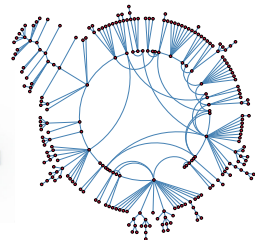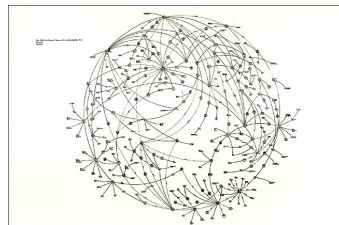# Introduction to Graphs

CS 62 - Spring 2016
Michael Bannister

This Week

- Weekly Assignment

  - 20 Questions Animal Game

  - Binary trees

 - Arbitrary length strings is **extra credit** and easy!

- Reading: Bailey Chapter 16

Examples of Graphs

- Communication
- Transportation
- Biological/chemical interaction
- Social interaction
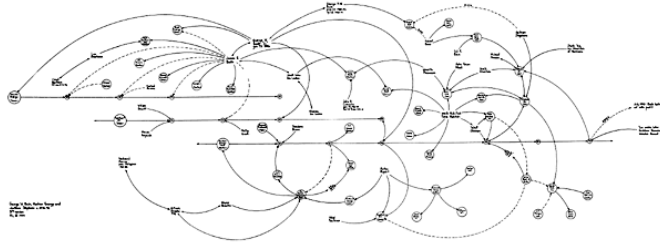- Matchings
- and many more…

Things to do with graphs

- Find shortest/cheapest routes
- Minimize cost of connecting a network
- Maximize communication throughput
- Answer sociological queries
- Match ads to viewers
- Visualize!
- Cure cancer
- Have fun!
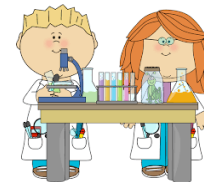
Definitions

A **graph** G is a pair (V, E) such that

- V is a (finite) set of vertices (aka nodes)
- E is a set of pairs of vertices called edges

Directed vs Undirected

Undirected graph: Edges are symmetric

- All roads are two way roads

Directed graph: Edges have a direction

- Some roads may be one way roads

Graph Terms

Incident

adjacent

degree (in and out)

path

path length

cycle

simple path

simple cycle

self loop

acyclic graph (tree)

simple graph

connected

strongly connected

Computer Representations

Adjacency Matrix

- Store graph as an n x n matrix of bools

Adjacency List

- For each vertex store a list of (in and out) neighbors

- Example see code uses adjacency list