SOCI41803 Social Network Analysis – Density

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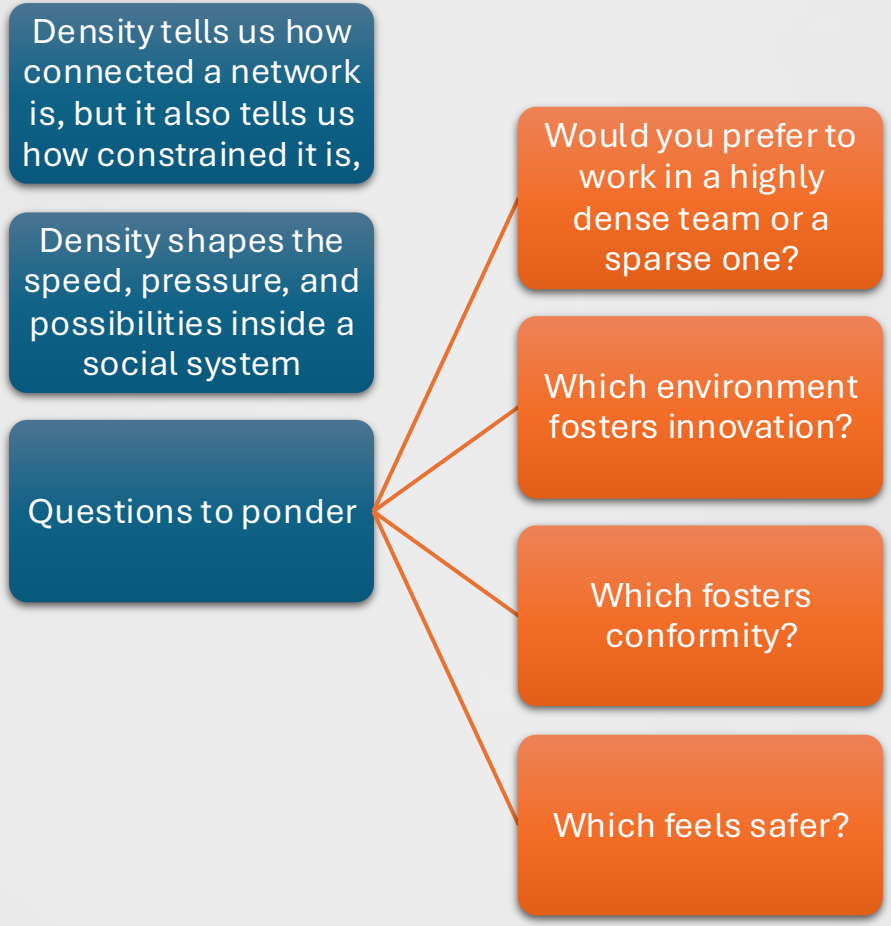
Why we study density: importance of density



Dense versus Sparse network information flows

In dense networks

- Information spreads quickly.
- Rumors travel fast.
- Norms are reinforced.
- Monitoring is easier.

In Sparse Network

- Information travels more slowly.
- Actors can broker between disconnected groups.
- Innovation may spread differently.

Density is a “Macro Snapshot”

Density is a whole-network measure.

- It summarizes the entire structure in one number.

That’s both:

- Its strength (clarity, comparability)
- And its limitation (it hides structure)

Density and Collective Outcomes

Density influences:

- Cooperation
- Trust
- Innovation
- Polarization
- Resilience to node removal

For example:

- Highly dense networks are robust to random failure.
- But they may be vulnerable to rapid contagion (disease, misinformation).

Density and Social Control

Dense networks create:

- Stronger normative pressure.
- Greater accountability.
- Less anonymity.
- More reputation effects.

Classic sociological idea: High-density communities often have stronger informal social control.

- Small communities vs. large cities
- Work teams vs. loose organizations

Density Reveals Structural Constraint

In dense networks:

- Actors have fewer unique structural advantages.
- Everyone knows everyone → fewer brokerage opportunities.

In sparse networks:

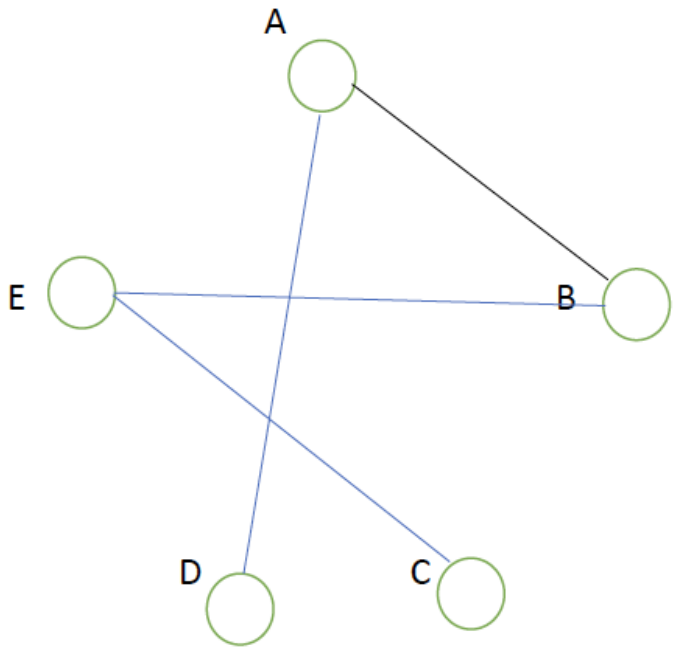
- Brokers emerge.
- Structural holes become important.
- Inequality in information access increases.

Computing density

- Assuming the graph/network being undirected and binary graph,

$$Density = \frac{\sum\sum X_{i,j}}{C_N^2}$$

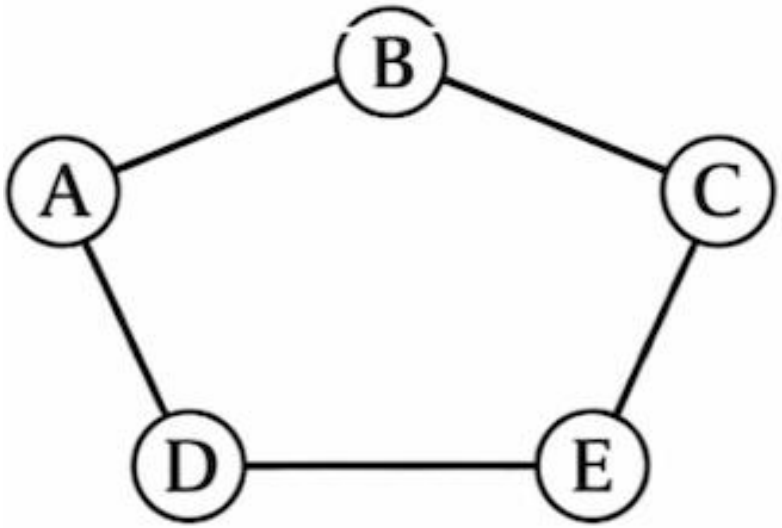
An example



This graph has density = 4/10 = 40%,

0 <= Density <= 1 or 100%, with closer to 0 means low connectivity, and closer to 1 or 100% means great connectivity.

Exercise: computing the density for the following graphs



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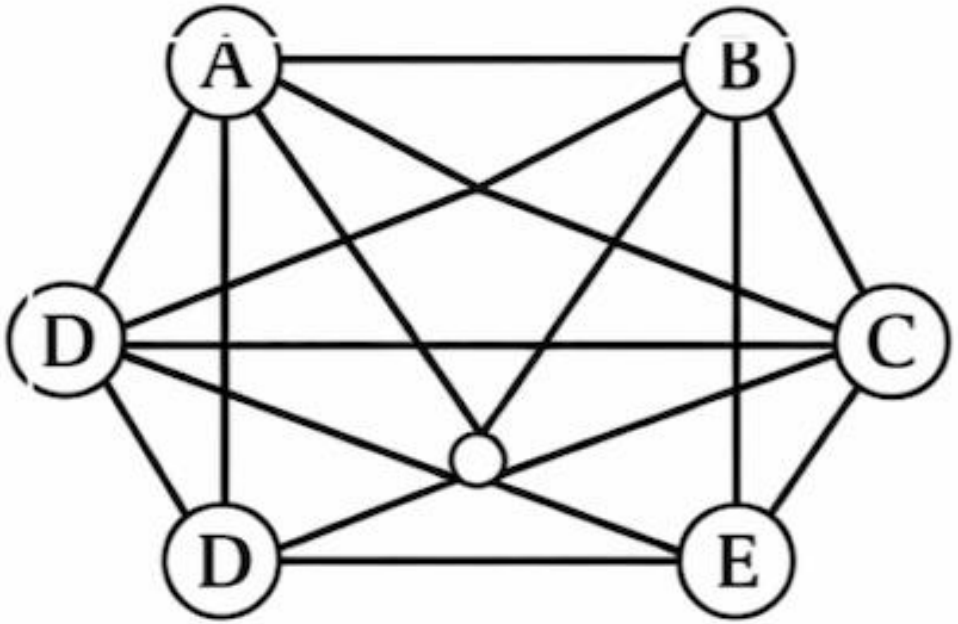

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