# Iterative Deepening

## State Space Search Technique

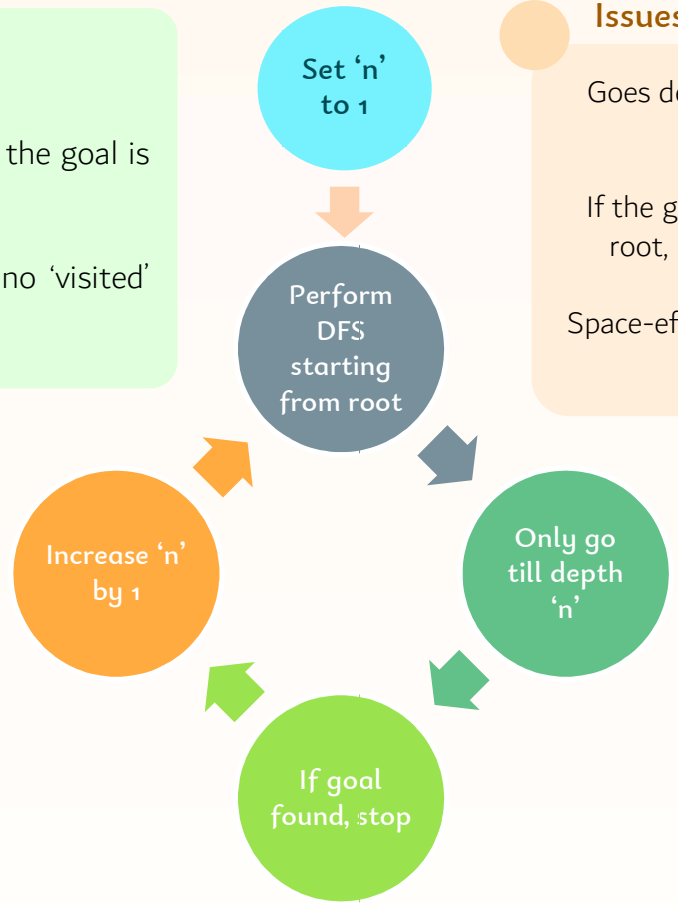
Combined benefit of
Depth First and Breadth First Search

Also known as Iterative Deepening Depth First Search
IDDFS

It is a depth limited version of a depth-first search

DFS is run repeatedly with increasing depths until the goal is found

It works only on directed graphs since there are no 'visited' flags stored




### Issues with DFS

Goes deeper into a sub-tree first

If the goal is adjacent to the root, DFS finds it very late

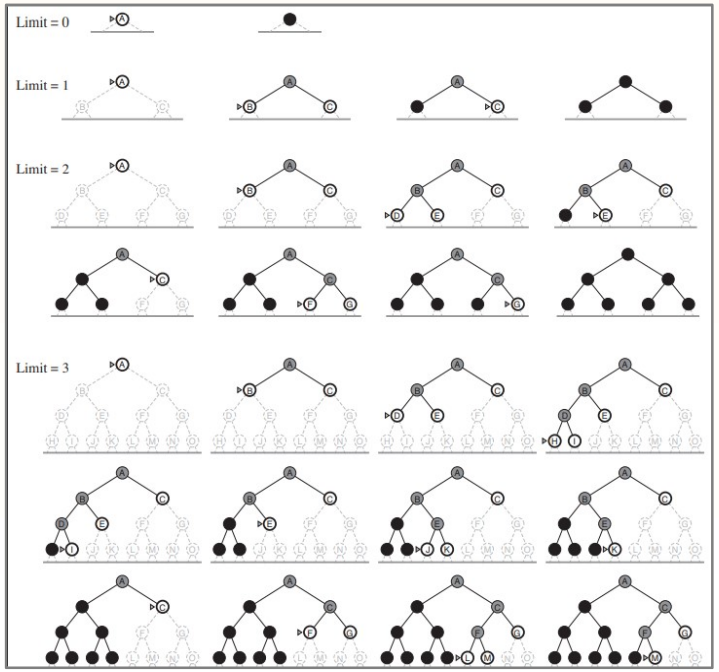
Space-efficient, but not time-efficient

### Issues with BFS

Explores adjacent nodes before going deeper into a sub-tree

It is time-efficient but not space efficient

## A sample run of IDDFS




## Features of Iterative Deepening

We visit top level nodes multiple times. The last (or max depth) level is visited once, second last level is visited twice, and so on.

This is not costly since in a tree most of the nodes are in the bottom level.

It is thus time efficient and space efficient, especially on graphs with infinite branching factor

Suppose we have a tree having branching factor 'b' (number of children of each node), and its depth 'd', i.e., there are $b^d$ nodes.

**Time complexity is O(b^d)**


References-
- IDDS – GeeksforGeeks
- Iterative deepening depth-first search - Wikipedia



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