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## Module 2 Quiz Review

## Graph basics

### Graph definition

- A set of vertices $V$
- A set of edges $E$
  - Each edge takes the form $(a, b)$ if $G$ is directed
  - ...or $\{a, b\}$ if $G$ is nondirected

### Graph representation

- Adjacency list:
  - Maintain a list of vertices; each vertex's list maintains a list of out-neighbors
- Adjacency matrix:
  - Maintain 2-d V x V array of vertices
  - Each entry in the vertex corresponds to a weight (if weighted) or just a binary "edge", "no edge" between vertices a and b. I.e., $M[a][b] \neq 0 \iff (a, b) \in E$

### Graph terms

- Vertex (pl. vertices) or node
- Edge
  - An vertex is "incident" to an edge if it is one of the vertices connected by that edge
- Dense graph
  - One with many edges
  - A *maximally dense* undirected graph has $\frac{1}{2}v(v-1)$ edges.
  - Maximally dense directed graph: $v(v-1)$ edges.
- Path
  - Sequence of vertices each reachable from the last
  - *Simple path*: a path that has no repeat vertices
- Connectedness
  - Undirected setting: every node is reachable from every other node
  - Directed setting:

    - Weakly connected: every pair of vertices is connected by some edges, even if we have to traverse in the wrong direction
    - Strongly connected: $\forall (u, v) \in V^2$ s.t. $u \neq v : v$ reachable from $u$

## BFS

- One algorithm for graph **traversal:** algorithm that