

## DFS: Specification

**Input** Directed or undirected graph  $G = (V, E)$

**Output** For each  $v$ , keep two timestamps and the predecessor:

- $v.d$  = discovery time
- $v.f$  = finishing time
- $v.\pi$  = predecessor of  $v$  in the depth-first ‘forest’

BFS gives us a shortest-path. DFS can be used in additional algorithms.

## Depth-First Forest and Breadth-First Tree

- $DFS(G)$  is usually for finding relationship among vertices (timestamps), not the relationship w.r.t a particular source  
Use  $DFS(G, s)$  as a subroutine
- $BFS(G, s)$  is usually for finding shortest path distances from a given source.

## Classification of Edges

**Tree Edge** In the depth-first forest. Found by exploring  $(u, v)$

**Back Edge**  $(u, v)$ , where  $u$  is a descendant of  $v$  (in dft)

**Forward Edge**  $(u, v)$  where  $v$  is a descendant of  $u$  but not a tree edge

**Cross Edge** any other edge