# Graphs

Michael Ernst

CSE 140
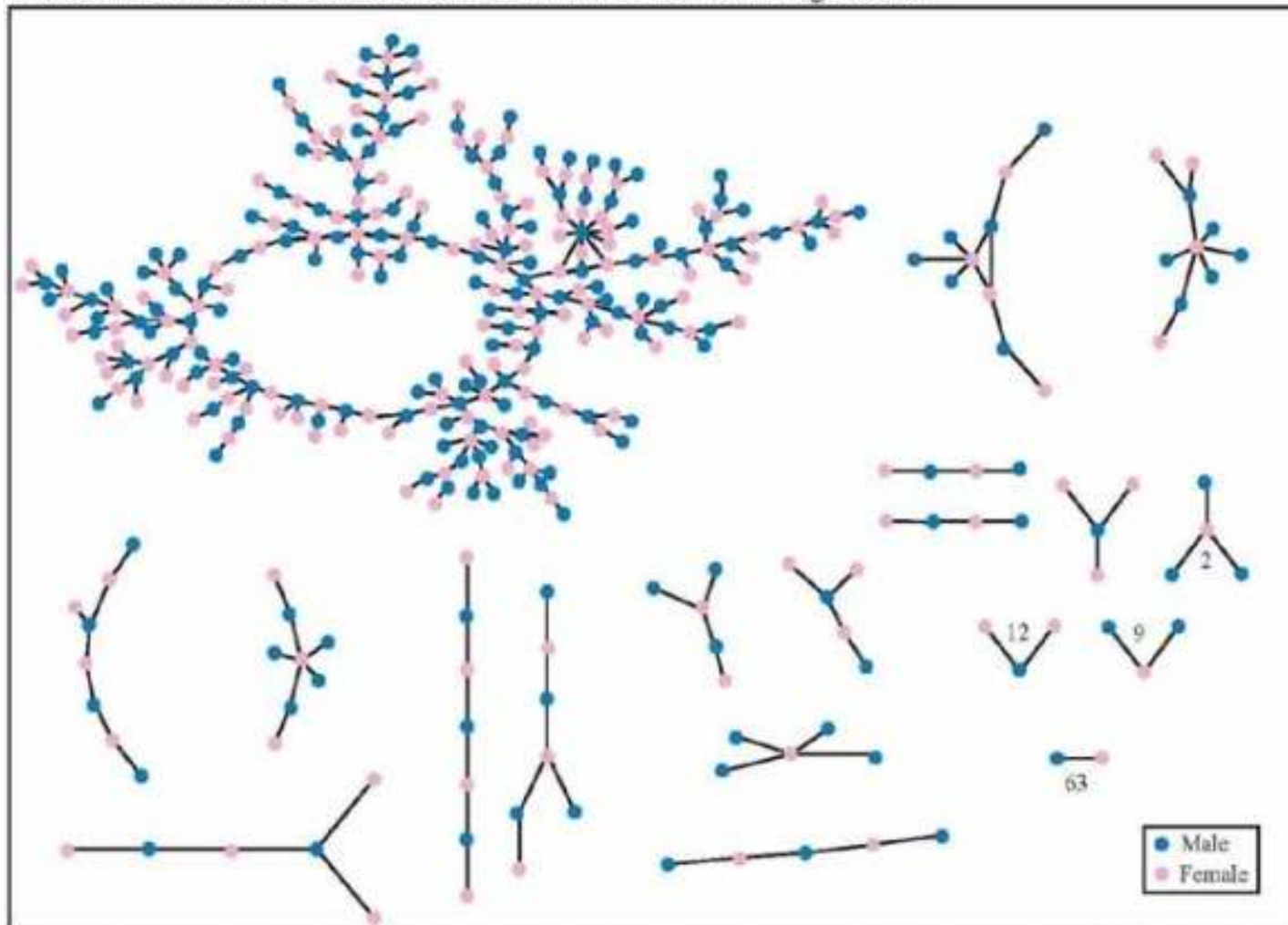
University of Washington

# A graph contains nodes and edges

- Example:  auto part compatibility

Washington State Map

- Lynden
- Ferndale
- Bellingham
- Friday Harbor
- Anacortes
- Mount Vernon
- Concrete
- Oroville
- Northport
- Metaline
- Ione
- Oak Harbor
- Coupeville
- Arlington
- Darrington
- Tonasket
- Conconully
- Riverside
- Republic
- Kettle Falls
- Colville
- Cusick
- Port Angeles
- Sequim
- Port Townsend
- Marysville
- Winthrop
- Twisp
- Omak
- Okanogan
- Chewelah
- Newport
- Forks
- Everett
- Mukilteo
- Edmonds
- Shoreline
- Index
- Pateros
- Brewster
- Bridgeport
- Nespelem
- Springdale
- Deer Park
- Grand Coulee
- Chelan
- Mansfield
- Mountlake Terrace
- Skykomish
- Enfiat
- Waterville
- Almira
- Creston
- Davenport
- Spokane
- Redmond
- Leavenworth
- Cashmere
- Coulee City
- Airway Heights
- Seattle
- Bellevue
- Issaquah
- Wenatchee
- East Wenatchee
- Wilson Creek
- Harrington
- Cheney
- Spangle
- Bremerton
- Burien
- Renton
- Ephrata
- Odessa
- Sprague
- Latah
- Des Moines
- Kent
- Quincy
- Moses Lake
- Ritzville
- Malden
- Oakesdale
- Federal Way
- Auburn
- Roslyn
- George
- Saint John
- University Place
- Tacoma
- Cle Elum
- Ellensburg
- Kittitas
- Warden
- Lind
- Endicott
- Colfax
- Garfield
- Lakewood
- Carbonado
- Royal City
- Othello
- Hatton
- La Crosse
- Washtucna
- Aberdeen
- Olympia
- Lacey
- Roy
- Pullman
- Westport
- Montesano
- Yelm
- Eatonville
- Tieton
- Mattawa
- Connell
- Mesa
- Kahlotus
- Starbuck
- Colton
- Oakville
- Tenino
- Selah
- Yakima
- Centralia
- Chehalis
- Morton
- Pomeroy
- Clarkston
- South Bend
- Pe Ell
- Mossyrock
- Wapato
- Toppenish
- Sunnyside
- Richland
- Waitsburg
- Dayton
- Asotin
- Winlock
- Toledo
- Mabton
- Kennewick
- Pasco
- Long Beach
- Castle Rock
- College Place
- Walla Walla
- Cathlamet
- Kelso
- Longview
- Kalama
- Woodland
- Yacolt
- Goldendale
- Battle Ground
- Stevenson
- Vancouver
- Camas
- Washougal

US Highways
Interstate Highways

0    50 KM    50 Miles

© geology.com

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