15

It's possible to swap entries to achieve a magic square such that the max difference decreases to zero.

But the sum or average difference must increase before decreasing.

number of possible tours of 20 cities

$$\frac{19 \cdot 18 \cdot 17 \cdot 16 \cdots 3 \cdot 2 \cdot 1}{2} = \frac{19!}{2} = 6 \times 10^{16}$$

N cities: number of tours is $\underline{(N-1)!}$

Traveling Salesperson Problem: Simulated Annealing

1. states: all possible tours

2. function to minimize: length of the tour

3. transitions: How to modify one tour to obtain another?

   • Swap two indexes.

- Look for largest distance, and make a swap.
- Pick two indexes at random and reverse the part of the tour between them.
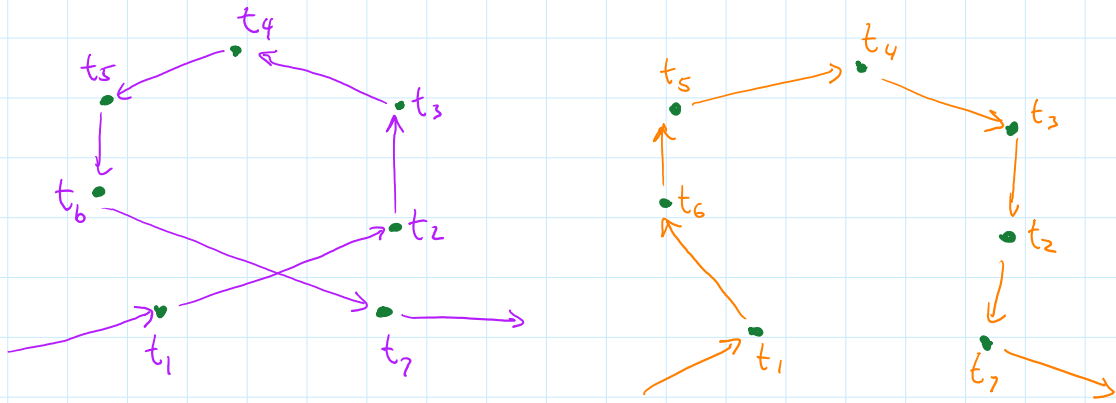
tour: $[\ldots, t_1, t_2, t_3, t_4, t_5, t_6, t_7, \ldots]$

$[\ldots, t_1, t_6, t_5, t_4, t_3, t_2, t_7, \ldots]$

reverse this part