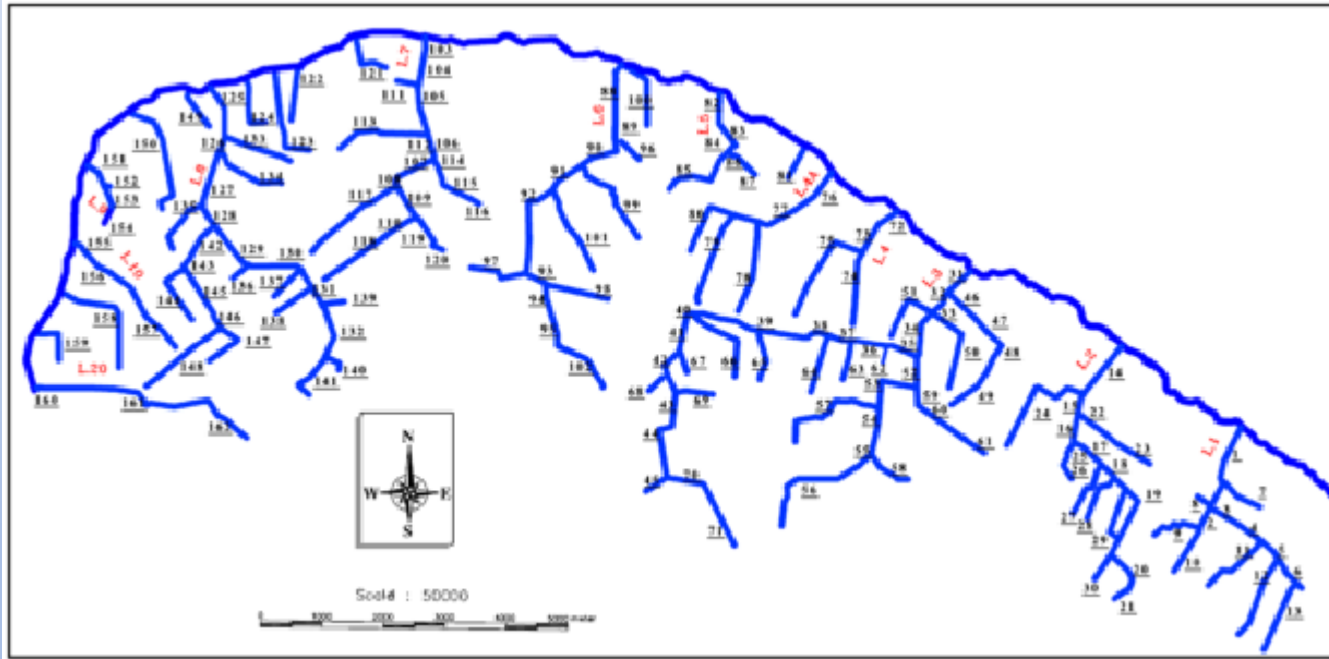# Applications of Graphs

CME4422

Oldest Network?

- Irrigation and sewer systems

Problem Definition

- What are the entities which will be represented by the nodes in the graph?
- Which relationship between the entities is represented by the edges?
- Which property of the relationship is represented by graph weights?

Social Media Friendship

- Mutual relationship, no need for a direction
- Two users can become friends only if both agree to it
- A possible weight option can be the time of friendship
- Follow relationship, on the other hand, must be a directional relationship.

Bi-partite Graphs

- For a set of nodes U and another set of nodes V, if we have a graph G where only edges $< u, v >$ where $u \in U$ and $v \in V$ are allowed, G is called a <u>bi-partite</u> graph.

- If all elements of U and V are connected with each other, a <u>complete bi-partite graph</u> is found.

- An example is a <u>neural network</u>.

- Bi-partite graphs can be converted into regular graphs by connecting nodes in U according to their connections in V.

Text Network

- Words are nodes
- Words that appear in the same text are connected by edges.
- Weight can be the number of texts where the words ocur together.
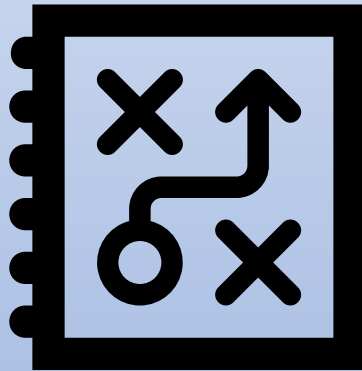- Example: Twitter #hashtags.

Data Mining Application

- Co-purchasing Network(Baby-beer example) used for Association Rule Mining

Academic Networks

- Collaboration Network
- Citation Network: unidirectional graph (Why?)

Infrastructure Networks

- Communication Networks
- Road Networks
- Power Grid Networks

Computer Applications

- Web Network: edges are hyper-links
- Software Dependency Graphs
  - Static Call Graph
  - Dynamic Call Graph

Biological Networks

- Gene Regulation Networks
- Signal Transduction Networks
- Protein Interaction Networks
- Metabolic Networks

Ecological Networks

- Predator-Prey Networks