- The first homework is posted. (due late next week.)
  - Specifically focused on network mapping
- PDF uploaded to peergrade – there is also a rubric online we should follow.

Rmk: From a stastical perspective there are canonical tasks we would like to do.

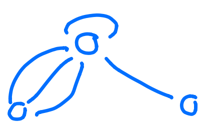
- Visualization
- Descriptive statistics
- Modeling
- Inference

Review of Graphs

Def: A graph $\underbrace{G = (V, E)}$ — V: vertices, E: edges. Elements of E are (un)ordered pairs of vertices

Def: $N_v = |V|$ order, $N_e = |E|$ size

Rmk: Graphs may have loops and multiedges



← multigraph

Typically we assume the graph is simple; no loops/multiedges.

Def: A subgraph $H = (V_H, E_H)$ is another graph s.t. $V_H \subseteq V$, $E_H \subseteq E$

An induced subgraph is a subgraph containing the maximal edge set of a specified vertex subset.

Def: Directed graph: edges are ordered pairs.
Weighted graphs: number associated with each edge

- Decorating Graphs: – vertex/edge attributes

Connectivity
- two vertices are adjacent if $(u,v) \in E$
- Vertex is incident to an edge if $v \in e \in E$.

- Degree is given by $deg(v) = \sum_{u \in V} \mathbb{1}((u,v) \in E)$

- The degree sequence is the sorted list $d_{(1)} \le d_{(2)} \le \cdots \le d_{(N_V)}$

Prop: $\sum_{i=1}^{N_V} d_{(i)} = 2 N_E$ similar notions for in/out degree

Def: - Walk alternating sequence of vertex - edge - vertex from $v_0 \to v_1$

- trail is a walk with no repeated edges

- path is a trail with no repeated vertices.

- Circuit is a walk with $v_0 = v_1$

- Cycle no repeated vertices

Def: · A vertex is reachable if there exists a walk from $u \to v$

- A graph is connected if every node is reachable

- We call each connected subgraph a component.

Def: In digraphs

- Weakly connected if connected ignoring direction

- Strongly connected if we don't ignore direction.