

Graphs

- a way of representing relationships which exist btwn. pairs of objects
- a graph is a set of objects (vertices) together w/ a collection of pairwise connections btwn. them (edges)

→ Viewed abstractly:

- a graph G is a set V of vertices and collection E of pairs of vertices from V , called edges
- thus, a graph is a way of representing connections btwn. pairs of objects from some set V

→ edges in a graph are either directed or undirected

- an edge (u, v) is directed from u to v if the pair (u, v) is ordered -- u precedes v
- an edge (u, v) is undirected if the pair (u, v) is not ordered

degrees/edges

- two vertices joined by an edge are called the end vertices of the edge
 - if directed, an edge's first point is its origin and the other is the destination
- two vertices u and v are said to be adjacent if there is an edge whose end vertices are u and v
- an edge is said to be incident to a vertex if the vertex is one of the endpoints
- the outgoing edges of a vertex are the directed edges whose origin is that vertex
- the incoming edges of a vertex are the directed edges whose destination is that vertex
- the degree of a vertex is the number of incident edges of v
- the in-degree and out-degree of a vertex is the number of incoming/outgoing edges respectively

paths/cycles

- a path is a sequence of alternating vertices and edges that starts at a vertex and ends at a vertex such that each edge is incident to its predecessor and successor vertex
- a cycle is a path that starts and ends at the same vertex, and that includes at least one edge
- we say a path is simple if each vertex in the path is distinct, except the first and last
- a directed path is a path such that all edges are directed and are traversed along their direction
- a directed cycle is ~~an~~ similarly defined
- a directed graph is acyclic if it has no directed cycles