Graph ADT

- Initialize($n$): Initialize a graph with $n$ vertices
- AddEdge($v, w$): Adds an edge between $v$ and $w$
- RemoveEdge($v, w$): If exists, removes the edge between $v$ and $w$
- IsAdjacent?($v, w$): Returns true if $v$ and $w$ are adjacent
- GetNeighbors($v$): Returns the set of all adjacent vertices of $v$
Graph Algorithms

- Breadth-first search (BFS)
- Depth-first search (DFS)
- Detect cycles
Breadth-first Search (BFS)

- An algorithm to visit all the vertices reachable for one starting vertex
- Visit the starting vertex \((v)\)
- Visit the neighbors of \((v)\)
- Visit the second-degree neighbors of \((v)\)
- …
- Until no more vertices to visit
Breadth-first Search (BFS)
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Breadth-first Search (BFS)

- In some cases, we would like to keep track of the path length from the starting vertex to each visited vertex.
- The visited vertices and edges can be used to create a BFS-tree representation of the graph.
Depth-first Search (DFS)

- An algorithm to visit all the vertices reachable for one starting vertex
- Visit the starting vertex (v)
- Visit one neighbor of v
- Visit as much as possible from that neighbor until moving to another neighbor
- ...
- Until all vertices reachable from v are visited
Depth-first Search (DFS)
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Graph Traversals

GraphTraversal(G, v) {
    L ← An empty data structure
    L << v
    while (L is not empty) {
        x ← Remove next item from L
        Visit(x)
        for (each neighbor n of x) {
            L << n
        }
    }
}

How to make this generic code work as a BFS or DFS?