Graphs

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UW CSE 160

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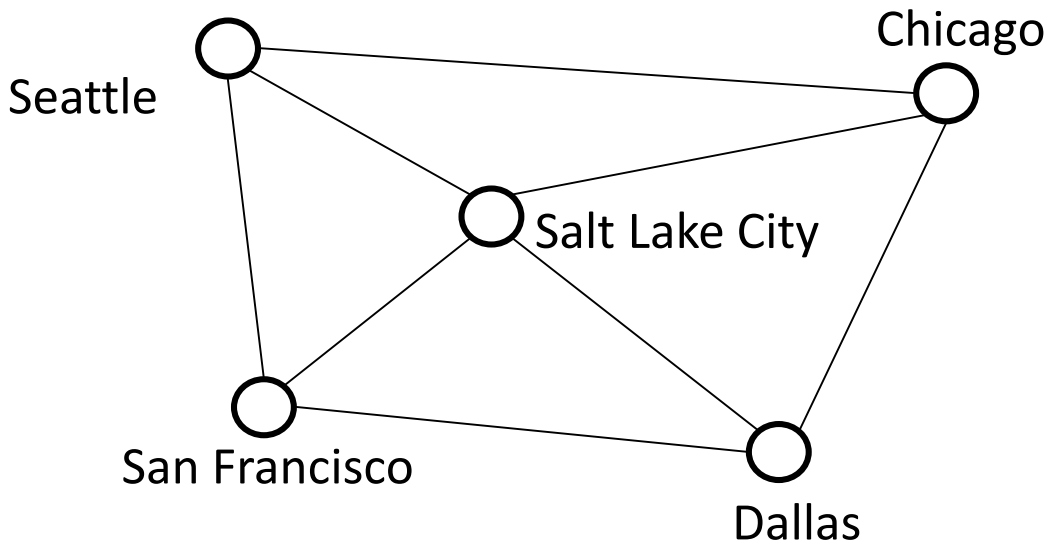
A graph contains nodes and edges

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Montesano
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Tenino
Eatonville
Centralia
Chehalis
South Bend
Pe Ell
Winlock
Morton
Mossyrock
Toledo
Long Beach
Castle Rock
Cathlamet
Longview
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Kalama
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East Wenatchee
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Entiat
Waterville
Chelan
Mansfield
Grand Coulee
Bridgeport
Brewster
Pateros
Twisp
Winthrop
Conconully
Omak
Okanogan
Oroville
Tonasket
Riverside
Nespelem
Coulee City
Almira
Creston
Davenport
Spokane
Airway Heights
Harrington
Cheney
Spangle
Odessa
Wilson Creek
Sprague
Ritzville
Warden
Lind
Othello
Hatton
Connell
Mesa
Kahlotus
Starbuck
Pomeroy
Dayton
Waitsburg
College Place
Walla Walla
Richland
Kennewick
Pasco
Sunnyside
Mabton
Wapato
Toppenish
Yakima
Selah
Tieton
Mattawa
Endicott
Colfax
La Crosse
Washtucna
Pullman
Colton
Clarkston
Asotin
Saint John
Oakesdale
Malden
Latah
Garfield
Harrington
Cheney
Spangle
Springdale
Deer Park
Newport
Chewelah
Cusick
Colville
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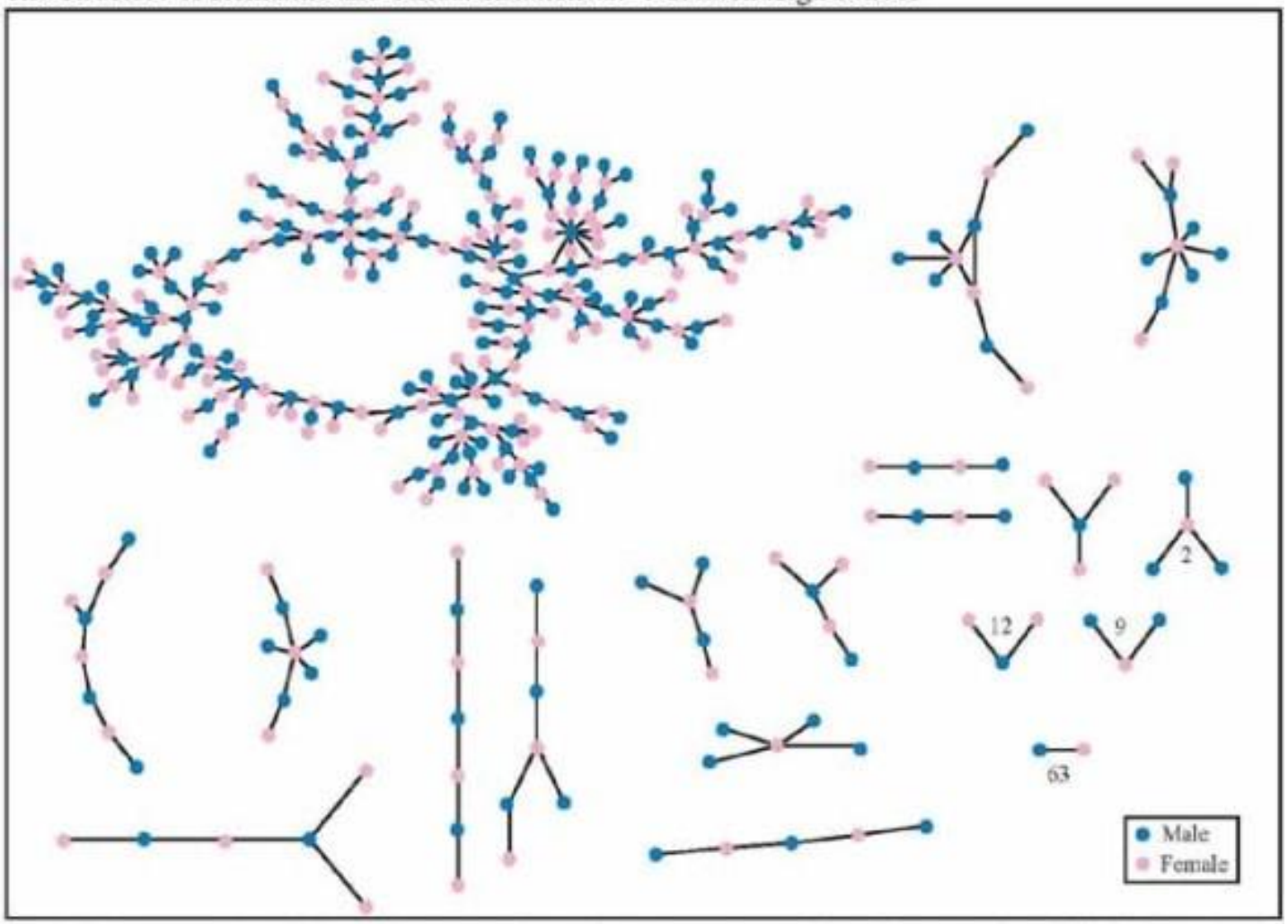
The Structure of Romantic and Sexual Relations at "Jefferson High School"



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);

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
- Included in the Anaconda Distribution
- https://networkx.github.io/documentation/stable/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())
```

Note: It is also o.k. to just add an edge before you add the individual nodes; the nodes will be added for you in that case.

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

g = nx.Graph()       # Creates a graph

g.add_edge(1, 2)     # Adds edge from node 1 to node 2
g.add_edge(1, 3)
g.add_node(4)        # Adds node 4
print("Edges:", g.edges())
print("Nodes:", g.nodes())
print("Neighbors of node 1:", list(g.neighbors(1)))

assert len(g.nodes()) == 4
assert len(g.edges()) == 2

nx.draw_networkx(g)  # Draw the graph
plt.show()           # Show the graph
```