STA6171: Statistical Computing for DS 1 Combinatorial Optimization

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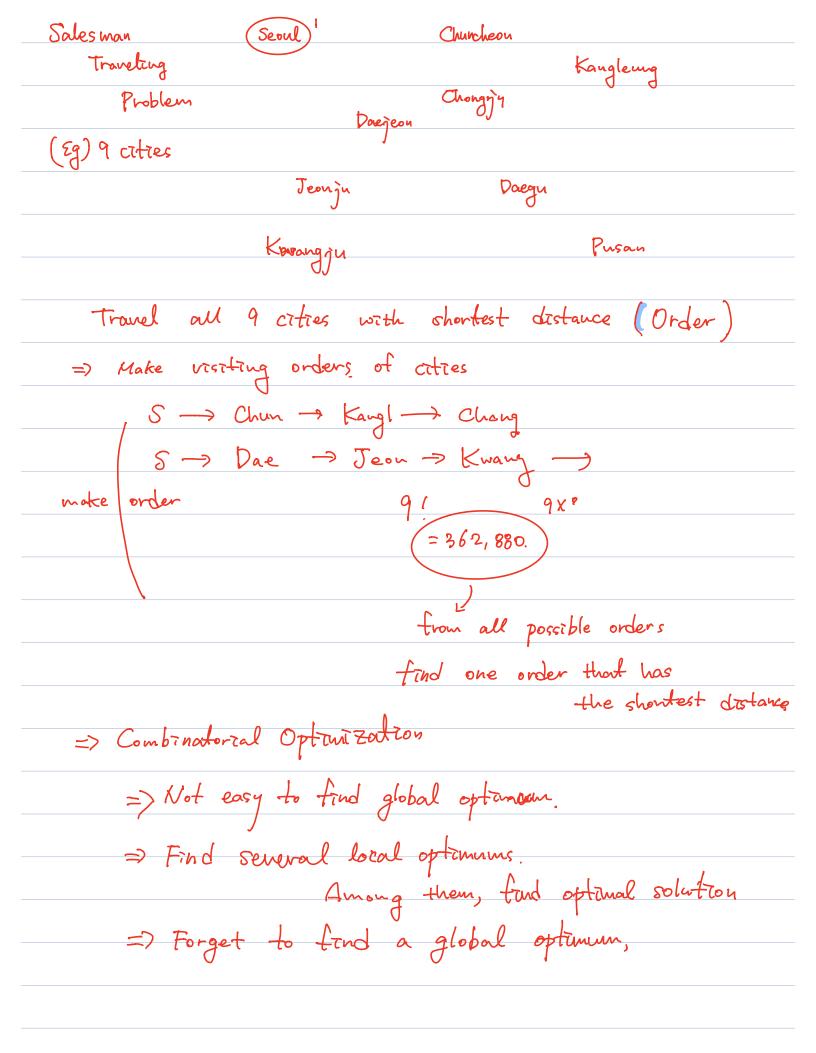
2020.09.16

- Introduction
- 2 Local Search
- Simulated Annealing
- Genetic Algorithm

Introduction to Combinatorial Optimization

Optimization for Combination.

- Let us assume that we are seeking the maximum of $f(\theta)$ w.r.t $\theta = (\theta_1, \dots, \theta_p)$, where $\theta = \Theta$ and Θ consists of N elements for a finite $\theta_1, \dots, \theta_p$ $\ell(\theta_1, \dots, \theta_p)$ $\theta_1, \theta_2, \dots \theta_n$ $\theta_1, \theta_2, \dots \theta_n$ positive integer N.
- Example: Profile Likelihood
 - In statistical applications, it is common for a likelihood function to depend on configuration parameters that describe the form of a statistical model and for which there are many discrete choices, as well as a small number of other parameters that could be easily optimized if the best configuration were known.
 - View $f(\theta)$ as the log profile likelihood of a configuration, θ , that is, the highest likelihood attainable using that configuration.



Regression with variable selection.
=> Small n large p
$\frac{\overline{\theta}_{i}, \overline{\theta}_{k}$
X,,, Xp.
We need to implement variable selection consider
Variable Selection include in model 1 binary
exclude in model 0.
Total possible models: (2P-1)
find best model from 2P-1 cases
2 (00 ° -1
need a combinatorial
optantention
Profile trketihood Case
A, , Dz,, Dio, we Oz choose to points from
fix
possible combination 5 9
G need to find that maximize likelihood with Dy

Hard Optimization Problems

- Hard optimization problems are generally combinatorial in nature.
- p items may be combined or sequenced in a very large number of ways.
 and each choice corresponds to one element in the space of possible solutions.
- Maximization requires a search of this very large space.
- Example: Traveling Salesman Problem
 - Suppose sales man must visit each of p cities exactly once and return to his point of origin using the shortest total travel distance.
 - Seek to minimize the total travel distance over all possible routes.
 - If the distance between two cities does not depend on the direction traveled between them, then there are (p-1)!/2 possible routes.
 - The difficulty of optimization depends on *p*.

