Graphs

Michael Ernst
CSE 331
University of Washington
A graph is a network. It represents relationships.

A graph has nodes and edges
These may be labeled
Road map
• Nodes = intersections (cities)
• Edges = roads
Queries
• Best route between cities
• Driving distance
Airline route map
• Nodes = airports
• Edges = flights
Queries
• Cost of a flight plan
• Travel time
Romantic and sexual relationships

- **Nodes** = people
- **Edges** = relationship

Queries

- Whom to inform/treat in case of STD discovery

+ 350 students in no romantic and/or sexual relationship

From: “Chains of Affection: The Structure of Adolescent Romantic and Sexual Networks”, *American Journal of Sociology*, by Peter Bearman of (Columbia), James Moody (Ohio State), and Katherine Stovel (U. of Washington);
Romantic and sexual relationships

- Nodes = people
- Edges = relationship

Queries

- Whom to inform/treat in case of STD discovery
Auto part compatibility
• Nodes = vehicles and parts
• Edges = part fits in vehicle
Queries
• What parts can I use for a repair
• What vehicles are most similar to one another
**Actions in a game**

- **Nodes** = behavior/mode
- **Edges** = event that causes change in behavior

**Queries**
- Implement the AI for a game
- **BRAINS**
World Wide Web
• Nodes = webpages (and their contents)
• Edges = links (and their anchor text)
Queries
• PageRank: Most informative page about a topic
Subtype hierarchy
• Nodes = classes/types
• Edges = subtyping relationships (and other dependences)

Queries
• Which method gets run
• Substitutability
Graph ADT operations

Creators:
• Create an empty graph

Observers:
• Look up a node: Does it exist? What are its neighbors?
• Look up an edge (= a pair of nodes): does it exist?
• Iterate through the nodes or edges

Mutators:
• Add/remove a node
• Add/remove an edge

Other observers?
• Path(s) between two nodes
• All reachable nodes
• Component a node is in
• Indegree and outdegree