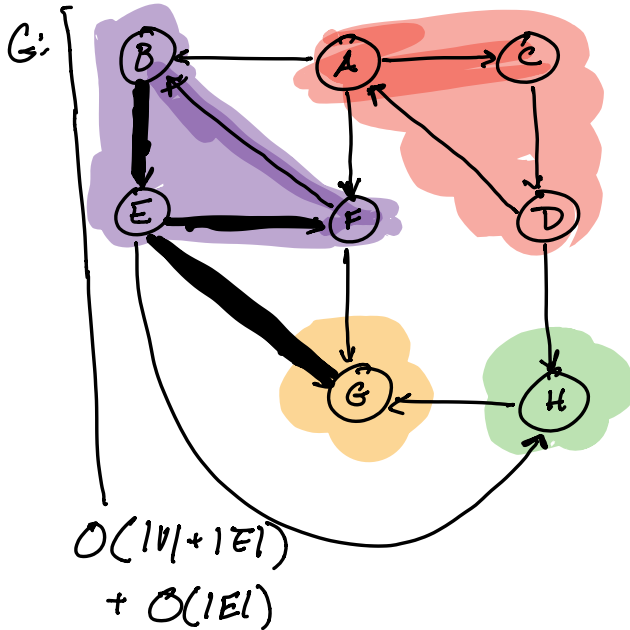


# Lecture 18 Scribble

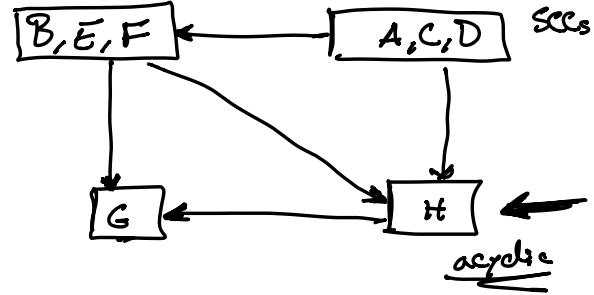
Chat Moderators: Emerson & Pooja

Topics: - Strongly-Connected Components

- Meta-Graph of SCCs
- Linear time algorithm for finding SCCs



Meta-graph of strongly connected components

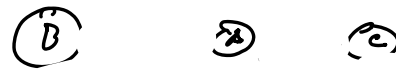


$u$  is strongly connected to  $v$  if there exists a path from  $v \rightarrow u$  &  $u \rightarrow v$



Find all SCCs

Algorithm 0: Brute Force



$G$   $G^{rev} = G$  with the edges reversed



- Find SCCs -  $V1(G)$

Mark all vertices as not visited

For each vertex  $u \in V$  not visited

Find  $SCC(G, u)$ :

Compute  $rch(G, u)$  using DFS( $G, u$ )

Compute  $rch(G^{rev}, u)$  using DFS( $G, u$ )

$SCC(G, u) \leftarrow rch(G, u) \cap rch(G^{rev}, u)$

$\forall u \in SCC(G, u)$ : Mark as visited

- Find SCCs  $V_2(G)$  ←

Do DFS ( $G^{rev}$  with pre/post calculations) ←  $O(|V| + |E|)$

Mark all vertices as not visited ←

For each vertex  $u \in V$  not visited and has highest postorder number

Find  $SCC(G, u)$ :

Compute  $rch(G, u)$  using DFS ( $G, u$ ) ←  $O(|V_{in SCC}|)$

Compute  $rch(G^{rev}, u)$  using DFS ( $G, u$ )

→  $SCC(G, u) \Leftarrow rch(G, u) \cap rch(G^{rev}, u)$

$\forall u \in SCC(G, u)$ : Mark as visited  $O(|V| + |E|)$

