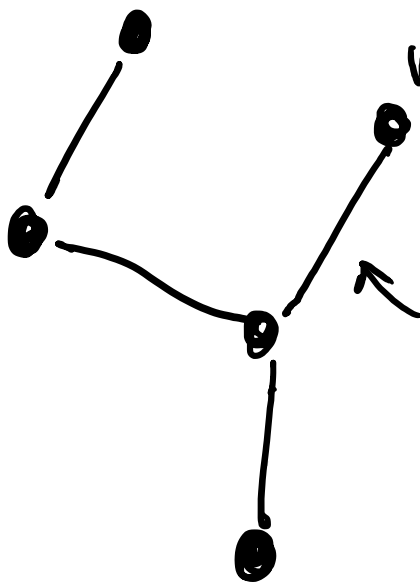
SYSM 6302

CLASS 1

Welcome!

Graph / Network



Nodes / Vertices ← entities, agents

Edges / Links ← interactions, communication

Network "Assumption": structure (topology) of the network provides information about the systems they represent

Examples of Networks

Roads

Internet

Power grid

Brain

Ecological Food web

Facebook

protein transcription

Internet

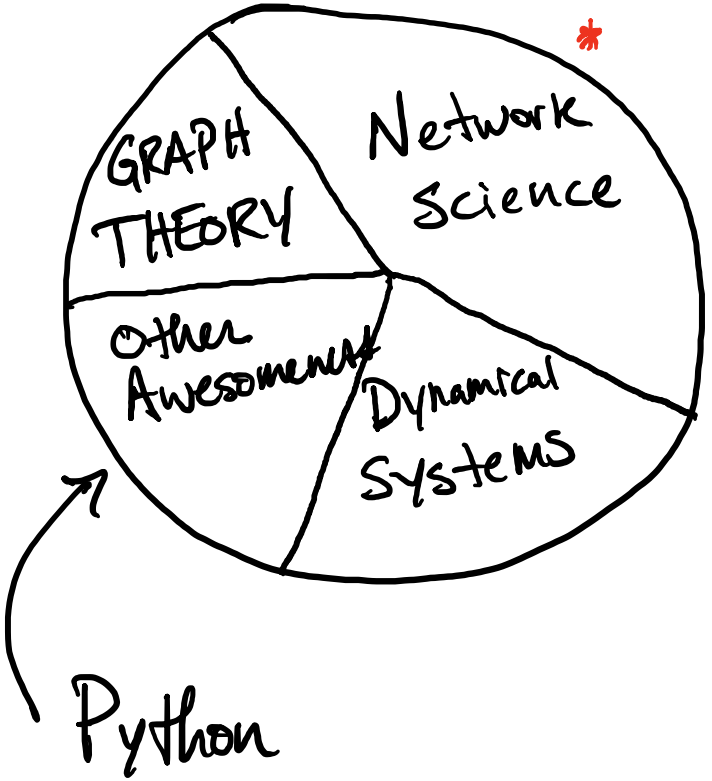
Why are networks so important (now)?

① Access to data ≠ data collection methods

② Access to sufficient computational power to do something interesting

③ Library of terms, tools, and algorithms for network analysis

THIS COURSE



*ALL PIE CHARTS IN THIS CLASS WILL BE USED SARCASTICALLY

We will use:

→ Linear Algebra

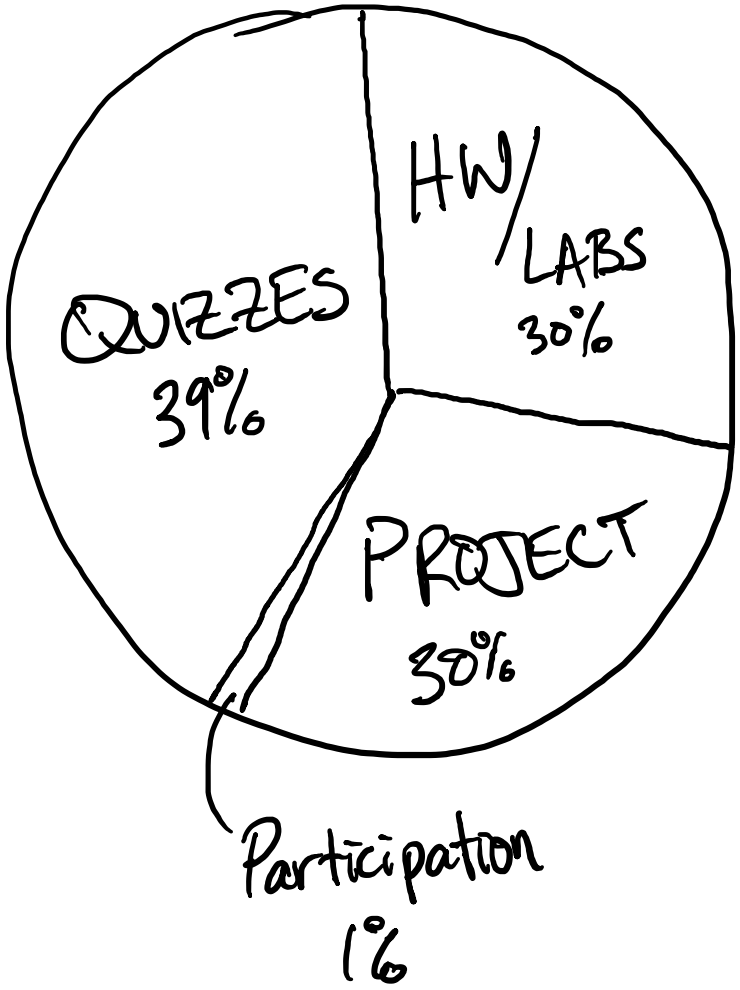
→ Probability

→ Differential Equations

→ Our Minds!

GOAL: To learn a practical, highly functional understanding of Networks and surrounding topics so as to broadly interpret network properties & dynamics.

This Course

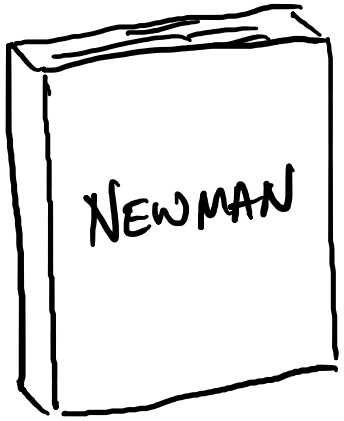


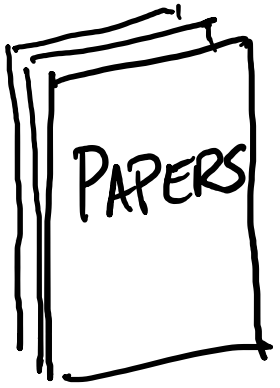
PRETTY MUCH Required reading

⇓

Let's us do some "hands-on" things in class.

Talk about the more confusing/detailed topics in class



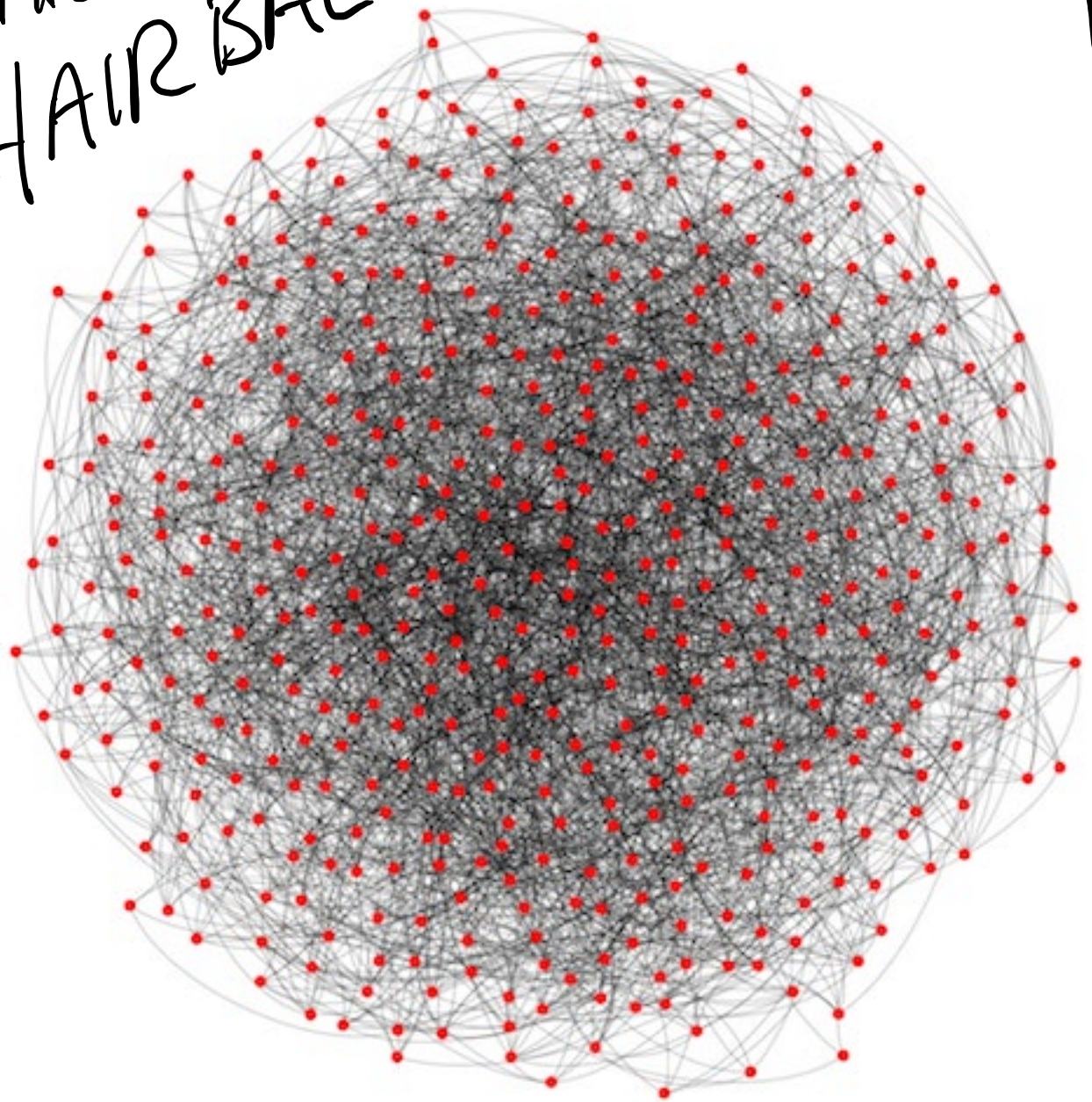


System structure is not always static (Facebook, Weibo)

Agents may have important dynamics that describe their state over time (but topology is still important) (schooling fish)

↖ state is defined as everything that is needed to specify/describe an entity/agent/part within a system

THE HAIRBALL!!



Visualizations must be useful!

They should:

→ Reflect any underlying structure

→ Be clearly labelled & described

↳ what is the layout?

↳ why are these nodes in the center in the center?

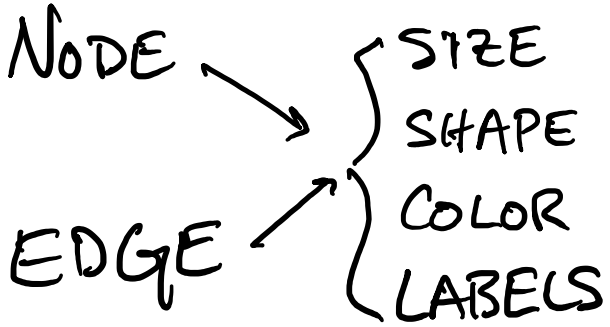
→ use colors to highlight groups or differences

→ minimize edge crossings

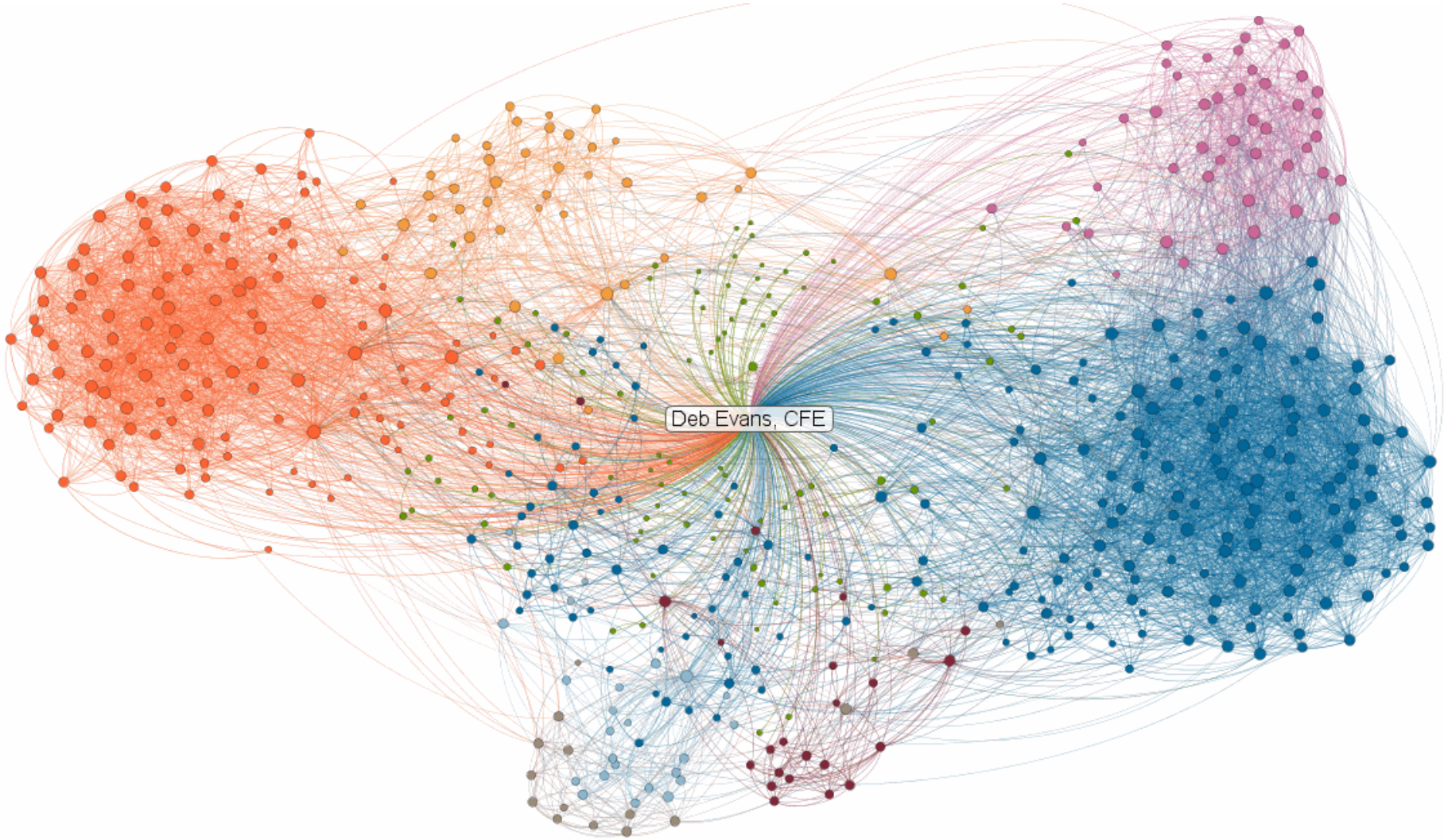
→ Be interactive!

Variables to consider:

LAYOUT



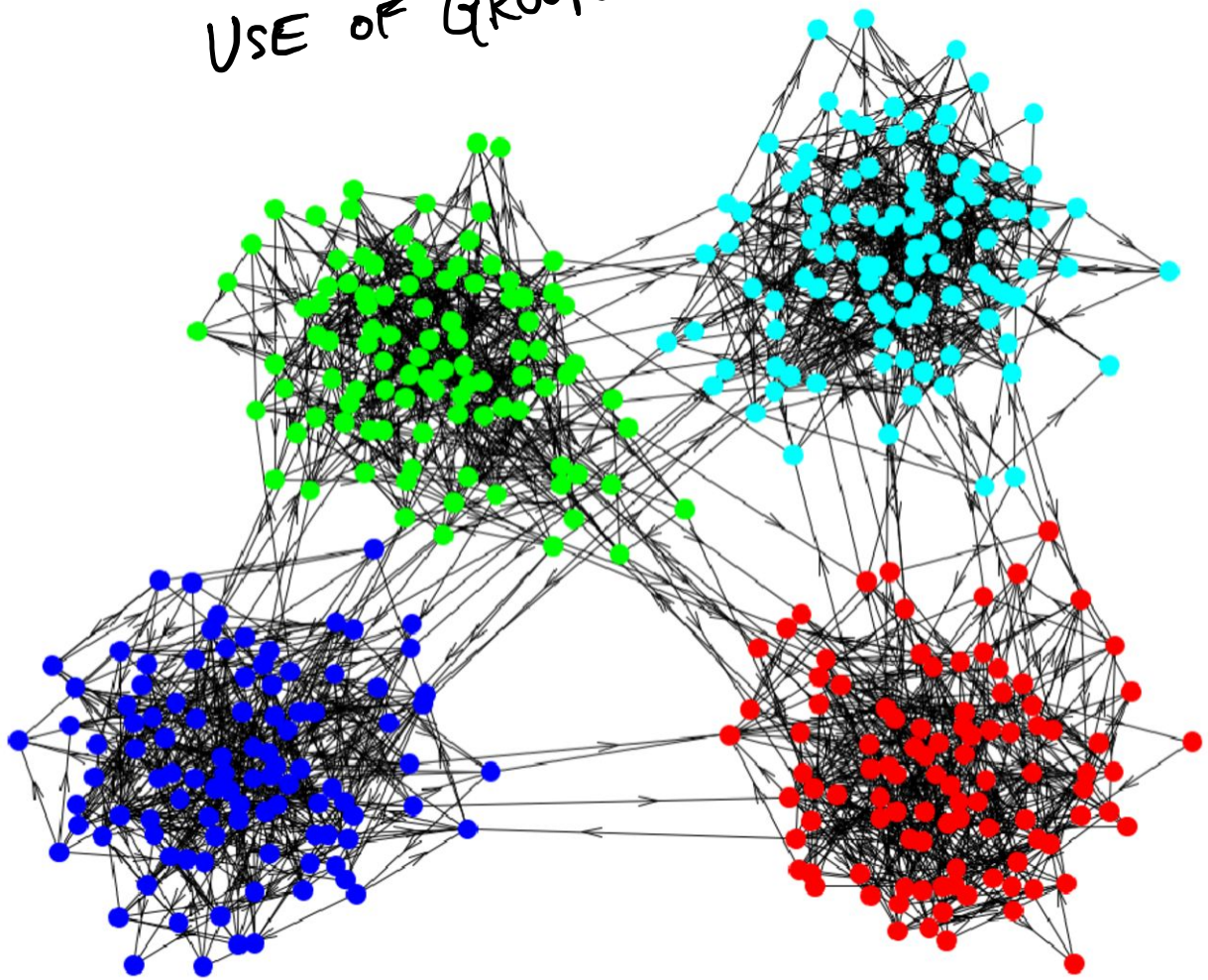
DRAWING NETWORKS IS FOR ILLUSTRATING A NARRATIVE

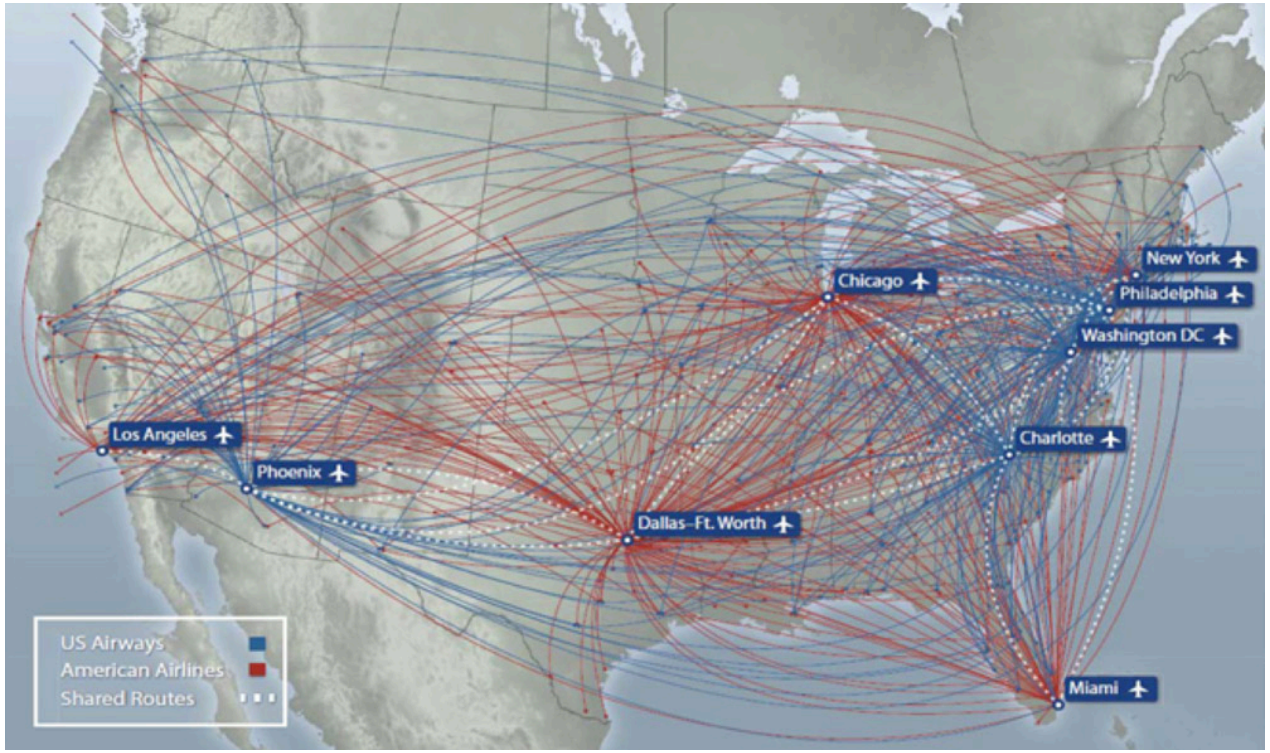


Ego-centric

"Deb must be super important because she has a lot of LinkedIn connections."

USE OF GROUPS





USE OF STRUCTURE!

(Blue & Red networks are subgraphs)

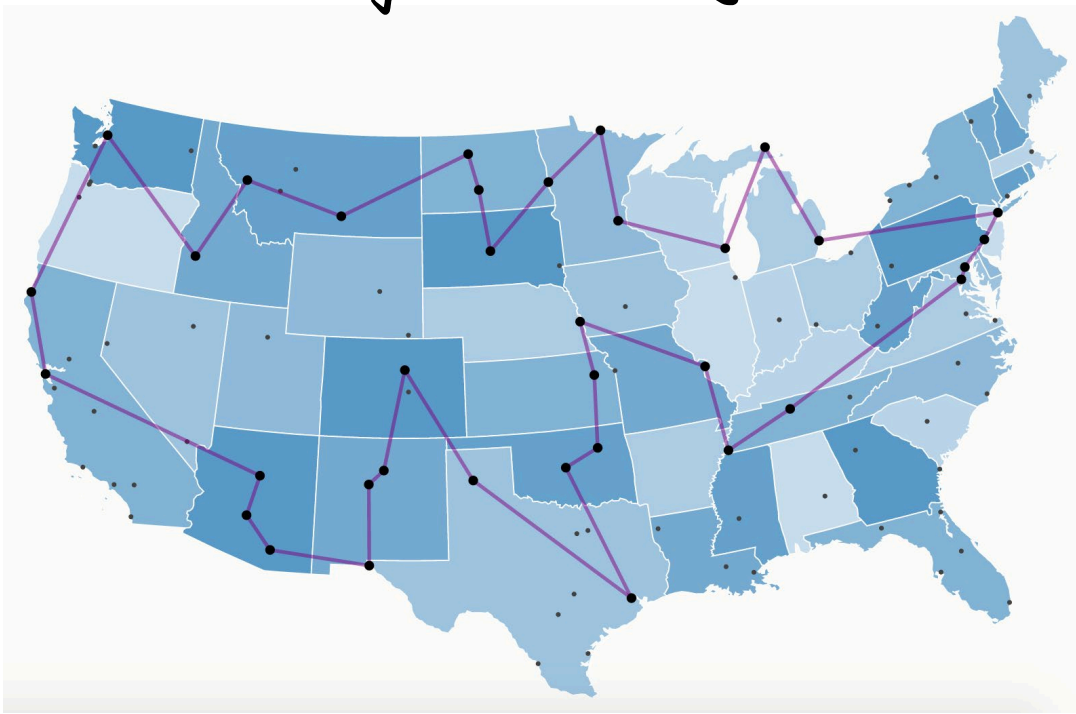
Visit every edge only once

Eulerian Circuit

Solvable in O(|E|)

(nodes may be repeated)

Visit every node only once



Hamiltonian Cycle

NP-Hard!