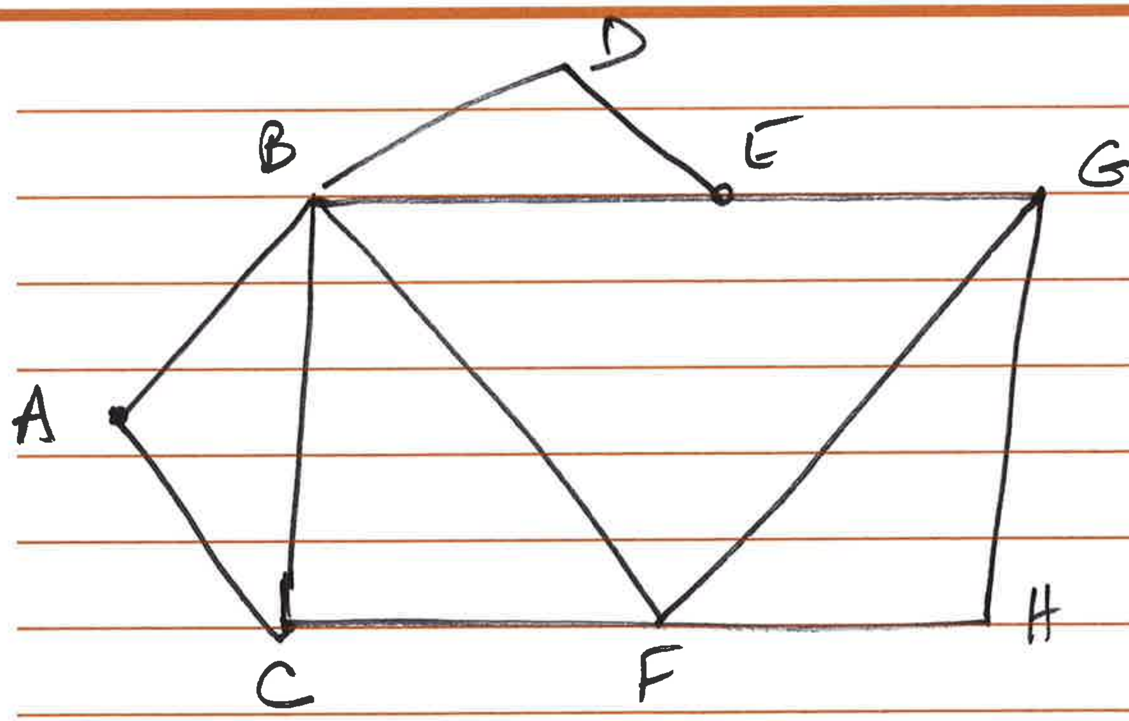
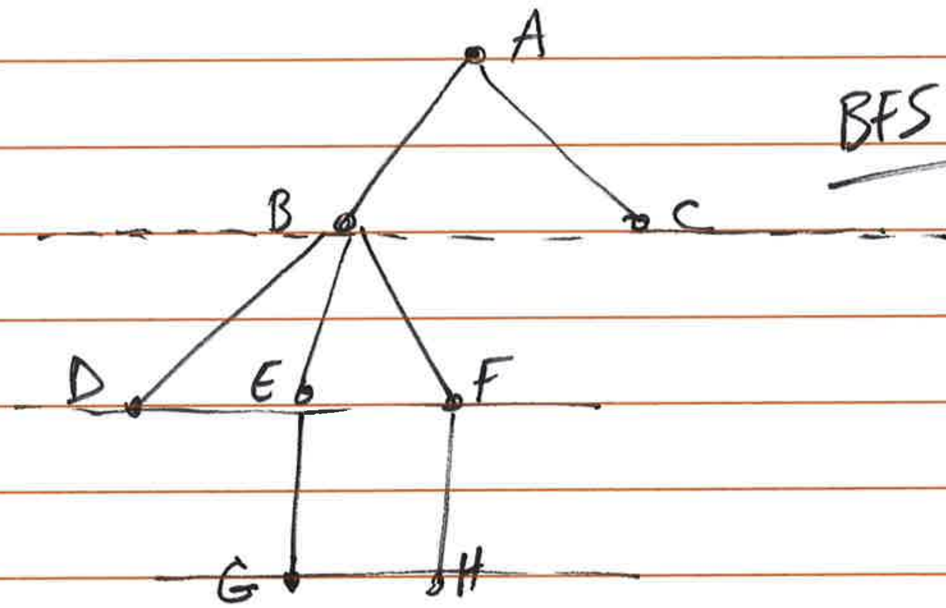
Review of
BFS & DFS

- Find out if there is a path from A to B

- Find all points in the graph that can be reached from A.

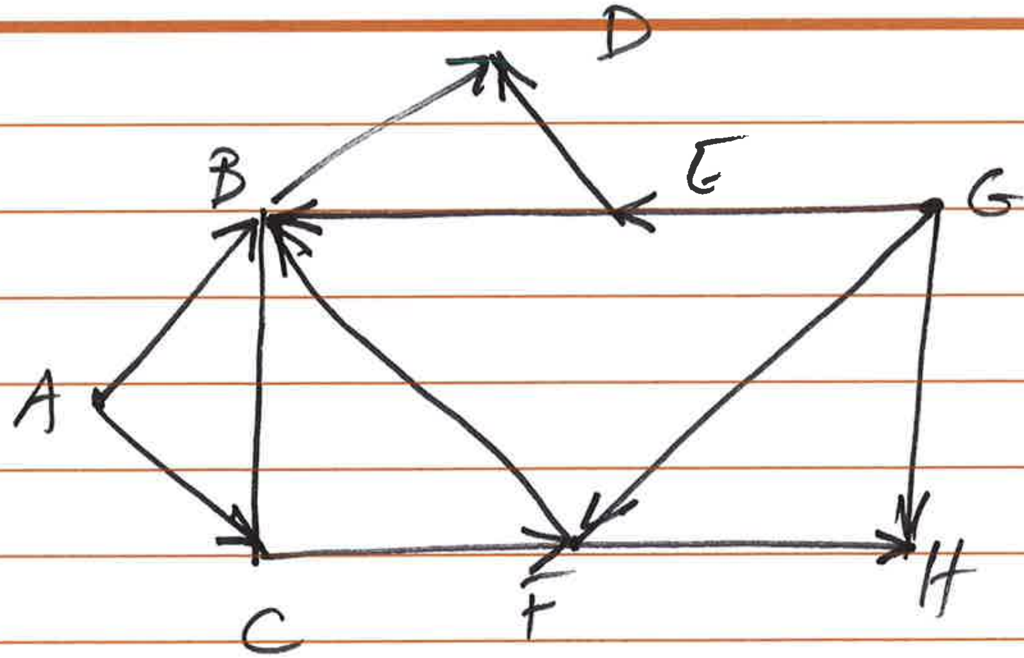


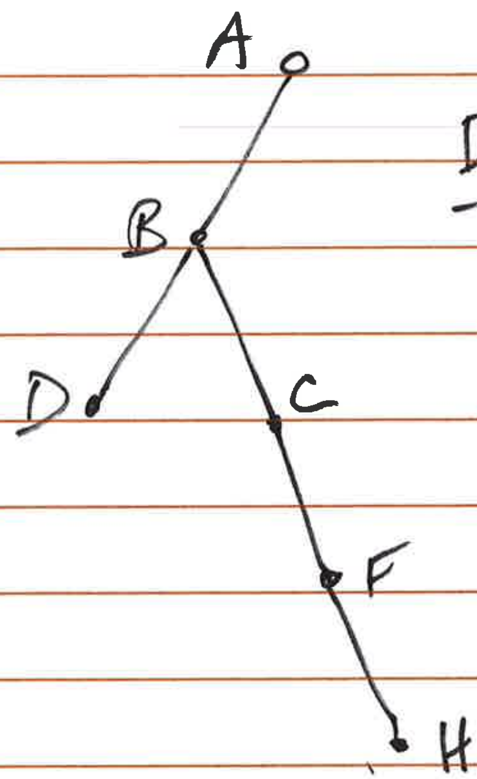


BFS tree

BFS search takes $O(m+n)$ to determine if there is a path from A to B.

BFS search takes $O(m+n)$ to ~~determine~~ find the set of points that are reachable from A.



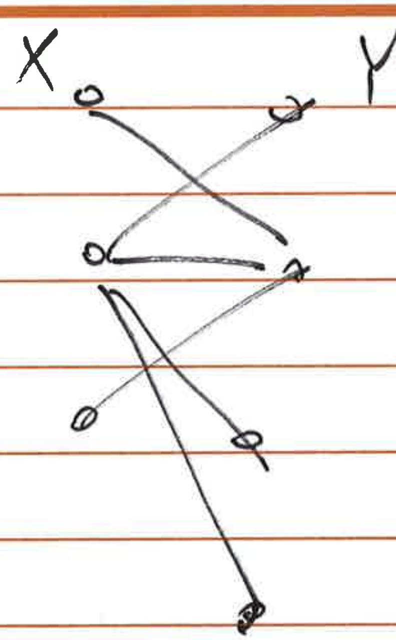


DFS tree

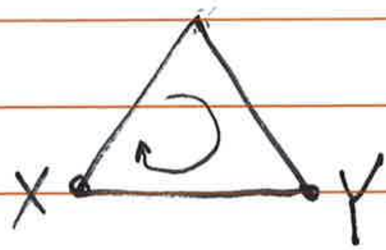
DFS takes $O(m+n)$

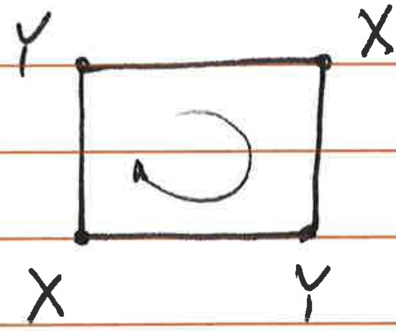
Def.

A graph $G=(V,E)$ is bipartite iff its node set V can be partitioned into sets X & Y in such a way that every edge has one end in X and the other in Y.

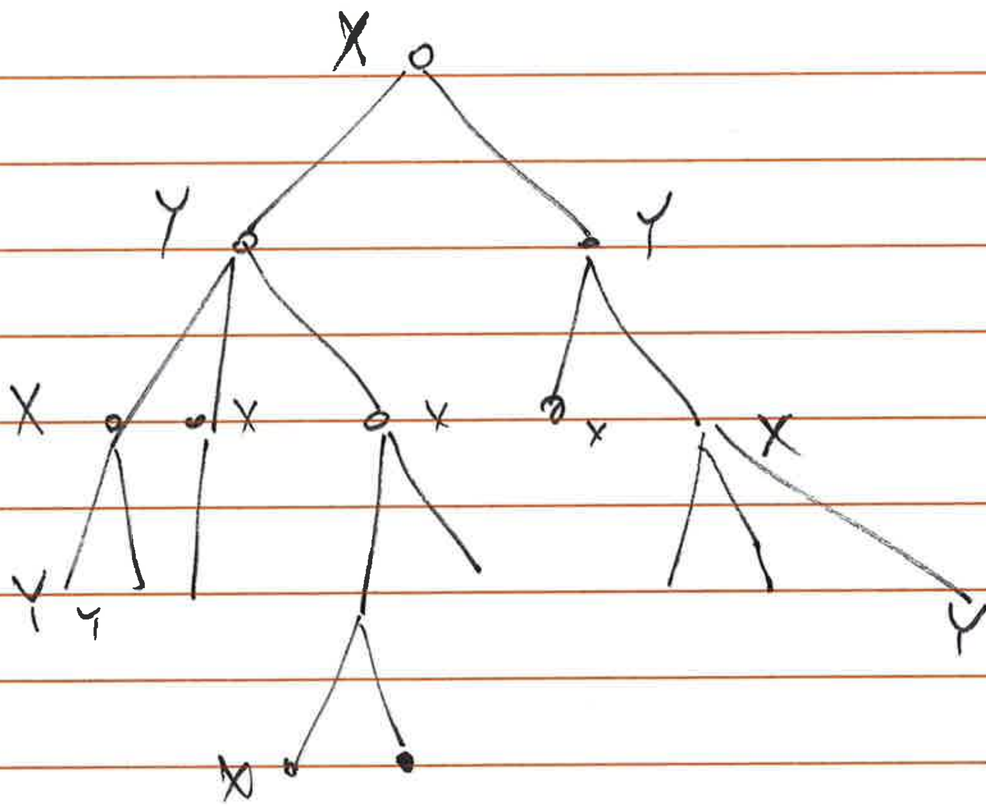


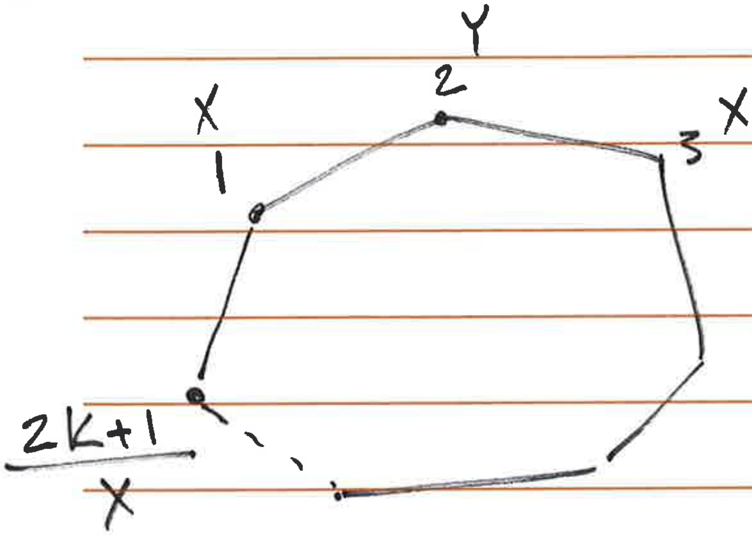
Q: How do you determine if a graph G is bipartite.



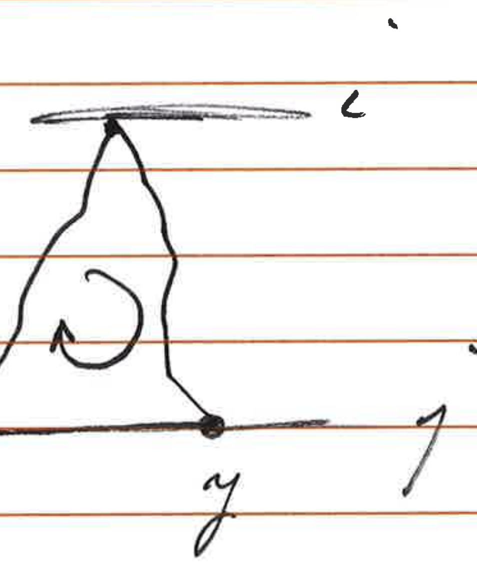


X





FACT: If a graph G is bipartite then it cannot contain an odd cycle.



$2*(j-i)+1$

To determine if G is bipartite

takes $O(m+n)$ for BFS

takes $O(m)$

overall $O(m+n)$

Strong Connectivity

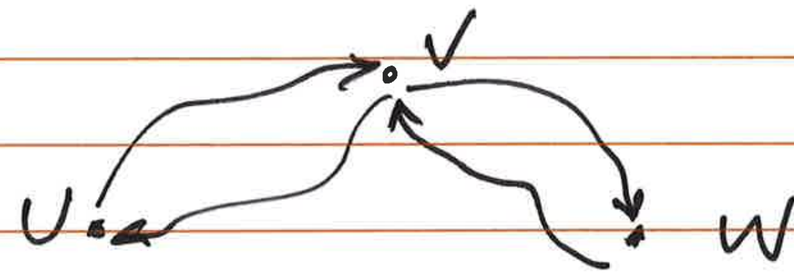
A directed graph is strongly connected if for every two nodes U & V, there is a path from U to V and a path from V to U.

Q: How do we determine if a directed graph G is strongly connected?

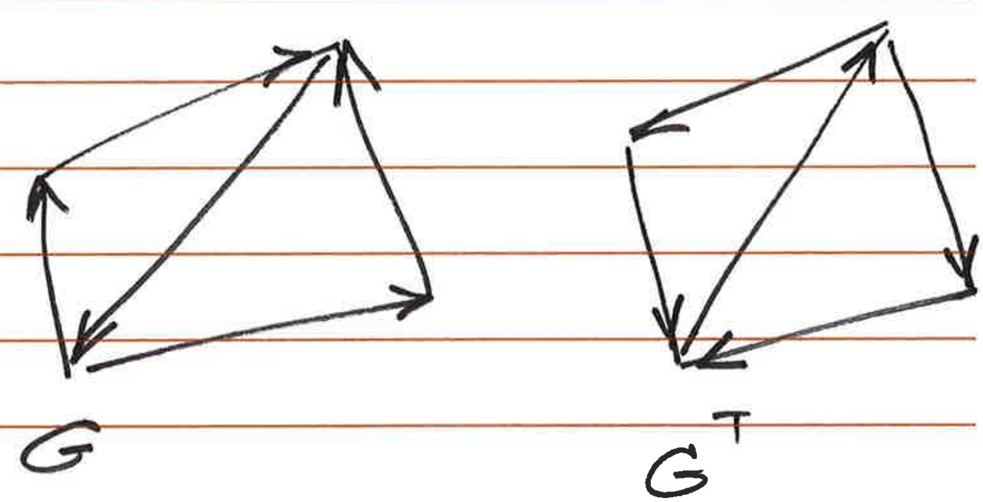
Brute force: run n BFS or DFS searches.

This takes $O(nm + n^2)$

FACT: If U and V are mutually reachable and V & W are mutually reachable then U & W are mutually reachable.



Solution:



Solution: Pick any node S, and run

BFS or DFS in G starting from S.

If the search is successful in finding all nodes in G, then create G^T and do a BFS or DFS in G^T starting from S.

if all points in G^T are reached from S then G must be strongly connected

otherwise, G is not strongly connected.

complexity of the sol. $= O(m+n)$