

# ITERATIVE DEEPENING DFS

CSE 511A: Introduction to Artificial Intelligence

Some content and images are from slides created by Dan Klein and Pieter Abbeel for CS188 Intro to AI at UC Berkeley.  
All CS188 materials are available at <http://ai.berkeley.edu>.

1

## PROPERTIES

	BFS	DFS
Correct the solution it finds is optimal	Yes if cost is uniform	No
Complete it terminates	Yes if $b$ is finite	Yes if $b$ & $m$ are finite
Space Complexity max nodes in memory	$O(b^{d+1})$	$O(bm)$
Time Complexity max nodes generated	$O(b^{d+1})$	$O(b^m)$

When should we use BFS and when should we use DFS?

2

# ITERATIVE DEEPENING DFS

Combining the best of both worlds:  
Iterative Deepening DFS pseudo-code:

- (1)  $limit = 0$
- (2) Run DFS with depth limit =  $limit$
- (3) If found goal, then stop
- (4)  $limit = limit + 1$
- (5) Go to (2)

3

# ITERATIVE DEEPENING DFS

depth:0



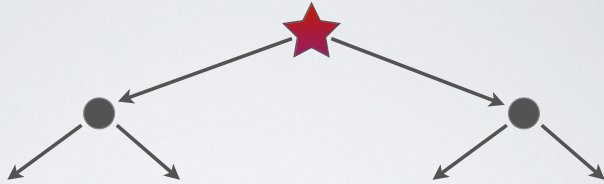
$limit = 0$

4

## ITERATIVE DEEPENING DFS

depth:0

depth:1



*limit = 1*

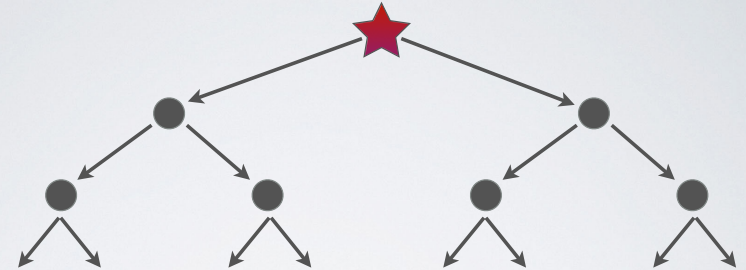
5

## ITERATIVE DEEPENING DFS

depth:0

depth:1

depth:2



*limit = 2*

6

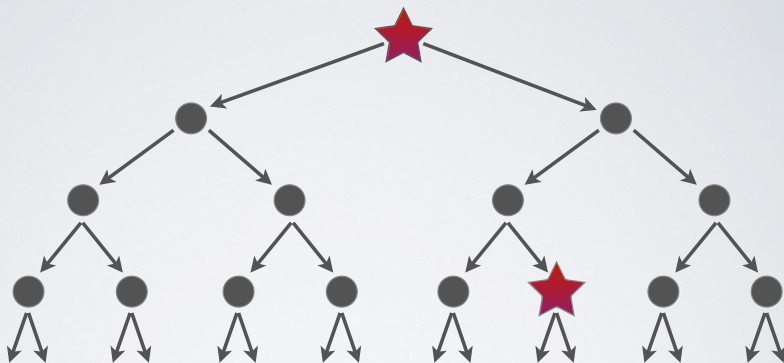
## ITERATIVE DEEPENING DFS

depth:0

depth:1

depth:2

depth:3



*limit = 3*

7

## PROPERTIES

	BFS	DFS	ID-DFS
Correct the solution it finds is optimal	Yes if cost is uniform	No	Yes if cost is uniform
Complete it terminates	Yes if $b$ is finite	Yes if $b$ & $m$ are finite	Yes if $b$ is finite
Space Complexity max nodes in memory	$O(b^{d+1})$	$O(bm)$	$O(bd)$
Time Complexity max nodes generated	$O(b^{d+1})$	$O(b^m)$	$O(b^{d+1})$

branching factor  $b$   
depth of the goal  $d$   
depth of tree  $m$

8