Graphs

\[ G = (V, E) \]

\[ V = \{ v_1, v_2, \ldots, v_n \} \]

\[ E = \{ (v_i, v_j), \ldots \} \]

undirected
unweighted

\[ V = \{ a, b, c, d, e \} \]

\[ E = \{ (a, b), (a, c), (b, c), (d, e), (b, e), (c, d) \} \]
Connectivity in Graphs

Questions

- can I get from a to b? Yes
- c to d? Yes
- g to f? Yes
- h to a? No
def explore(G, u, visited):
    visited[u] = True
    for each edge e = (u, v) in E:
        if not visited[v]:
            explore(G, v, visited)
    return

visited[] initialized to False.
Correctness

explore(G, h, visited)

assume there is a path from h to a.

visited[a] is False.

1. In explore, every edge that leaves h is traversed.
2. Every vertex you can directly reach from h is visited.
3. Every vertex two hops from h will be visited.
4. Every vertex n hops from h will be visited.
5. a will be visited if there is a path. **Contradiction.**
Runtime

$O(|E| + |V|)$