Lecture 10
Solving Problems by Searching

Artificial Intelligence

Dr. Ahmed Mateen

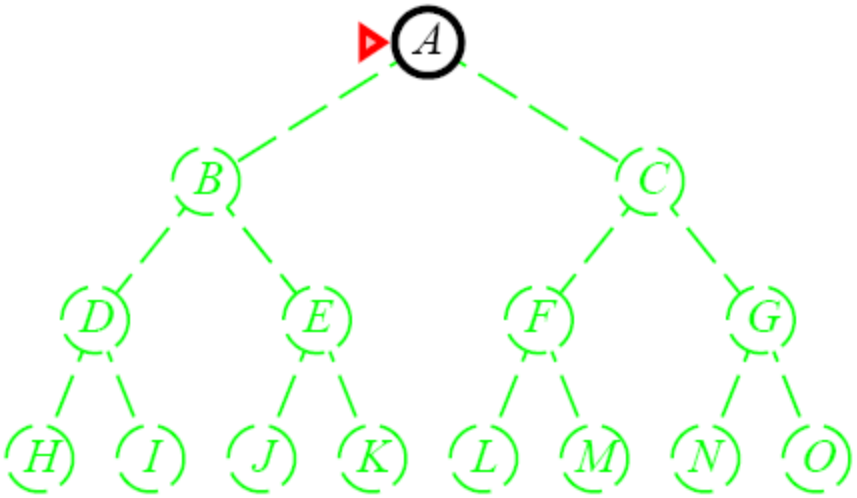
Today's Agenda

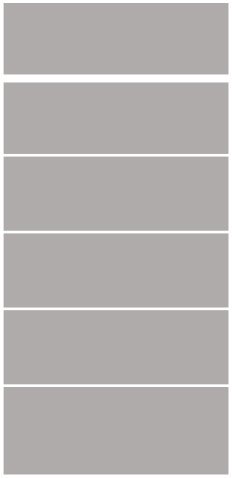
- Depth First Search

Depth-First Search

- Recall from Data Structures the basic algorithm for a depth-first search on a graph or tree
- Expand the ***deepest*** unexpanded node
- Unexplored successors are placed on a stack until fully explored

Depth-First Search



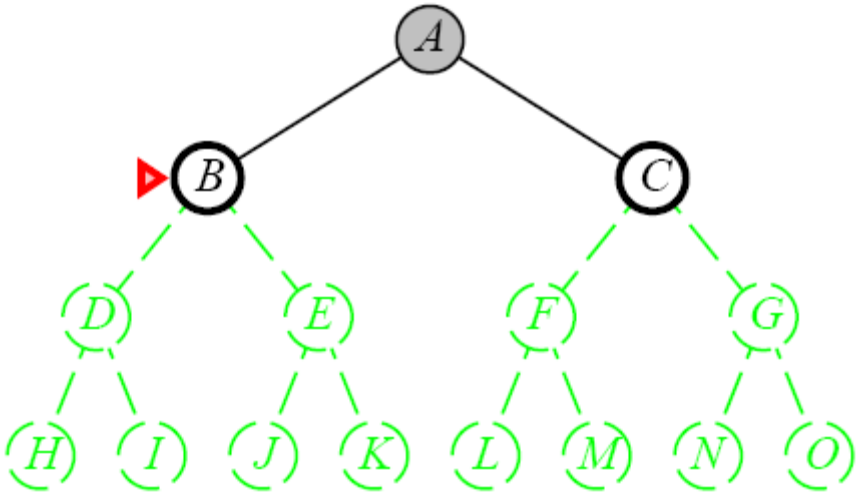


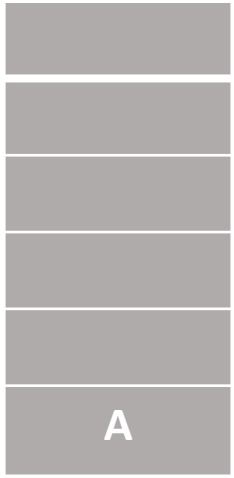
Stack

Output

Depth-First Search

Root-> Left Child -> Right child

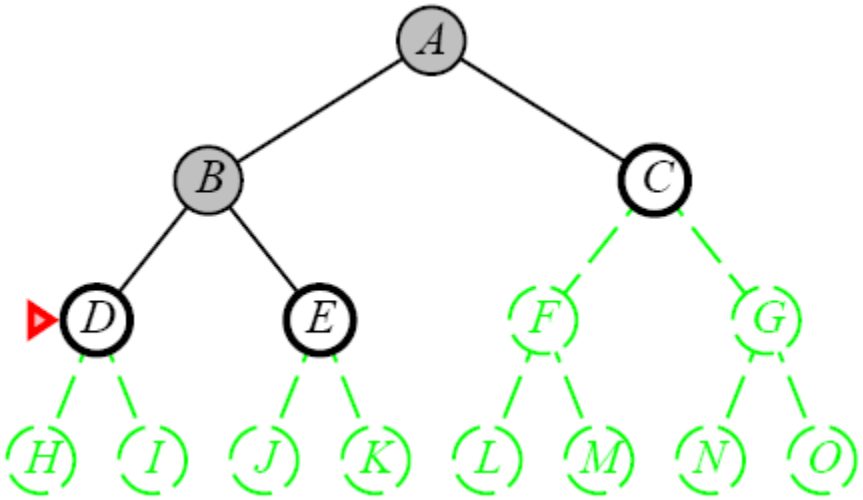


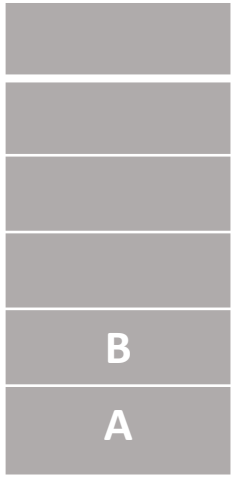


Stack

Output | A | | | | | | | | | | | | | |

Depth-First Search





Active

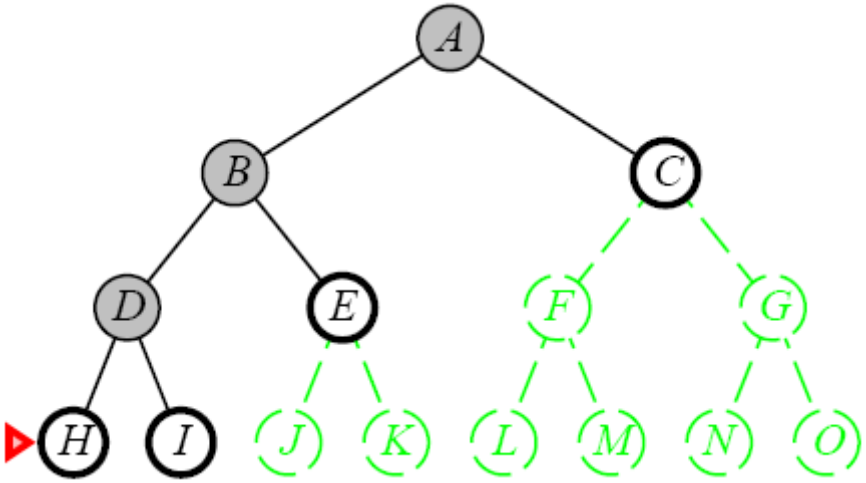
Paused

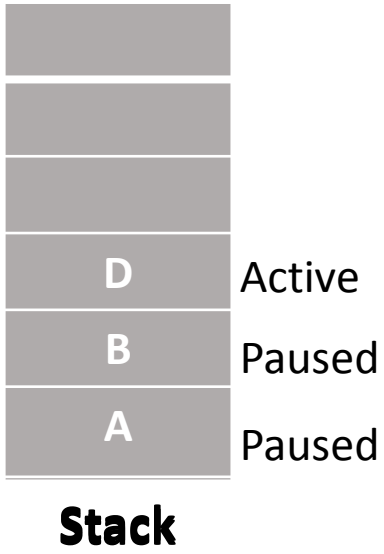
Stack

Output

A	B													

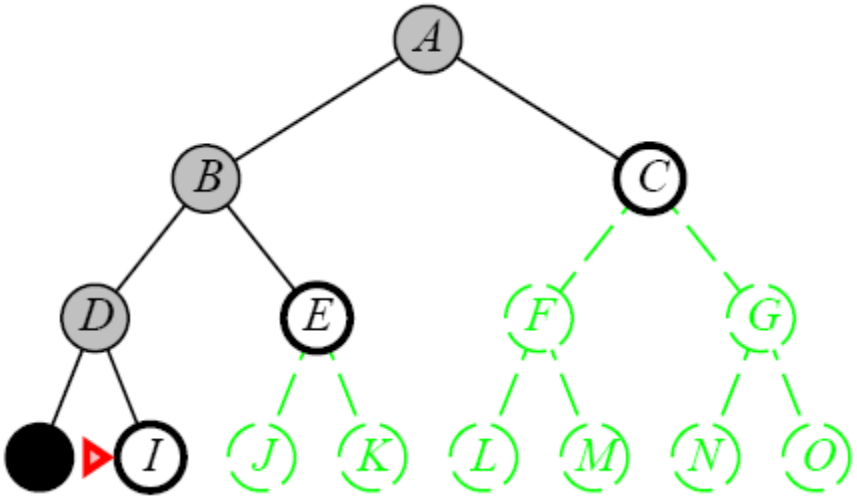
Depth-First Search

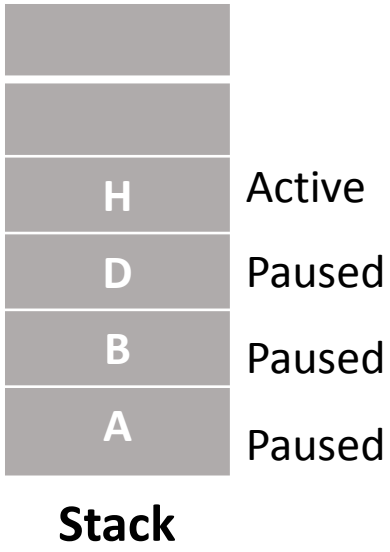




Output	A	B	D											

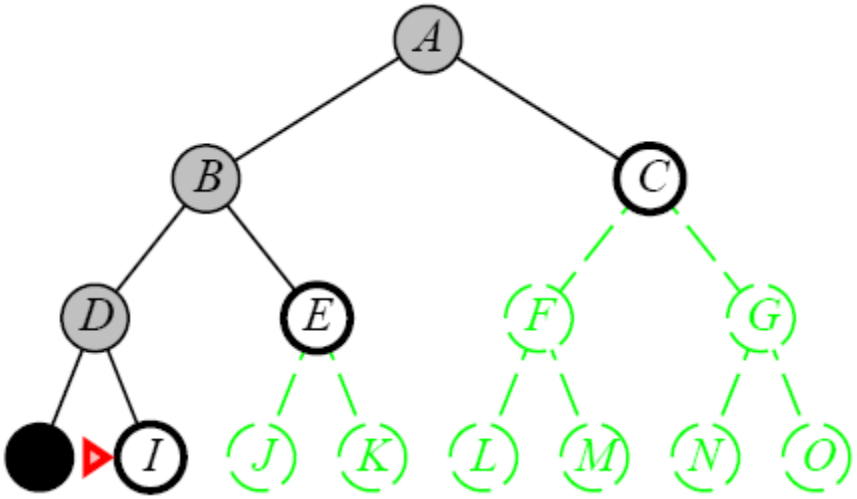
Depth-First Search

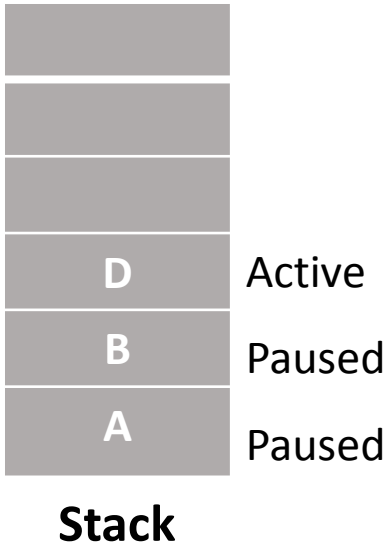




Output	A	B	D	H										

Depth-First Search

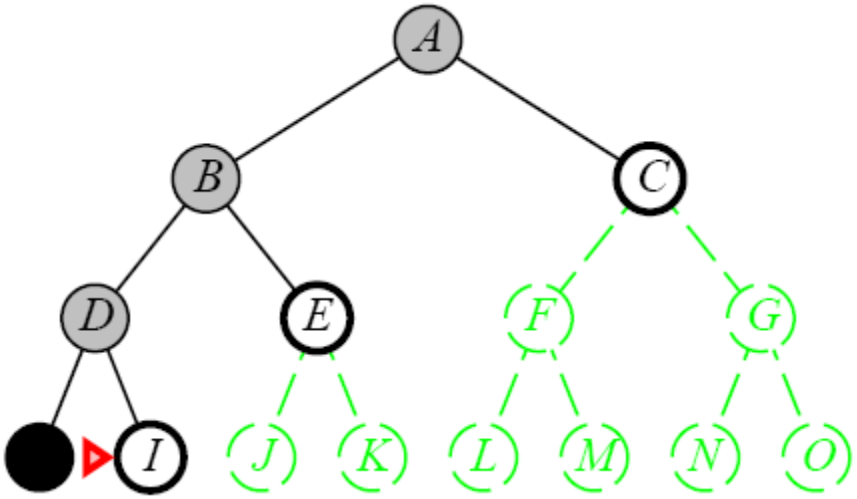


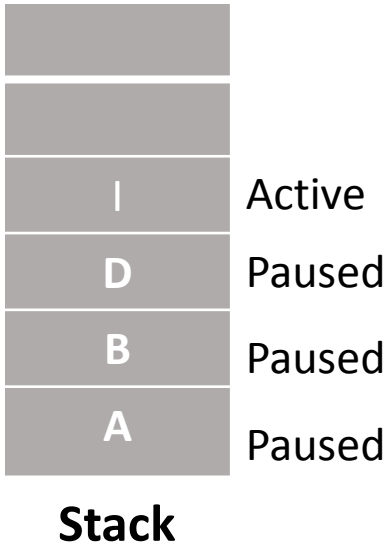


Output

A	B	D	H											

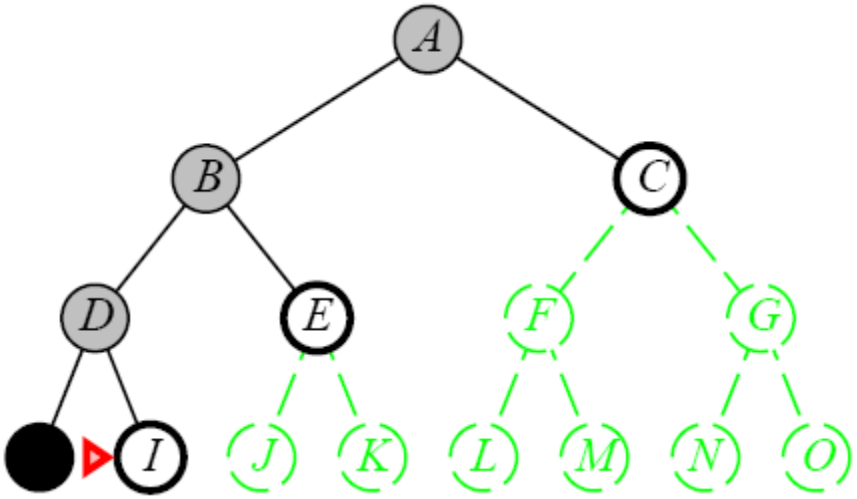
Depth-First Search

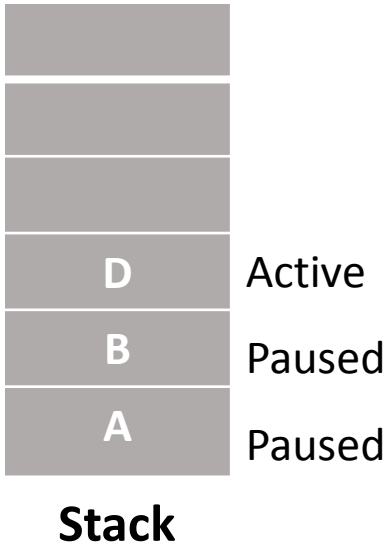




Output	A	B	D	H	I										

Depth-First Search

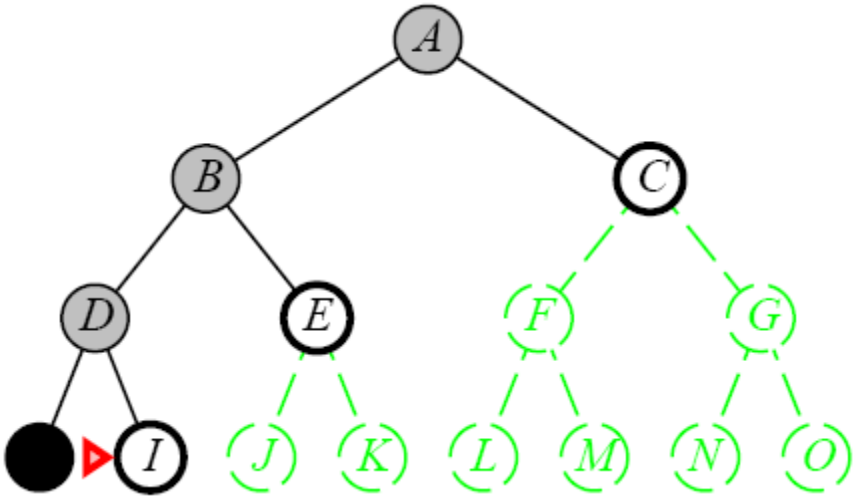


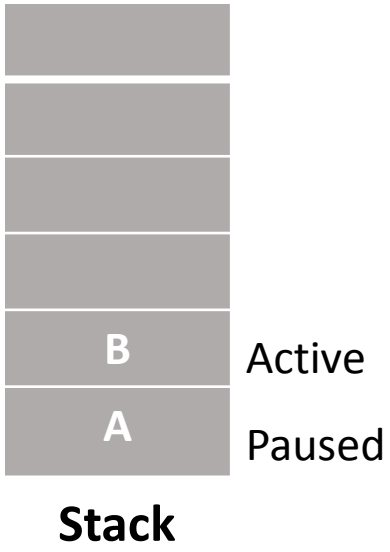


Output

A	B	D	H	I										

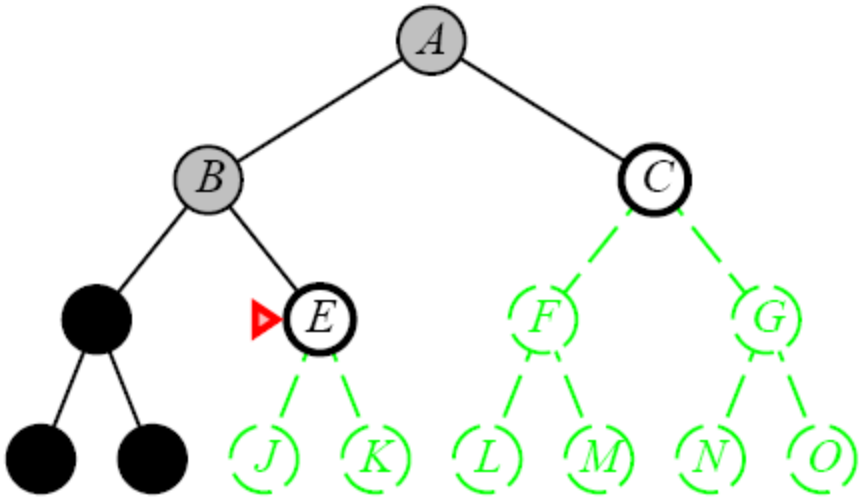
Depth-First Search

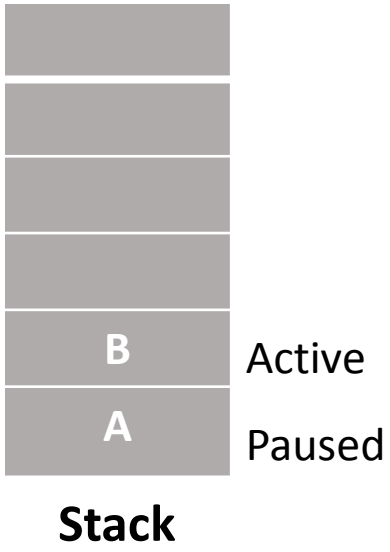




Output	A	B	D	H	I										

Depth-First Search

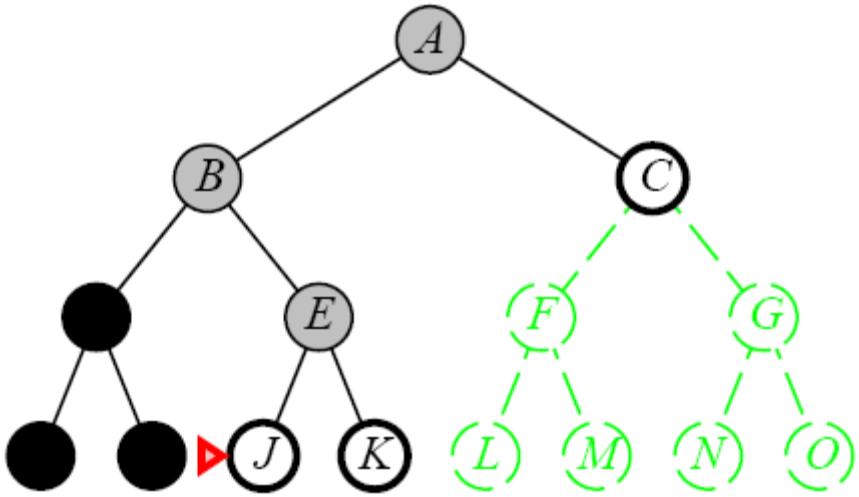


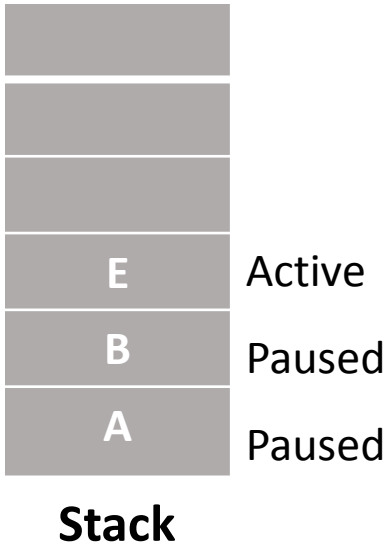


Output

A	B	D	H	I									

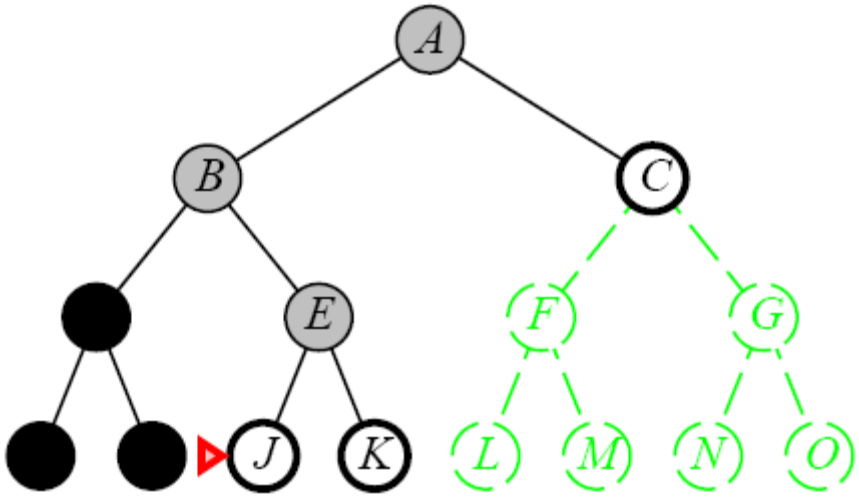
Depth-First Search

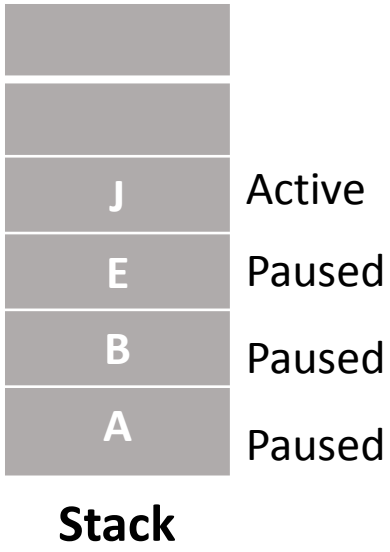




Output	A	B	D	H	I	E									

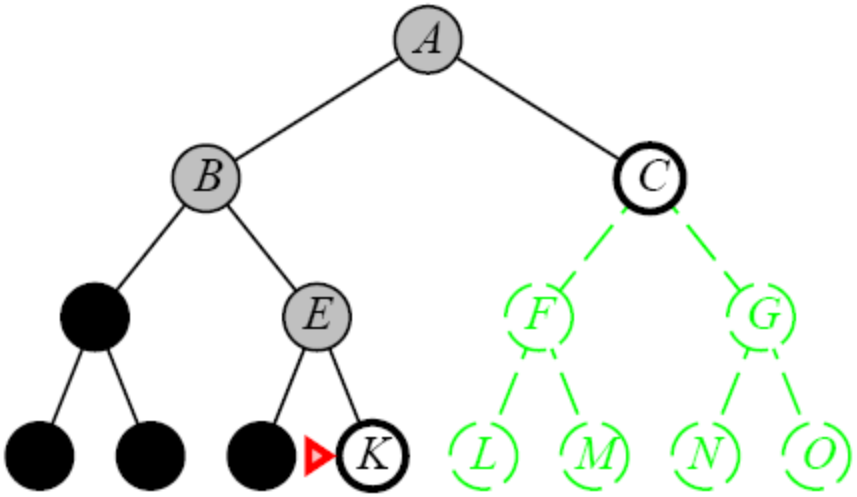
Depth-First Search

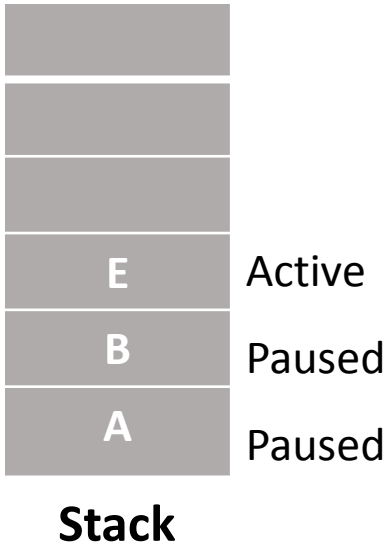




Output	A	B	D	H	I	E	J								

Depth-First Search





Output	A	B	D	H	I	E	J								

Depth-First Search

- Complete?

- Time Complexity?
  - if the maximum path length is m and the maximum branching factor is b
    - $O(b^{m+1})$

Depth First Search

- Space
  - O(bm)
- Optimal
  - No

Using Depth-First Search

- When is DFS appropriate?
  - space is restricted
  - solutions tend to occur at the same depth in the tree
- When is DFS inappropriate?
  - some paths have infinite length
  - the graph contains cycles
  - some solutions are very deep, while others are very shallow