Graphs

Michael Ernst

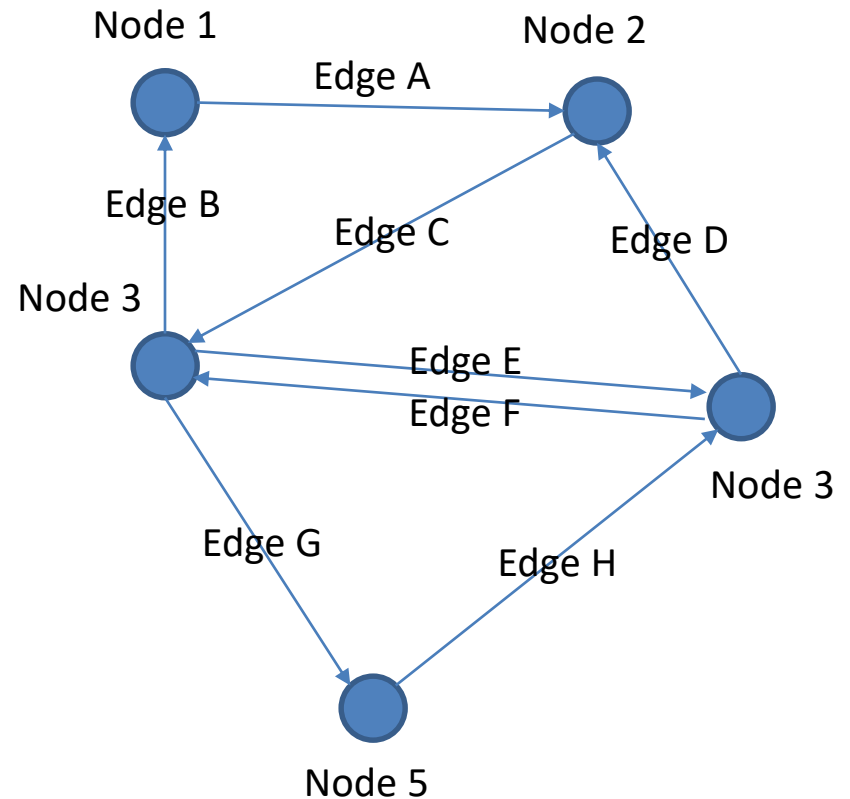CSE 331

University of Washington

A graph is a network.
It represents relationships.

A graph has nodes and edges
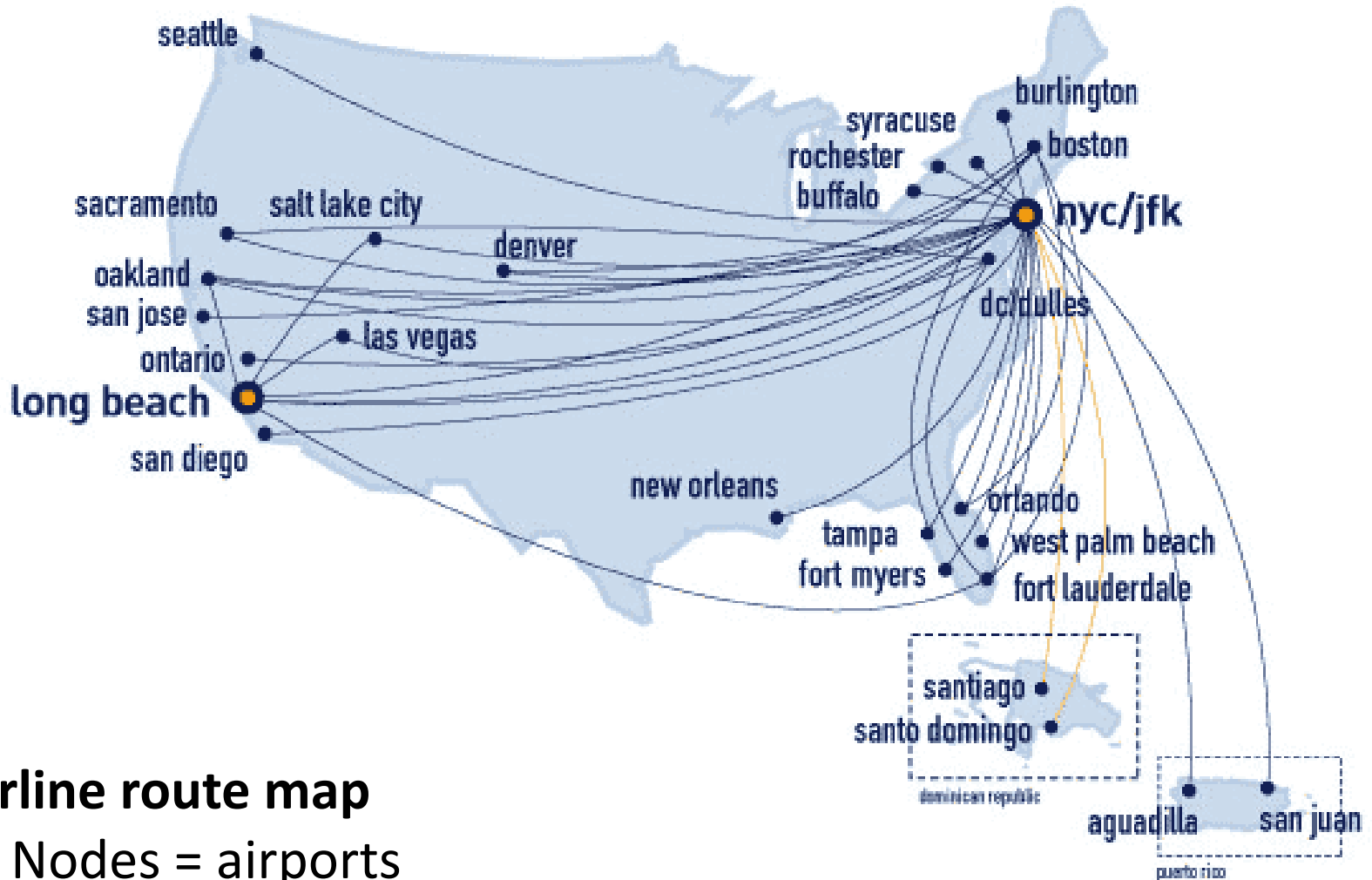
These may be labeled

Road map

- Nodes = intersections (cities)
- Edges = roads

Queries

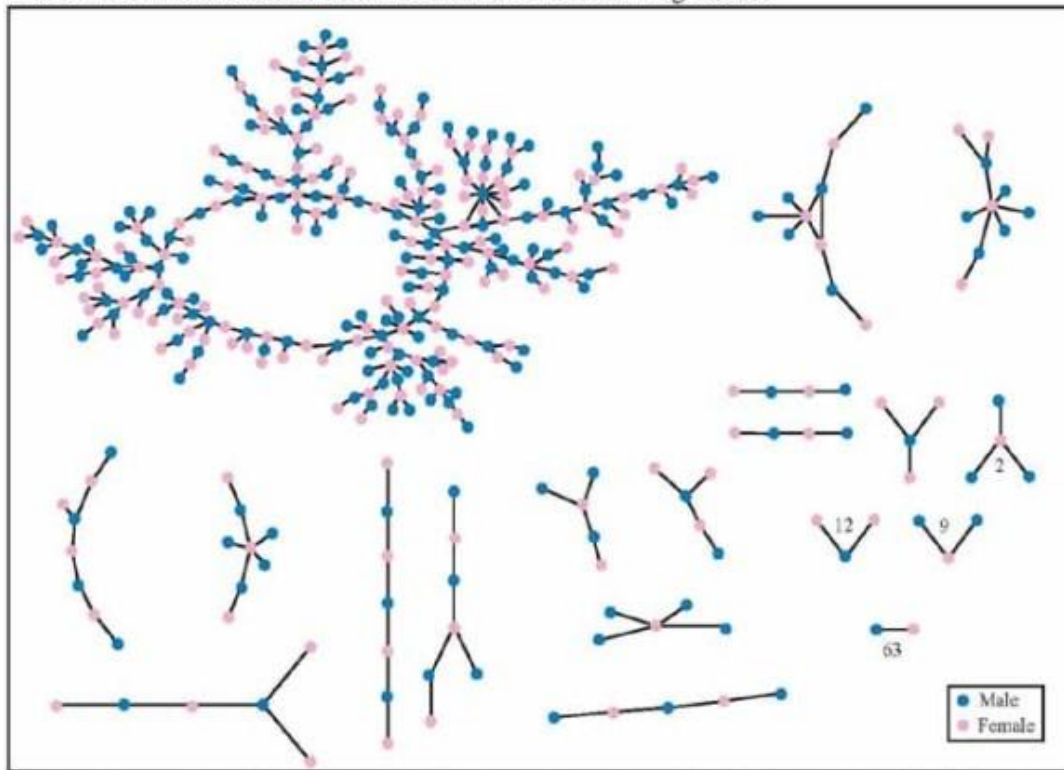- Best route between cities
- Driving distance

Airline route map
- Nodes = airports
- Edges = flights

Queries
- Cost of a flight plan
- Travel time

The Structure of Romantic and Sexual Relations at "Jefferson High School"

Each circle represents a student and lines connecting students represent romantic relations occuring within the 6 months preceding the interview. Numbers under the figure count the number of times that pattern was observed (i.e. we found 63 pairs unconnected to anyone else).

+ 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 Washngton);

Romantic and sexual relationships

- Nodes = people
- Edges = relationship

Queries

- Whom to inform/treat in case of STD discovery
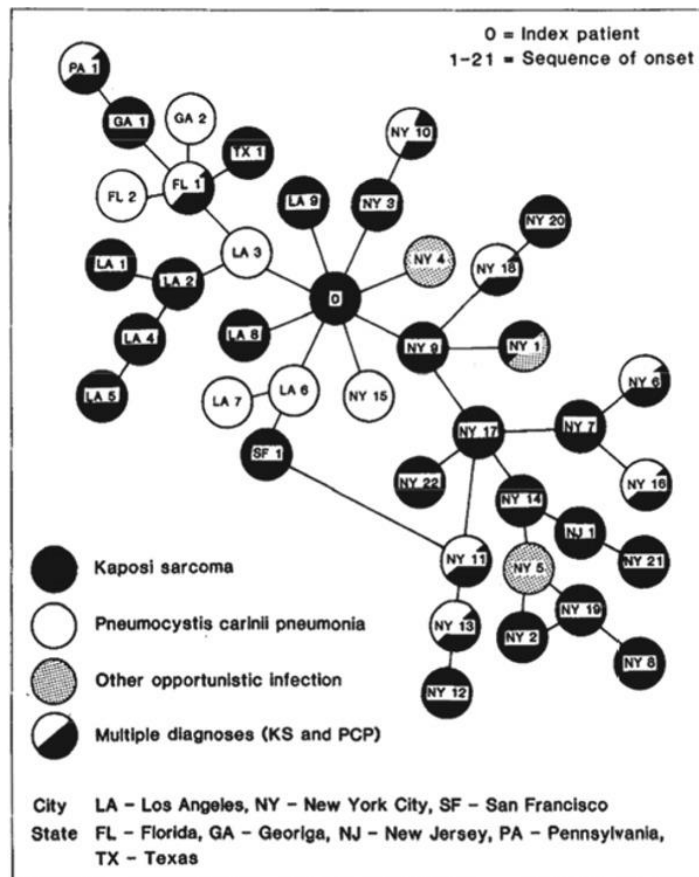
Romantic and sexual relationships
- Nodes = people
- Edges = relationship

Queries
- Whom to inform/treat in case of STD discovery
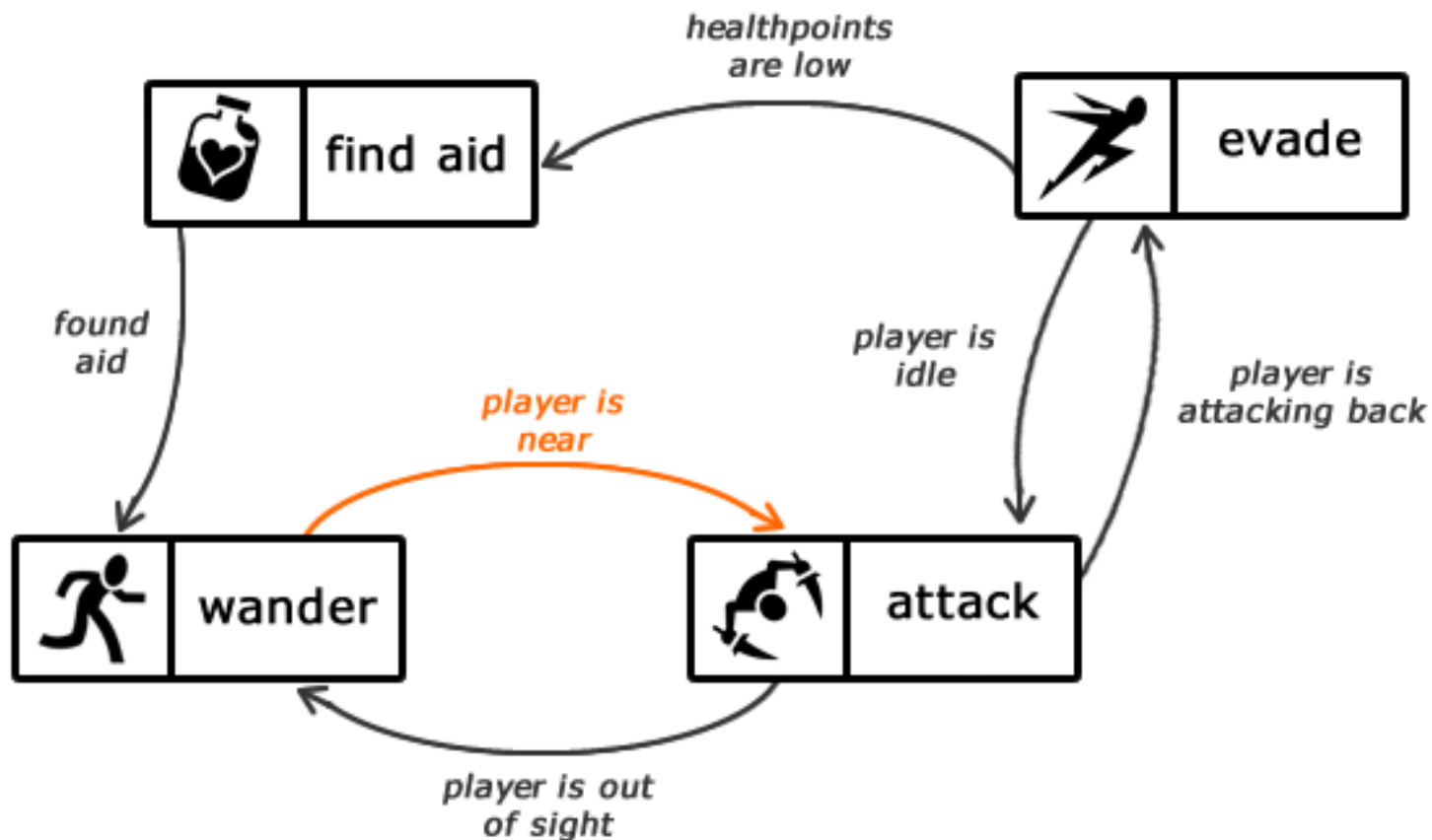
Auto part compatibility

- Nodes = vehicles and parts
- Edges = part fits in vehicle

Queries

- What parts can I use for a repair
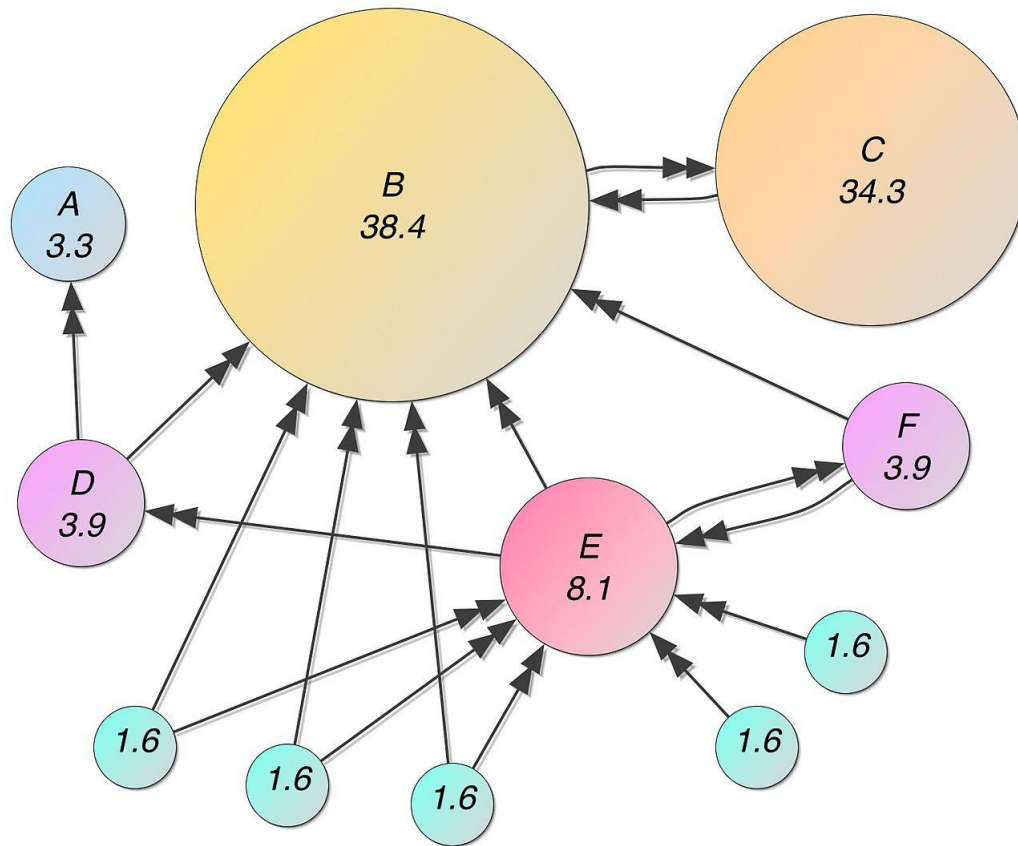- What vehicles are most similar to one another

Actions in a game
- Nodes = behavior/mode
- Edges = event that causes change in behavior

Queries
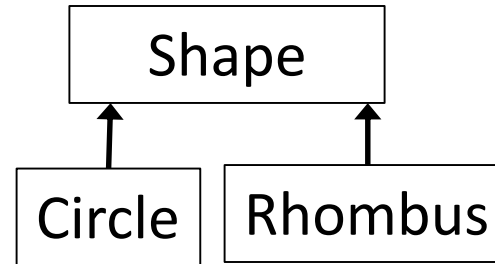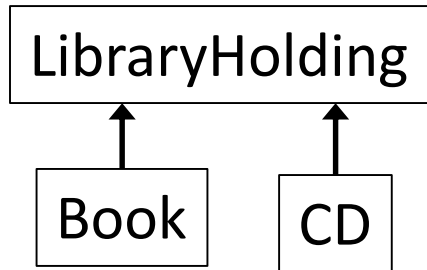- Implement the AI for a game
- BRAINS

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