Network Terminology & Representation

What is a social network?

A set of "actors"
(i.e. people, orgs, …)

Alecia

Blanca

Cheng

Dorothy

Esther

Fernanda

Hassan

Ivan

And a set of "relations"
(i.e. friendship, payment, …)

Alecia — Blanca

Hassan — Ivan

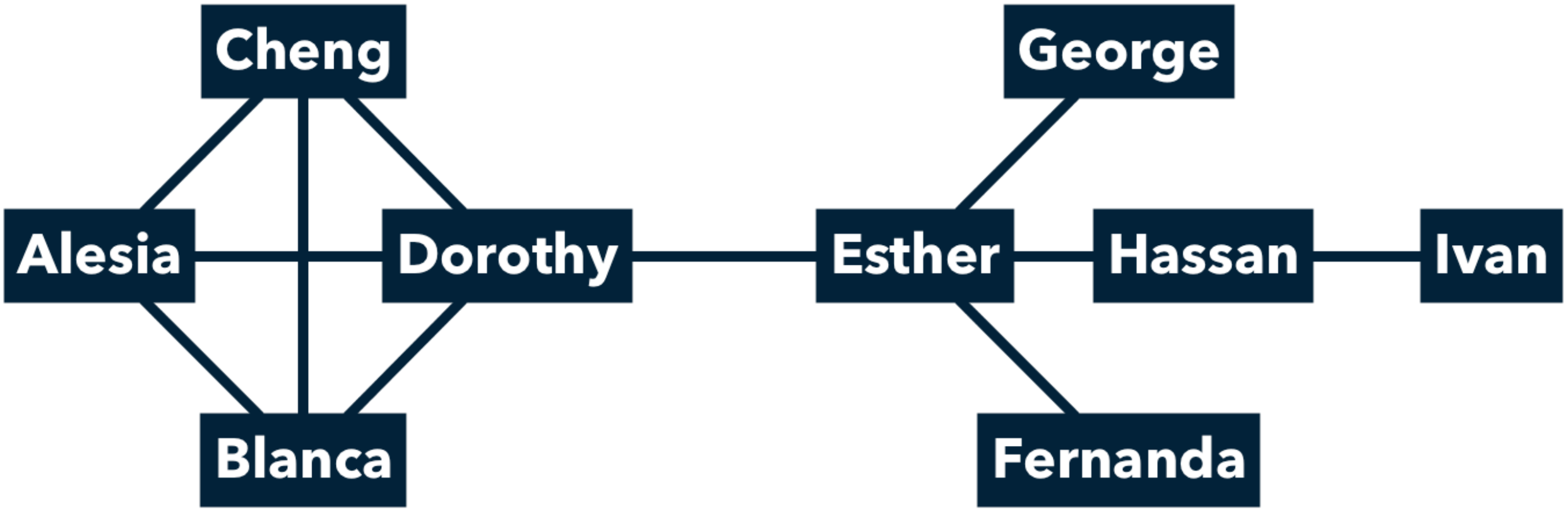
Esther — Fernanda

Alecia — Cheng

Dorothy — Cheng

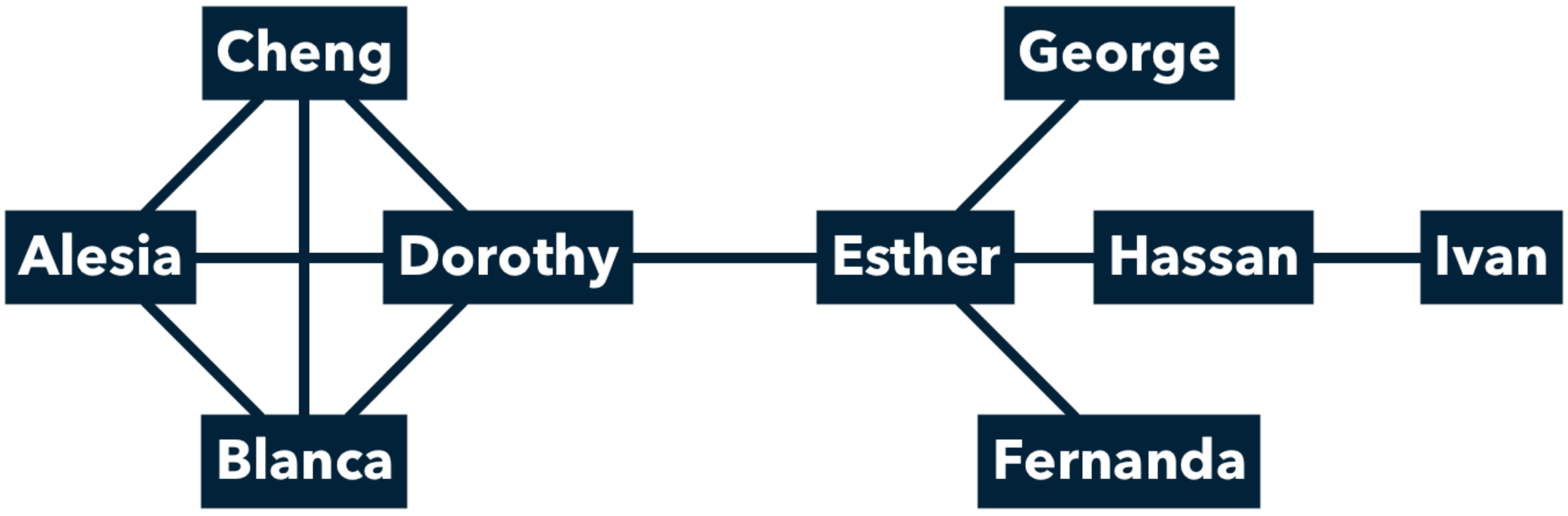
What is a social network?

Putting these together gives us a “network” picture



Network mini-glossary

- **Node / vertex / actor:** A single person, organization, etc.
- **Edge / tie / relation / arc:** A link between two nodes
- **Ego:** A focal node
- **Alter:** Anyone connected to ego
- **Path:** A chain of nodes connected by edges (usually: no repeats)
- **Cluster:** A subset of nodes that are “tightly tied” to each other



Network representations

Graph visualizations

Intuitive

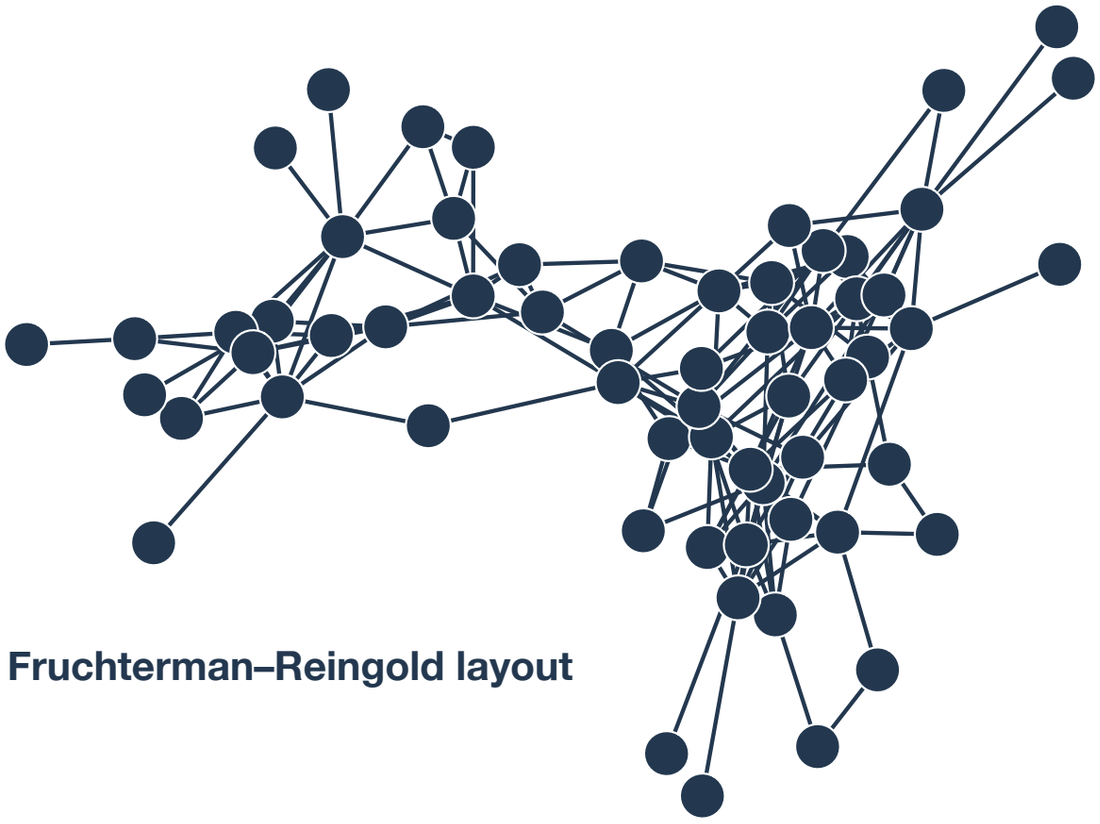
- Easy to understand!
- Circles connected by lines don't require much explanation

Descriptive

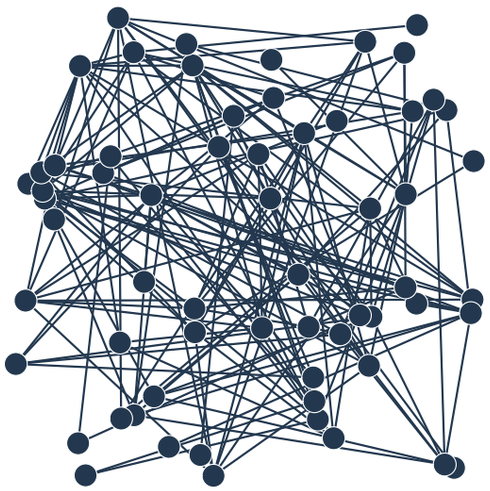
- Easily gives an idea of the size of a network, overall density of relations, etc.
- Can suggest important structure

Can be deceptive!

- Graph visualizations use a large number of heuristics to get a picture that "looks good."
- Different heuristics and different runs of the same heuristic can tell diverginig stories



Fruchterman–Reingold layout



Random layout

Multidimensional scaling

Lusseau, David, Karsten Schneider, Oliver J. Boisseau, Patti Haase, Elisabeth Slooten, and Steve M. Dawson. 2003. "The Bottlenose Dolphin Community of Doubtful Sound Features a Large Proportion of Long-Lasting Associations."

Network representations

Adjacency matrices

Mathematically convenient

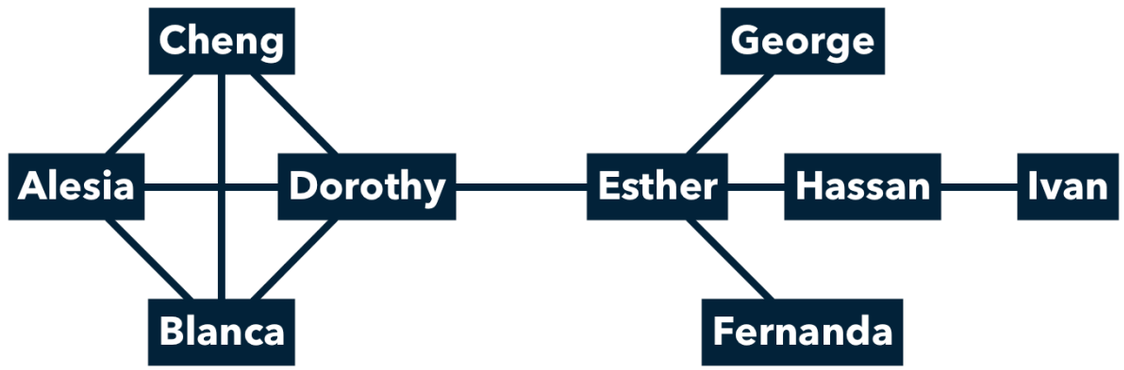
- Tool borrowed from formal graph theory
- Allows for analysis (and theorization!) using the branch of mathematics called linear algebra

Computationally convenient

- Computers are very good at working with adjacency matrices (unless they get very big)
- Easy to perform simple measurements and manipulations

Looks intimidating

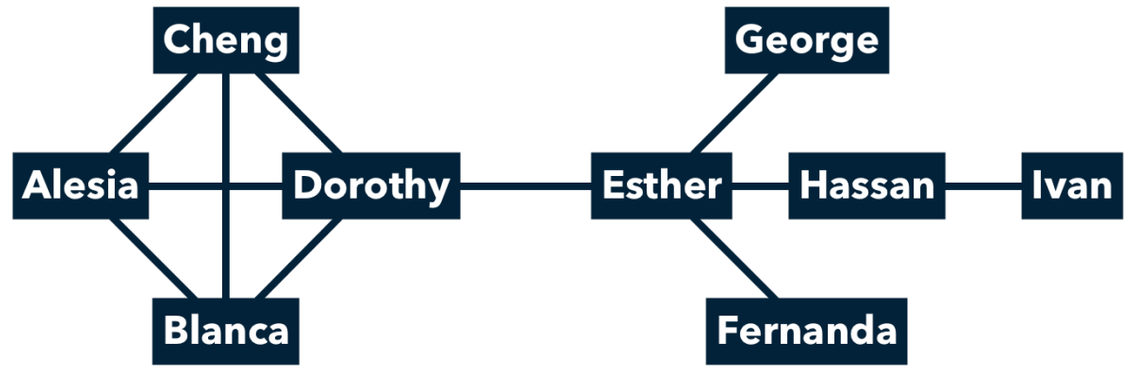
- Can look overwhelming for those without a background in math or computer science



0	1	1	1	0	0	0	0	0
1	0	1	1	0	0	0	0	0
1	1	0	1	0	0	0	0	0
1	1	1	0	1	0	0	0	0
0	0	0	1	0	1	1	1	0
0	0	0	0	1	0	0	0	0
0	0	0	0	1	0	0	0	0
0	0	0	0	1	0	0	0	1
0	0	0	0	0	0	0	1	0

Network representations

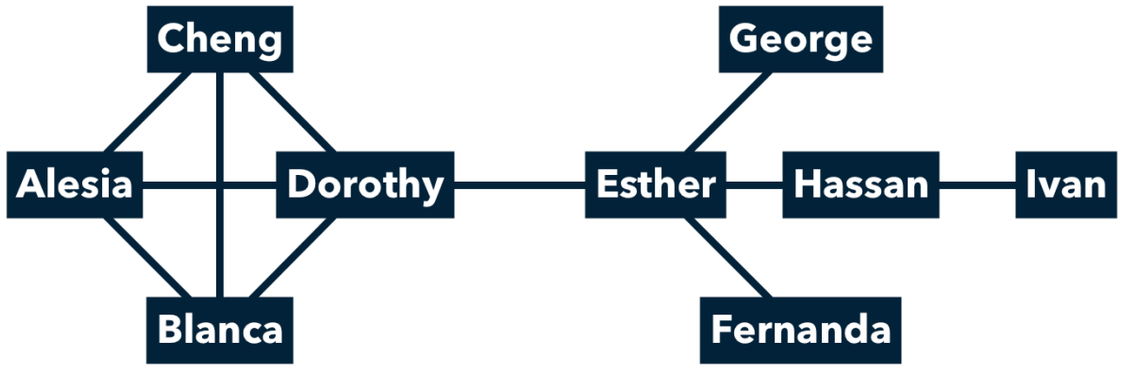
Reading adjacency matrices



	A	B	C	D	E	F	G	H	I
Alesia	0	1	1	1	0	0	0	0	0
Blanca	1	0	1	1	0	0	0	0	0
Cheng	1	1	0	1	0	0	0	0	0
Dorothy	1	1	1	0	1	0	0	0	0
Esther	0	0	0	1	0	1	1	1	0
Fernanda	0	0	0	0	1	0	0	0	0
George	0	0	0	0	1	0	0	0	0
Hassan	0	0	0	0	1	0	0	0	1
Ivan	0	0	0	0	0	0	0	1	0

Network representations

Reading adjacency matrices

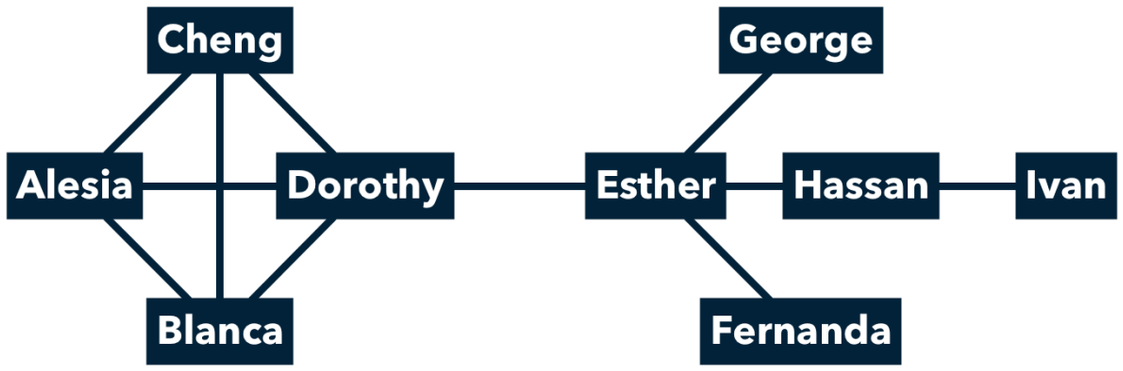


	A	B	C	D	E	F	G	H	I
Alesia	0	1	1	1	0	0	0	0	0
Blanca	1	0	1	1	0	0	0	0	0
Cheng	1	1	0	1	0	0	0	0	0
Dorothy	1	1	1	0	1	0	0	0	0
Esther	0	0	0	1	0	1	1	1	0
Fernanda	0	0	0	0	1	0	0	0	0
George	0	0	0	0	1	0	0	0	0
Hassan	0	0	0	0	1	0	0	0	1
Ivan	0	0	0	0	0	0	0	1	0

Esther is friends with Dorothy, Fernanda, George, and Hassan

Network representations

Reading adjacency matrices

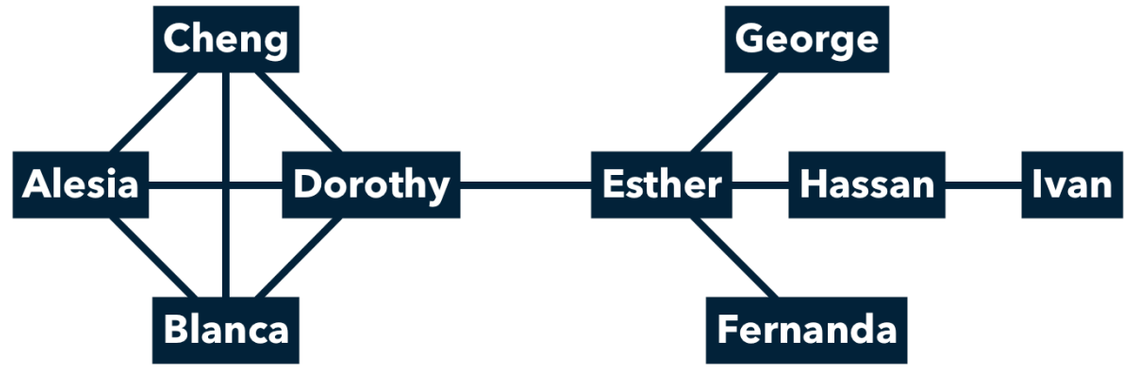


	A	B	C	D	E	F	G	H	I
Alesia	0	1	1	1	0	0	0	0	0
Blanca	1	0	1	1	0	0	0	0	0
Cheng	1	1	0	1	0	0	0	0	0
Dorothy	1	1	1	0	1	0	0	0	0
Esther	0	0	0	1	0	1	1	1	0
Fernanda	0	0	0	0	1	0	0	0	0
George	0	0	0	0	1	0	0	0	0
Hassan	0	0	0	0	1	0	0	0	1
Ivan	0	0	0	0	0	0	0	1	0

The *diagonal* of the matrix shows self-relationships (often all zeros)

Network representations

Reading adjacency matrices



	A	B	C	D	E	F	G	H	I	
Alesia	0	1	1	1	0	0	0	0	0	**3**
Blanca	1	0	1	1	0	0	0	0	0	**3**
Cheng	1	1	0	1	0	0	0	0	0	**3**
Dorothy	1	1	1	0	1	0	0	0	0	**4**
Esther	0	0	0	1	0	1	1	1	0	**4**
Fernanda	0	0	0	0	1	0	0	0	0	**1**
George	0	0	0	0	1	0	0	0	0	**1**
Hassan	0	0	0	0	1	0	0	0	1	**2**
Ivan	0	0	0	0	0	0	0	1	0	**1**

Easy to see how many friends each person has with *row or column sums*

Network representations

Adjacency matrices are closely related to affiliation matrices like the one from this week's worksheet

Names of Participants of Group I	Code Numbers and Dates of Social Events Reported in *Old City Herald*													
	(1) 6/27	(2) 3/2	(3) 4/12	(4) 9/26	(5) 2/25	(6) 5/19	(7) 3/15	(8) 9/16	(9) 4/8	(10) 6/10	(11) 2/23	(12) 4/7	(13) 11/21	(14) 8/3
1. Mrs. Evelyn Jefferson	X	X	X	X	X	X	....	X	X	....	....	....	....	....
2. Miss Laura Mandeville	X	X	X	....	X	X	X	X	....	....	....	....	....	....
3. Miss Theresa Anderson	....	X	X	X	X	X	X	X	X	....	....	....	....	....
4. Miss Brenda Rogers	X	....	X	X	X	X	X	X	....	....	....	....	....	....
5. Miss Charlotte McDowd	....	....	X	X	X	....	X	....	....	....	....	....	....	....
6. Miss Frances Anderson	....	....	X	....	X	X	....	X	....	....	....	....	....	....
7. Miss Eleanor Nye	....	....	....	....	X	X	X	X	....	....	....	....	....	....
8. Miss Pearl Oglethorpe	....	....	....	....	....	X	....	X	X	....	....	....	....	....
9. Miss Ruth DeSand	....	....	....	....	X	....	X	X	X	....	....	....	....	....
10. Miss Verne Sanderson	....	....	....	....	....	....	X	X	X	....	....	X	....	....
11. Miss Myra Liddell	....	....	....	....	....	....	....	X	X	X	....	X	....	....
12. Miss Katherine Rogers	....	....	....	....	....	....	....	X	X	X	....	X	X	X
13. Mrs. Sylvia Avondale	....	....	....	....	....	....	X	X	X	X	....	X	X	X
14. Mrs. Nora Fayette	....	....	....	....	....	X	X	....	X	X	X	X	X	X
15. Mrs. Helen Lloyd	....	....	....	....	....	....	X	X	....	X	X	X	....	....
16. Mrs. Dorothy Murchison	....	....	....	....	....	....	....	X	X	....	....	....	....	....
17. Mrs. Olivia Carleton	....	....	....	....	....	....	....	....	X	....	X	....	....	....
18. Mrs. Flora Price	....	....	....	....	....	....	....	....	X	....	X	....	....	....

FIG. 3.—Frequency of interparticipation of a group of women in Old City, 1936—Group I.

Network Theory

What is a network tie?

What counts as a tie?

- At its broadest, a tie is any kind of relation between actors

- Many network scholars focus on *social* ties (*relationships* rather than just *relations*)

Tie characteristics

- ***Events*** vs ***states***

- ***Directed*** vs ***undirected***
(asymmetric vs antisemetric vs semetric)

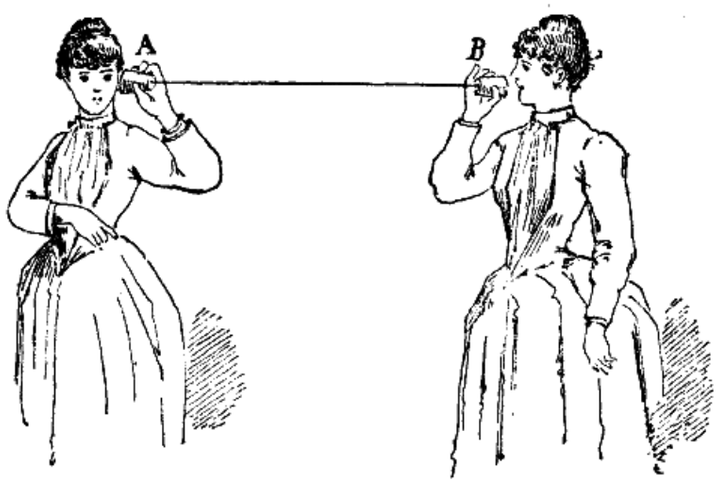
- ***Valued*** vs ***binary***
(weights and other attributes)

Network representations

Borgatti and Halgin (2011) on *network theory*

Two conistent traits of network theories

- Focus on ***structure*** and ***position*** as causal elements
- Implicit theories of what a network ***does***



Networks allow *flow*

- One view of what networks 'do' is act as pipes that transmit information, money, contagions, norms, etc.
- Rarely stated, but implicit in the large majority of network analysis
- E.g. Strength of weak ties (Granovetter) and structural holes (Burt)

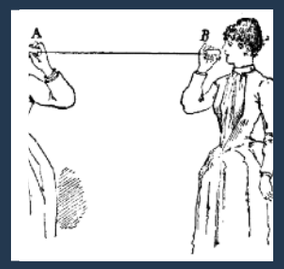
Networks reflect *bonds*

- A long-running (but somewhat less common) theorization holds that network ties define us (our interests, capabilities, identities)
- E.g. managers are defined by relationships of authority over others
- E.g. being followed by a celebrity on social media can grant status
- Networks are *prisms* (Podolny) that affect how we are seen and how we see ourselves

Discussion

Image credit

Screenshot from I Love Lucy (1951), via anthonybalduccisjournal.wordpress.com



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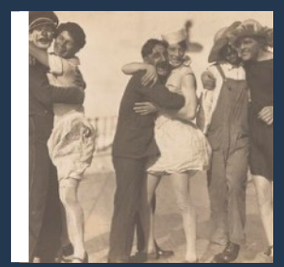

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