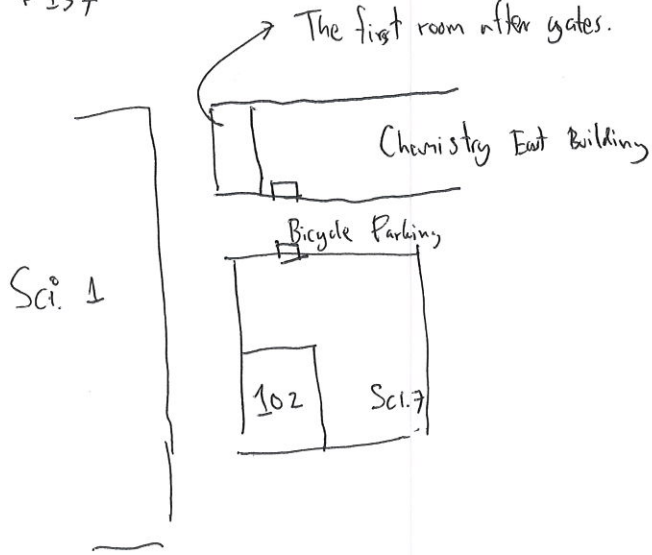
Voraparn Soppakitpaisarn (International Center for IST)

* I sometimes announce about exchange programs with foreign universities at this class.

Office hour : Thursday 2:30 - 4:00 pm.

Office : Chemistry Building #137



There is no room number pasted in front of my room!!

Schedule

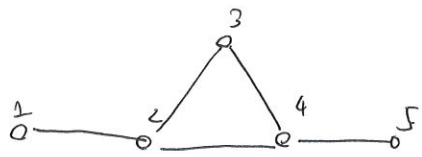
10/1	Introduction, Quick catch up on our course on last semester.
10/8	No class (public holiday).
10/15	Social ~~Sensor~~ Networks: Graph Clustering
10/22, 10/29	Social Networks: Page Rank and SimRank
11/5, 11/8 (Thu)	Social Network: Influence Maximization.
11/12	Midterm Examination (30% of credits)
11/19	Sensor Networks: Target Coverage Problem
11/26, 12/3	Sensor Networks: Maximum Lifetime Coverage Problem
12/10	Sensor Networks: Localization Problem
12/18	Guest Lecture (TBP)
12/24, 12/31	No class.
1/7	Final Examination (70% of credits)

Please contact me before 10/15 if you can not join the midterm and final exam!

Graph V: Set of points (nodes)

E: Set of lines between points (edges or links).

Example



$V = \{1, 2, 3, 4, 5\}$

$E = \{\{1,2\}, \{2,3\}, \{2,4\}, \{3,4\}, \{4,5\}\}$

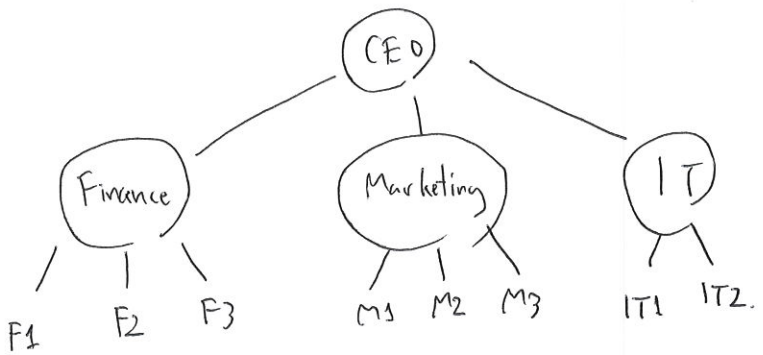
Paths 1 wants to communicate with 5.

1 can send a message to 2 asking him to ask 4 to send to 5.

paths $\begin{cases} 1 \to 2 \to 4 \to 5 \\ 1 \to 2 \to 3 \to 4 \to 5 \end{cases}$ ⟶ paths with smallest number of forwarding = shortest path

Trees A graph that there is only one path between all two points.

Example organization chart



Social Networks: Networks of persons

V: points → persons

E: lines → lines between 2 persons that are friends.

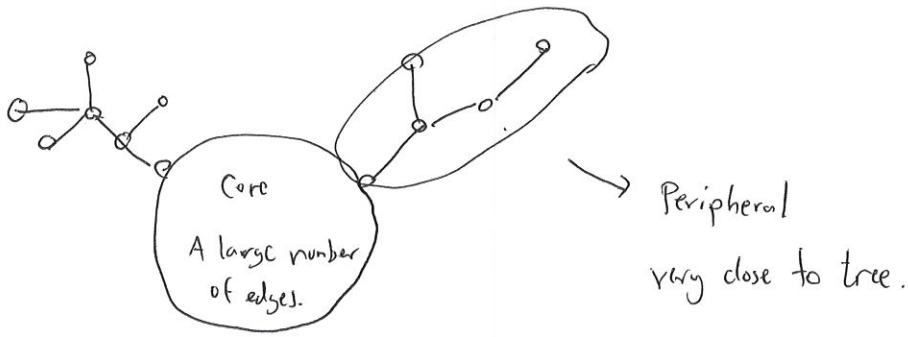
What makes social networks difference?

1. Small-world Properties.

   I am a friend of a friend of a friend of a friend of a friend of a friend of everyone.

   Shortest paths between 2 persons are not longer than 6 forwardings.

2. Core - peripheral Property

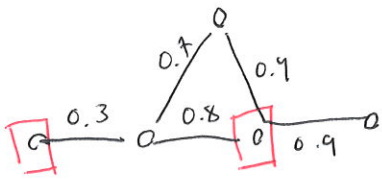


Use 2 properties to speed up computations.

Influence Maximization.

- We want to advertise an information in a social network
- We have a budget to tell at most k (2-3) persons in the network, and hope that they will forward the information to their friends as much as possible.

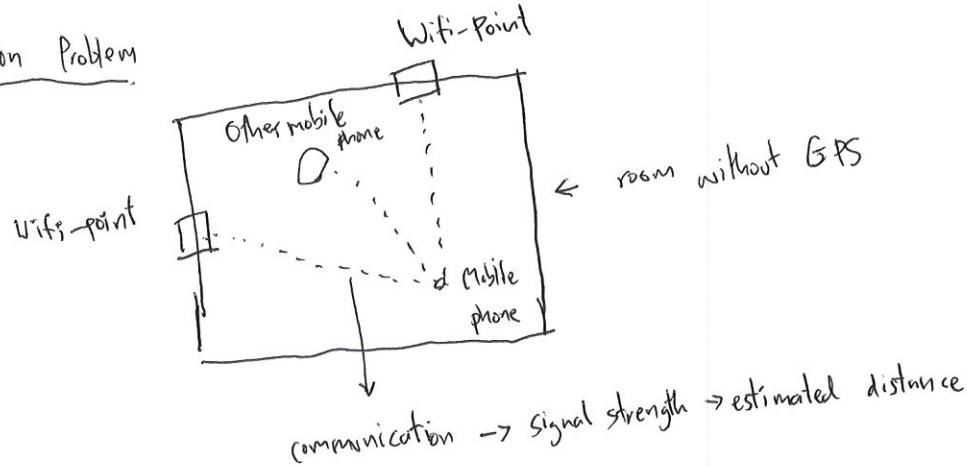
Example



Sensor Networks

- Dense networks, Each node has small energy
- Management has to be seriously done.

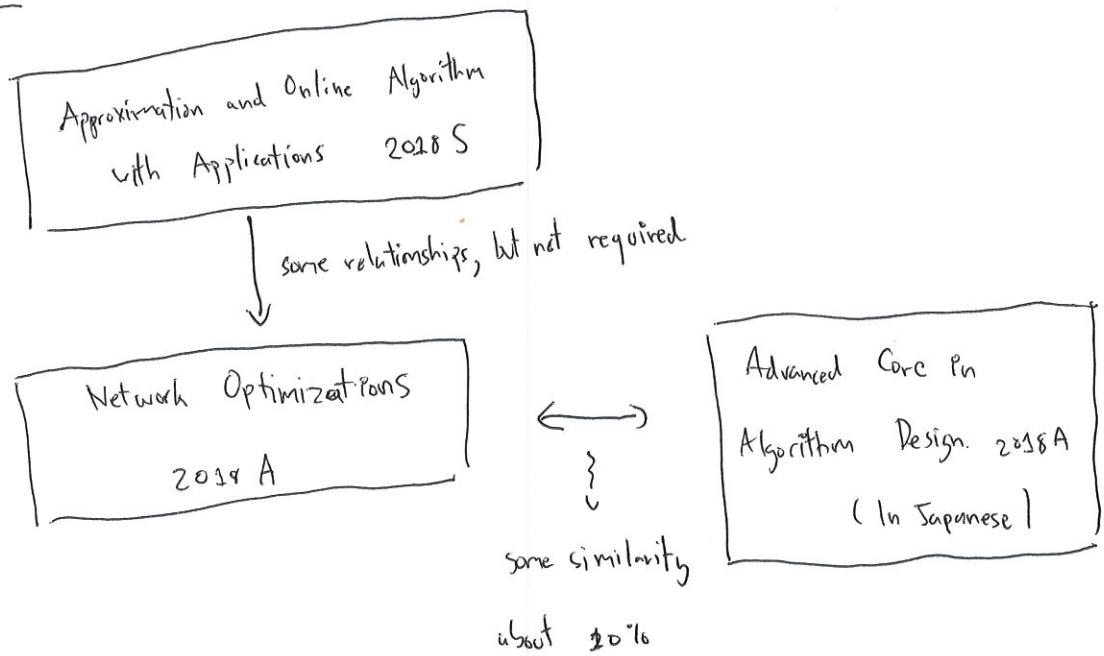
Localization Problem



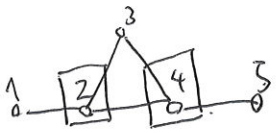
Technical Concepts

- k-way clustering
- Submodular function optimization.
- Garg-Konnman. optimization method.
- Semi-Definite Programming (SDP)

Relationship with other courses



Domination Set



- We want everyone to know the information
- We select persons, they will forward information to all friends. The friends will not further forward the information
- We will select the smallest number of persons.

Optimization Formulization

Input: Social Network (V, E)

Output: Set of selected persons $S \subseteq V$ — What the output can be?

Constraint: For all $v \in V$, either $v \in S$ or there is $u \in S$ such that $\{u, v\} \in E$

Objective Function: Minimize $|S|$ → What is the desirable output?

Input: Social Network (V, E)

Output: Suppose that $V = \{1, \cdots, n\}$, $x_1, x_2, \cdots, x_n \in \{0, 1\}$

~~$x_i = 0$~~ $x_i = 0$ if we do not select i

$x_i = 1$ if we select

Objective Function: Minimize $\sum_{i=1}^{n} x_i$

Constraint: For all i, $\sum_{j \in N(i) \cup \{i\}} x_j \geq 1$

$N(i)$: friends of i

Example of constraints

$x_1 + x_2 \geq 1$ ← 1 must know information

$x_1 + x_2 + x_3 + x_4 \geq 1$

$x_2 + x_3 + x_4 \geq 1$

$x_2 + x_3 + x_4 + x_5 \geq 1$

$x_4 + x_5 \geq 1$