Lecture 37: Graphs

Fall 2016

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Midterms

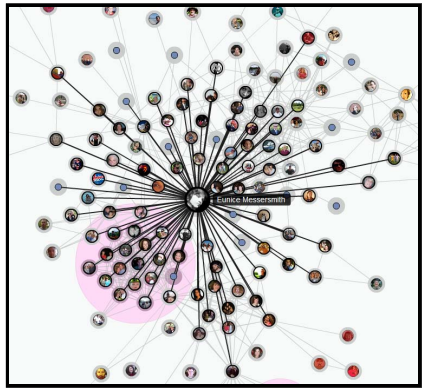
- Ask Prof. Mawhorter if you want yours back

This Week

- Lab 12: Graph Algorithms
- Assignment 12: Driving Directions
  - The last assignment

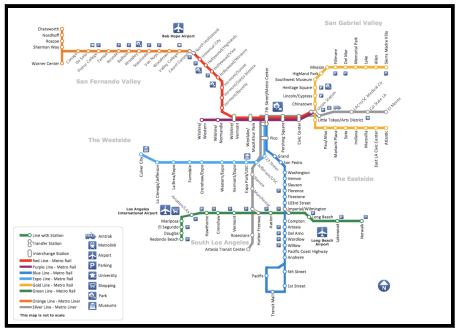
What is a Graph?

- Any kind of network
  - Facebook friendships
  - Subway routes
  - Metabolic pathways
  - etc.
- Has *nodes* and *edges*



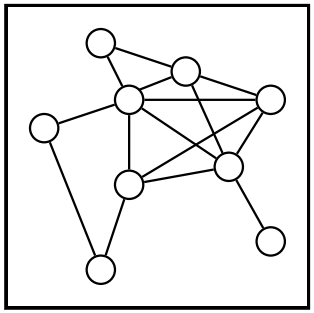
Graph Algorithms

- Shortest/cheapest routes
- Minimum-cost connectivity
- Maximize throughput
- Node similarity



Formal Defintion

- A graph G is a pair (V, E) where:
  - V is a set of *vertices* (a.k.a. *nodes*)
  - E is a set of (ordered) pairs of vertices called *edges*



Directed vs. Undirected

- Undirected graphs: edges are symmetric
  - Two-way roads
- Directed graphs: Edges go from a *source* to a *destination*
  - Some roads may be one-way

Graph Terms

- Indicent
- Adjacent
- Degree (in and out)
- Path
- Path Length
- Cycle
- Self loop
- Simple graph
- Simple path
- Simple cycle
- Acyclic graph (tree)
- Connected
- Strongly connected

(on board)

Data Structures

- Adjacency Matrix
  - Store an $n \times n$ boolean matrix
  - `true` means there is an edge from node i to node j
- Adjacency List
  - For each vertex, story a list of outgoing edges
  - Can store incoming edges too