Graphs
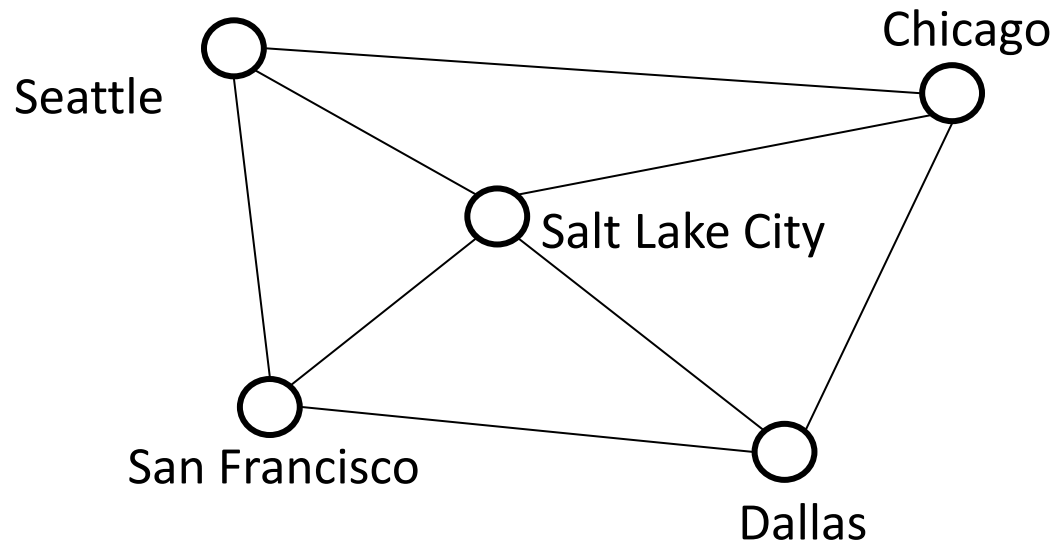
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UW CSE 160

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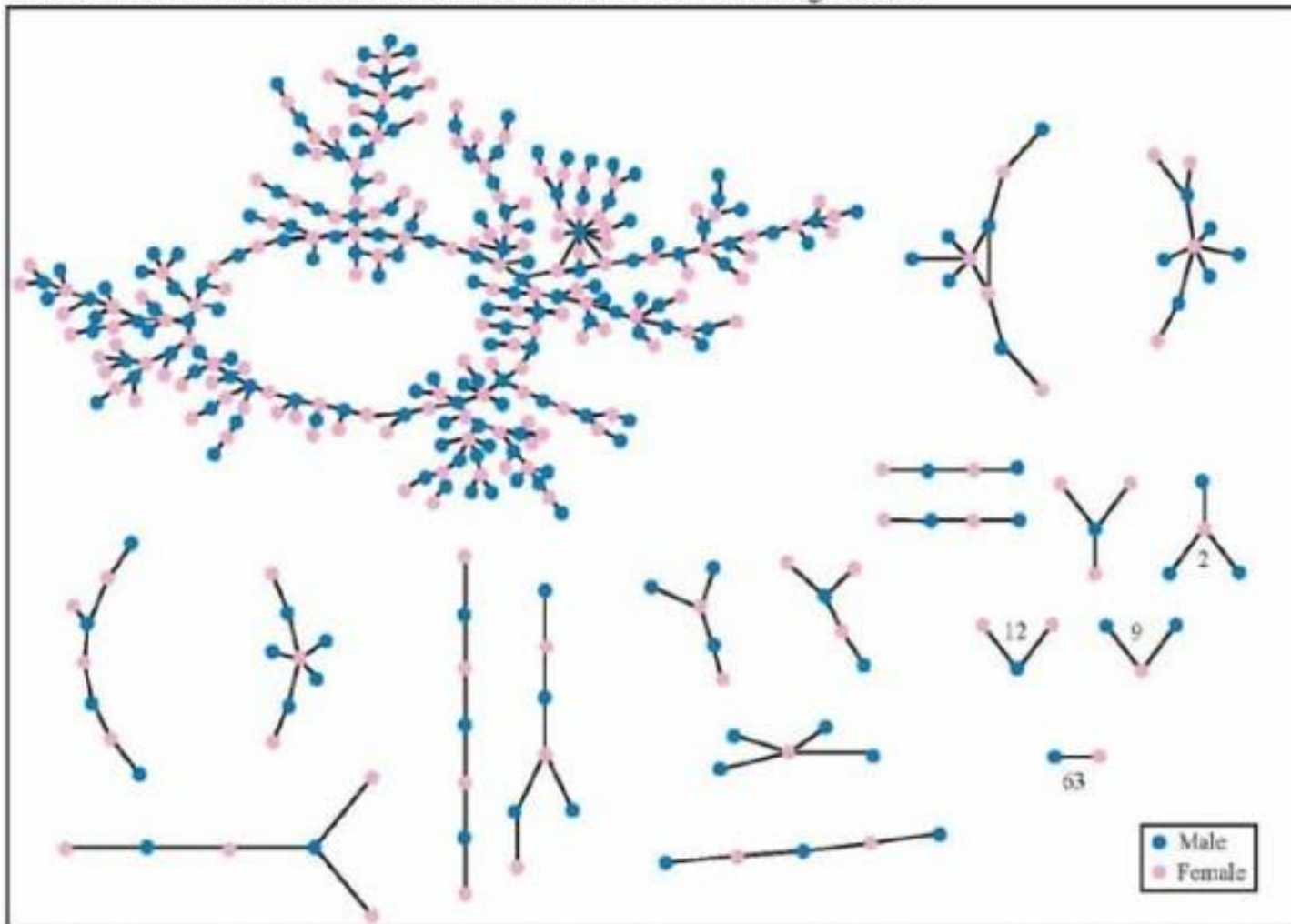
A graph contains nodes and edges

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);

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Graphs

- A graph can be thought of as either of:
  - a collection of edges
    - Each edge represents some relationship
  - for each node, a collection of neighbors
    - The neighbors are those connected by an edge

Operations on a graph

Creation:

- Create an empty graph

Querying:

- Look up a node: Does it exist? What are its neighbors?
- Look up an edge (= a pair of nodes): does it exist? (You know the nodes it connects.)
- Iterate through the nodes or edges

Modification:

- Add/remove a node
- Add/remove an edge

networkx Graph Library

- Used in Homework 4
- http://networkx.github.io/documentation/latest/tutorial/tutorial.html

```
import networkx as nx
g = nx.Graph()
g.add_node(1)
g.add_node(2)
g.add_edge(1, 2)
print g.nodes()
print g.edges()
```

Installing networkx Graph Library

- Used in Homework 4
- http://networkx.github.io/documentation/latest/tutorial/tutorial.html

- To install networkx:
  - In Canopy select Tools-> Package Manager
  - Click on "Available Packages" and type "networkx" in the search box in the upper left
  - Once found, the button next to networkx will say something like "free", click on that button.
  - It will ask if you want to install, say yes.
  - To check if you have it installed, type "import networkx" in the python interpreter in Canopy (nothing should happen, but if it is NOT installed you will get an error message).

```python
import networkx as nx
import matplotlib.pyplot as plt

g = nx.Graph()          # Creates a graph

g.add_node(1)           # Adds node 1
g.add_node(3)
g.add_node(2)
print g.nodes()

g.add_edge(1, 2)        # Adds edge from node 1 to node 2
g.add_edge(1, 3)
print g.edges()

assert len(g.nodes()) == 3
assert len(g.edges()) == 2

nx.draw_networkx(g)  # Draw the graph
plt.show()              # Show the graph in a separate window
```