binary trees

traversals, searches, game trees

slides
bit.ly/abhi-disc

attendance
bit.ly/abhi-attendance

announcements

1. HW 5 due ~~3/8 (tomorrow)~~ 3/29 tuesday after spring break
2. Lab 8 due 3/11 (friday)
3. Weekly survey due tomorrow!

trees 

trees

- structures that follow three basic rules

trees

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1) if there are N nodes, there are N-1 edges

trees

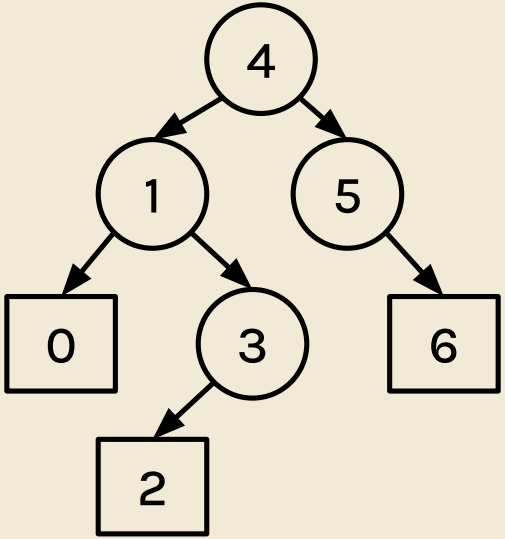
- structures that follow three basic rules

1) if there are N nodes, there are N-1 edges
2) there’s exactly one path from every node to every other node

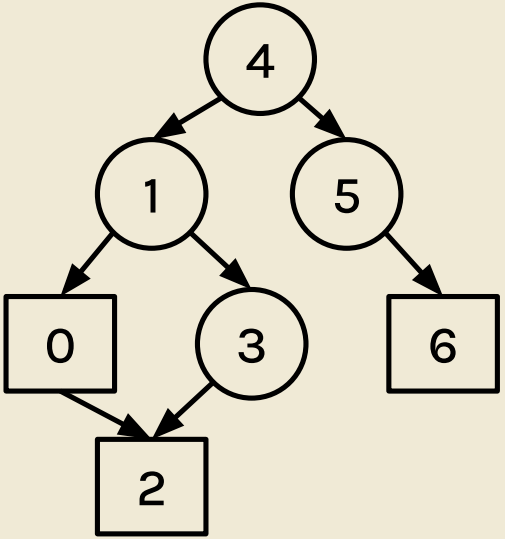
trees

- structures that follow three basic rules

1) if there are N nodes, there are N-1 edges
2) there's exactly one path from every node to every other node
3) there are no cycles (follows from 1 and 2)



valid tree



invalid tree

tree traversals

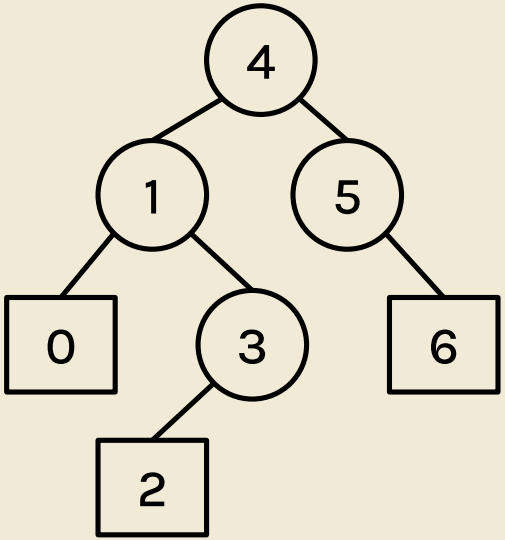
- **preorder:** visit node, then traverse children
- **inorder:** traverse left child, then node, then traverse right child
- **postorder:** traverse children, then visit node

tree traversals (informal)

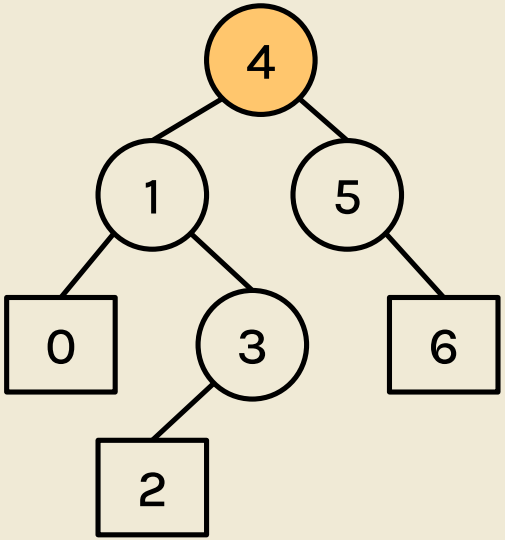
start by tracing the tree counterclockwise

- **preorder:** visit “left sides” of nodes
- **inorder:** visit “bottom sides” of nodes
- **postorder:** visit “right sides” of nodes

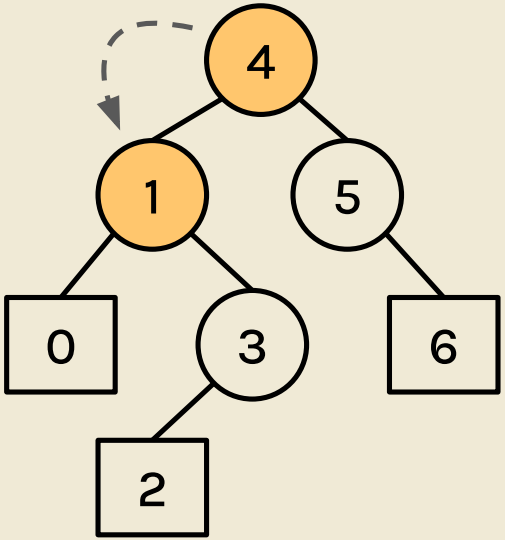
tree traversals (preorder)



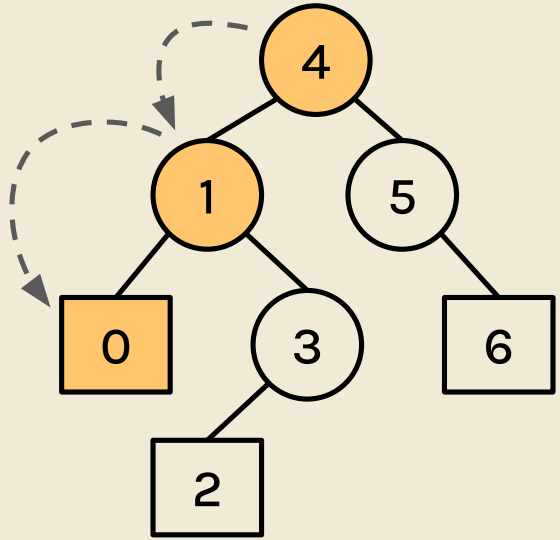
tree traversals (preorder)



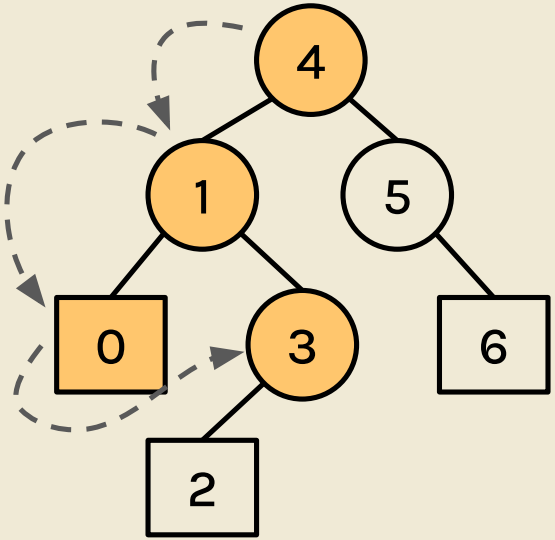
tree traversals (preorder)



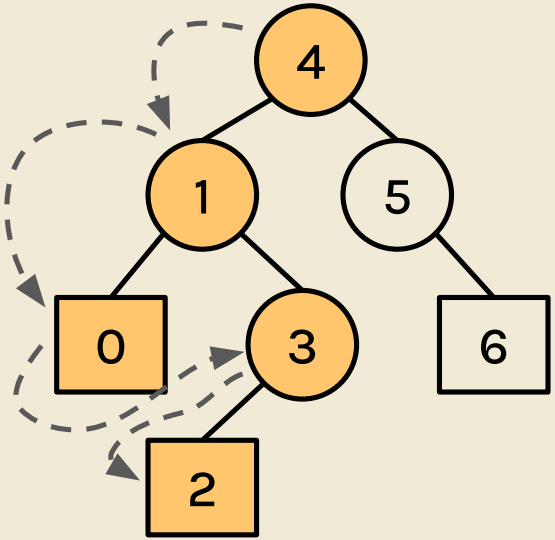
tree traversals (preorder)



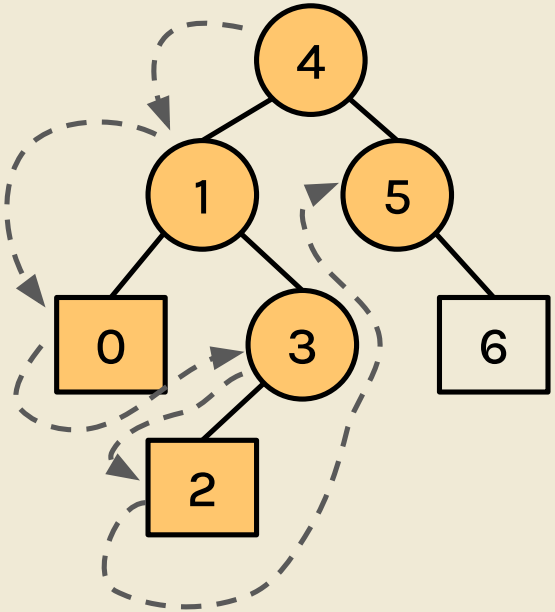
tree traversals (preorder)



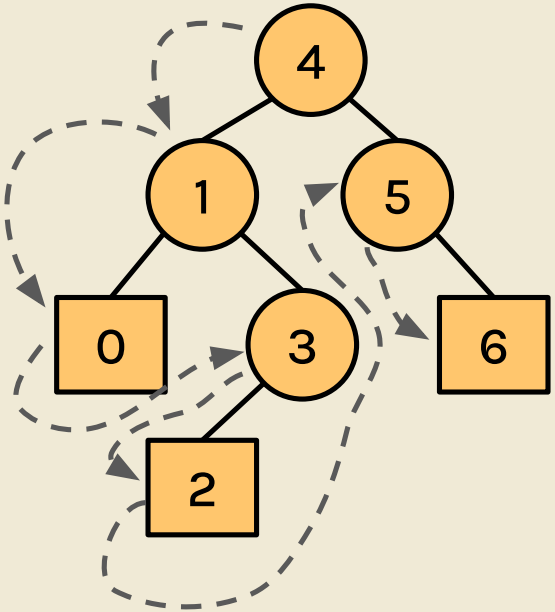
tree traversals (preorder)



tree traversals (preorder)



tree traversals (preorder)



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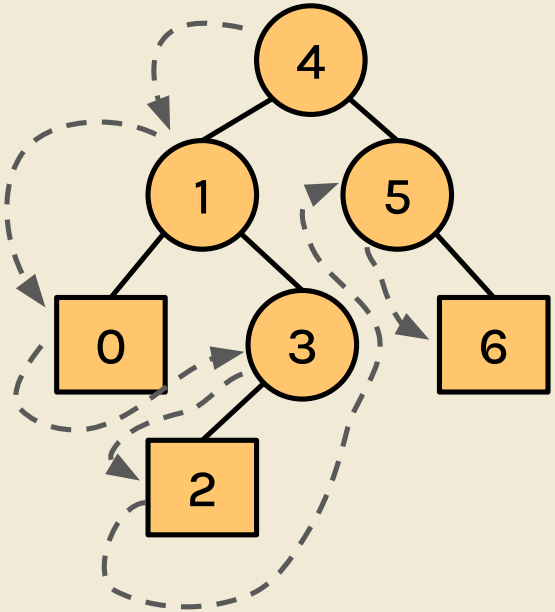
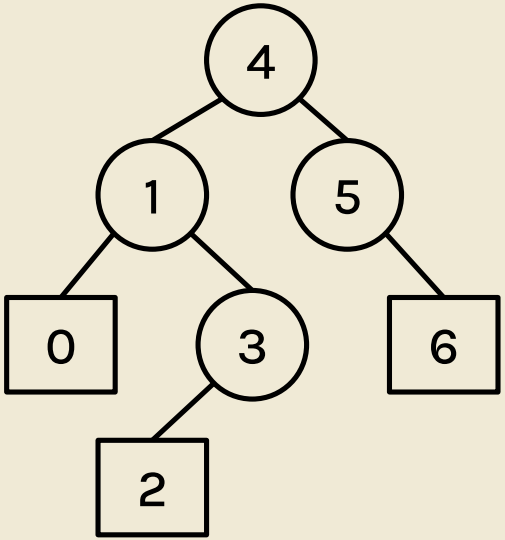
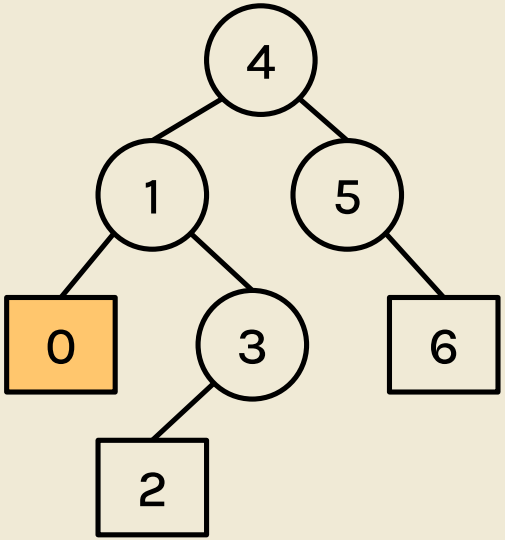


4, 1, 0, 3, 2, 5, 6

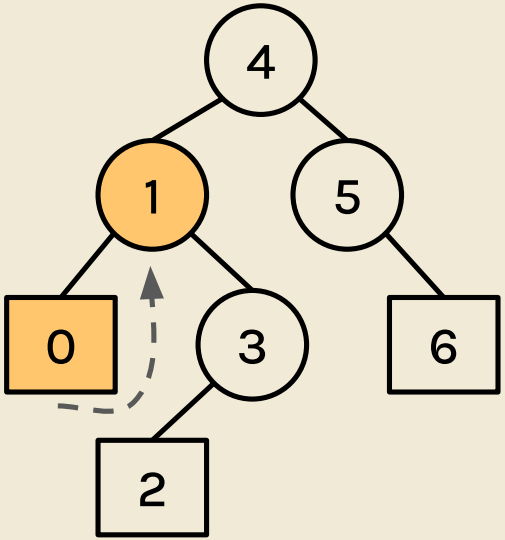
tree traversals (inorder)



tree traversals (inorder)



tree traversals (inorder)



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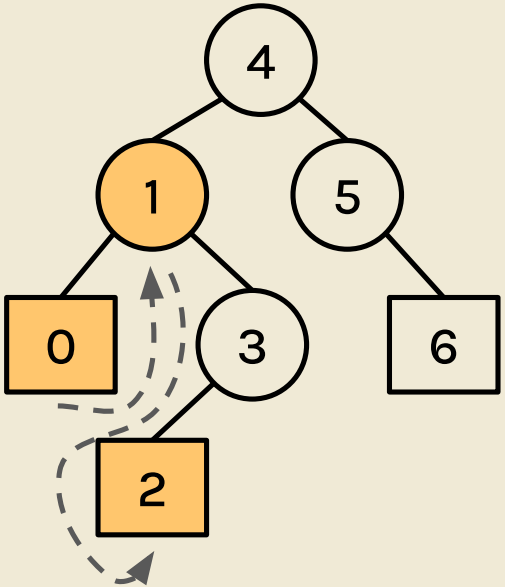

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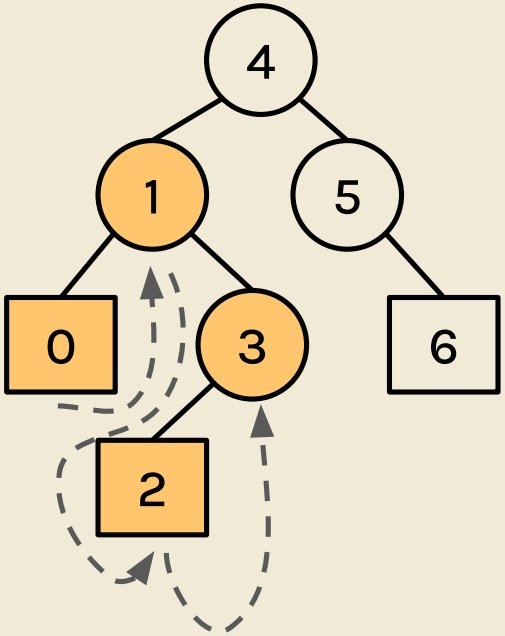

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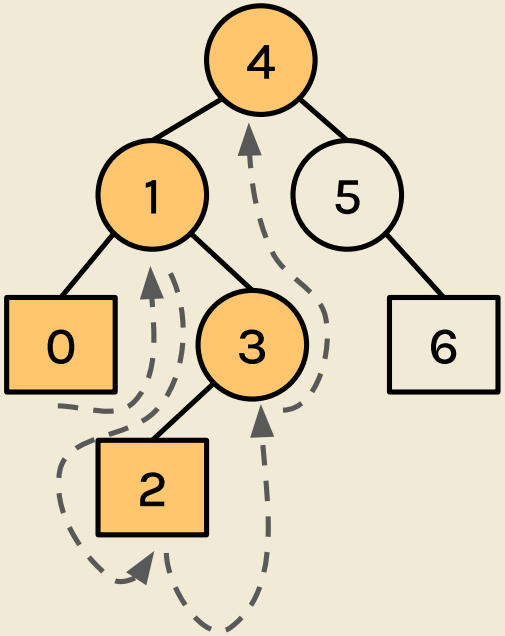

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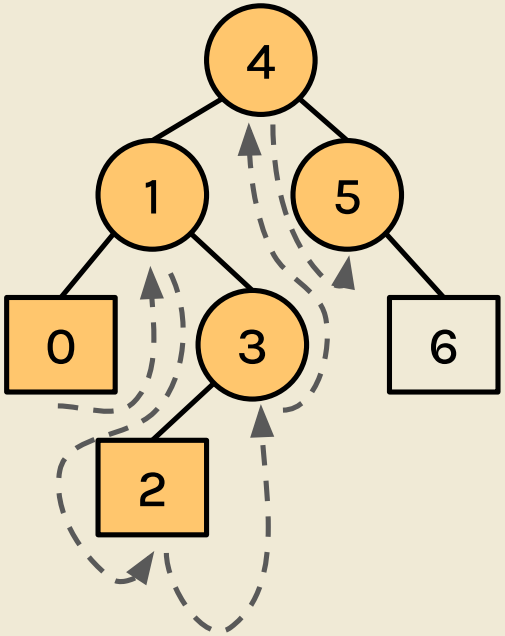

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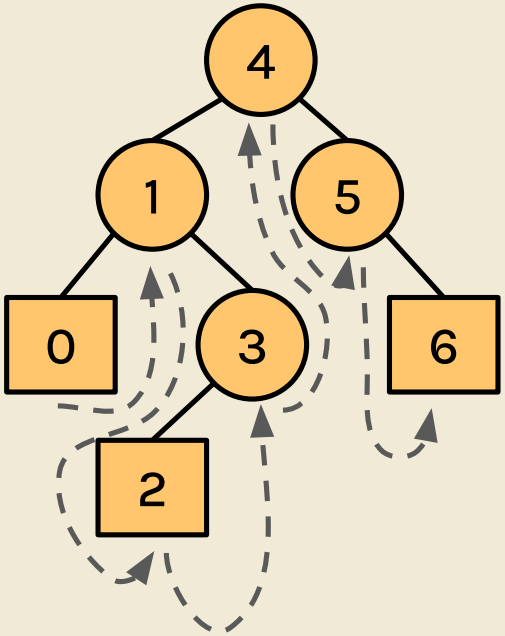

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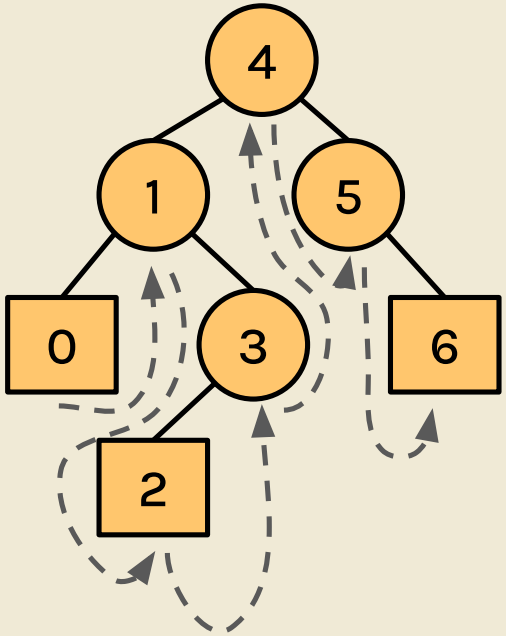
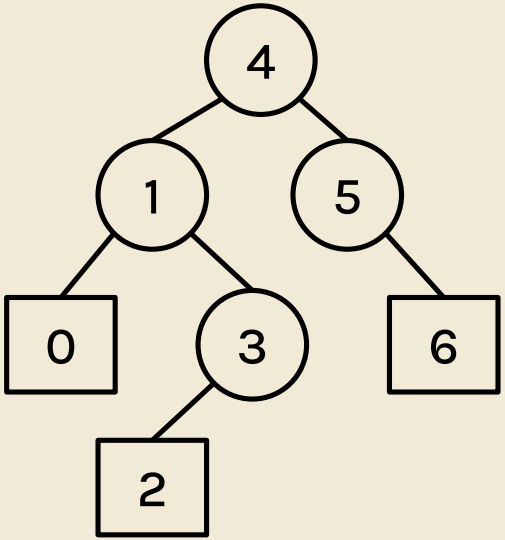


0, 1, 2, 3, 4, 5, 6

tree traversals (postorder)



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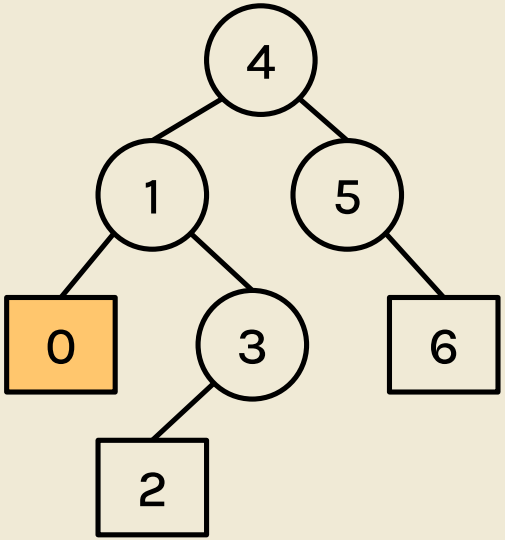

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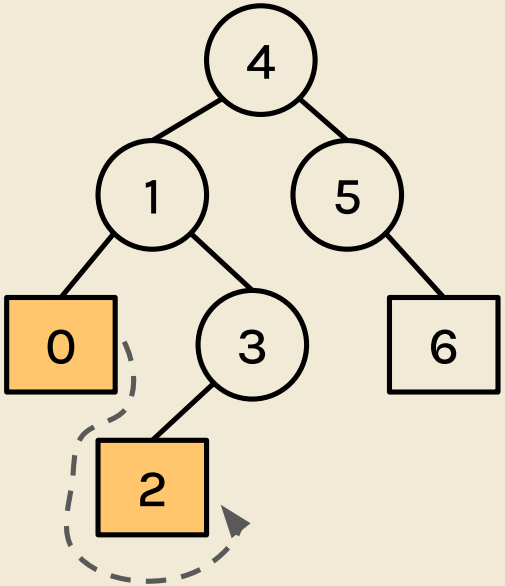

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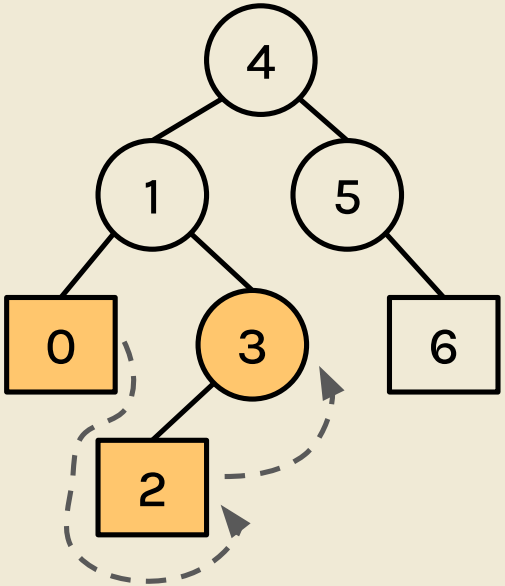

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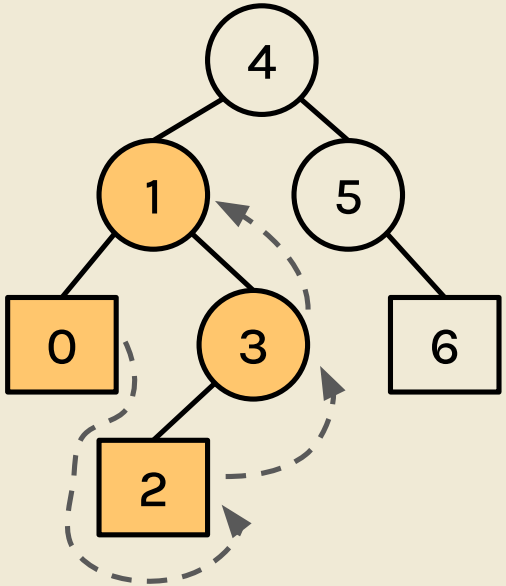

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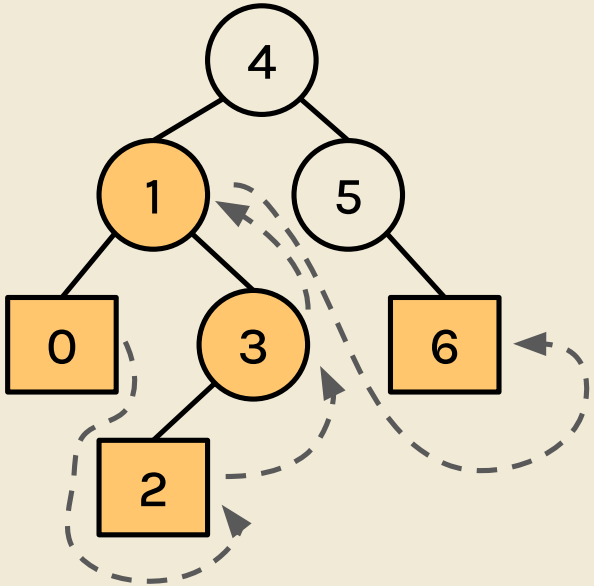

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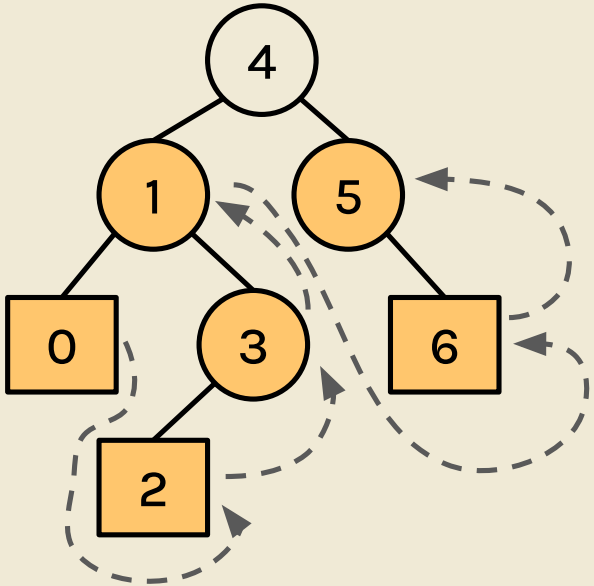

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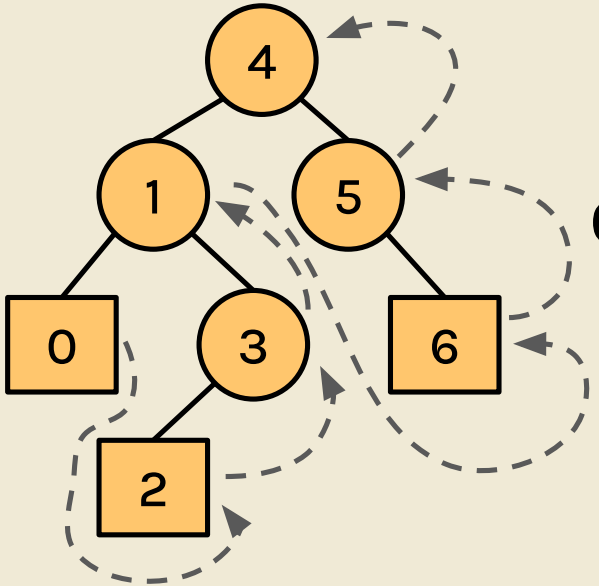
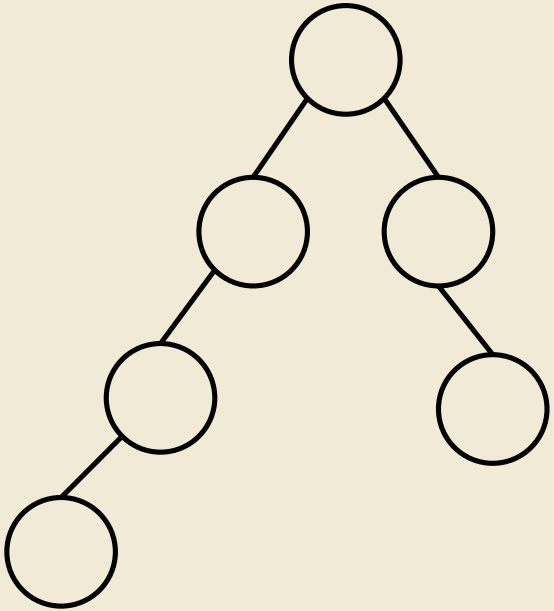


0, 2, 3, 1, 6, 5, 4

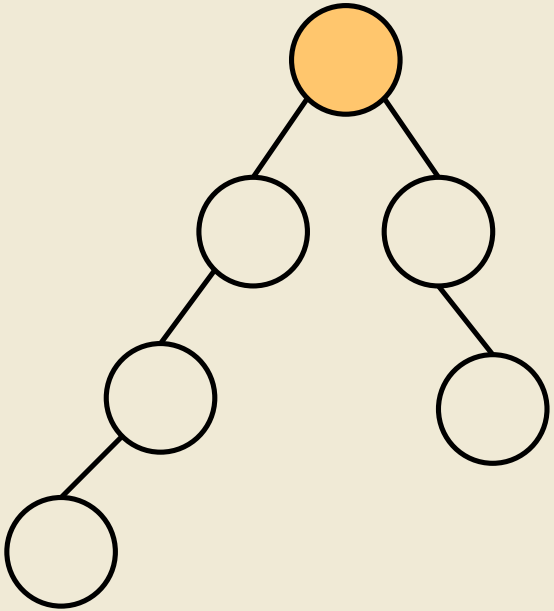
breadth first search

- visit nodes in order of distance to the source
- implemented through a queue

breadth first search



breadth first search



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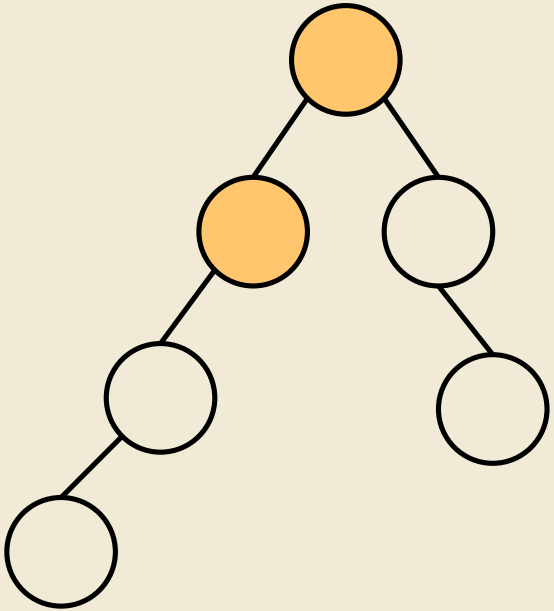

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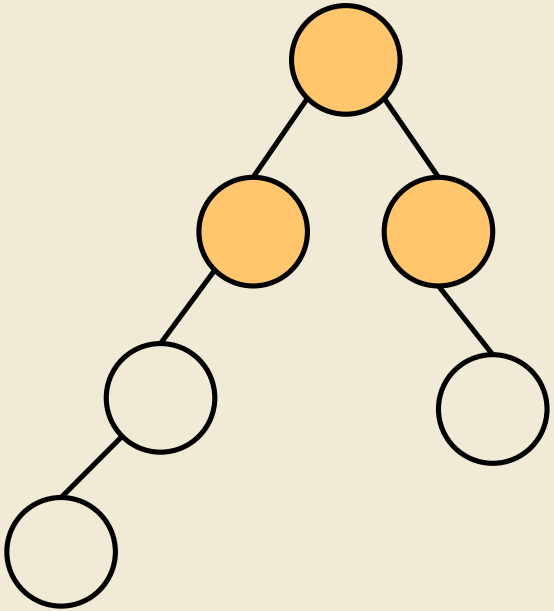

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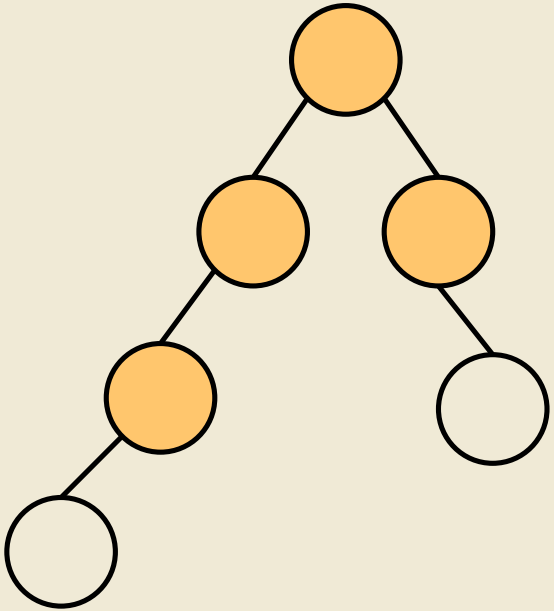

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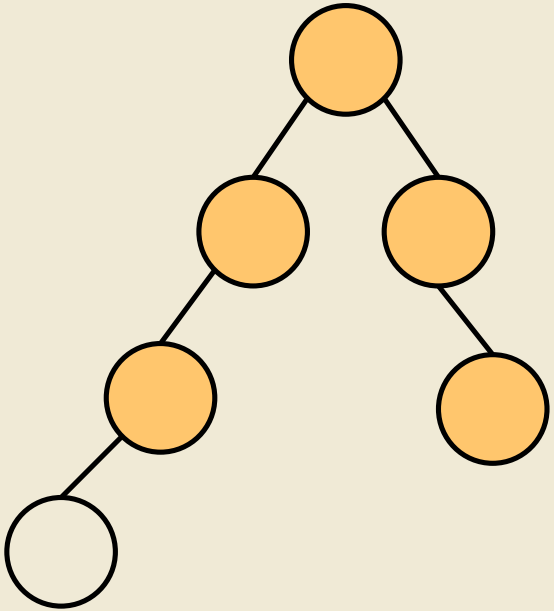

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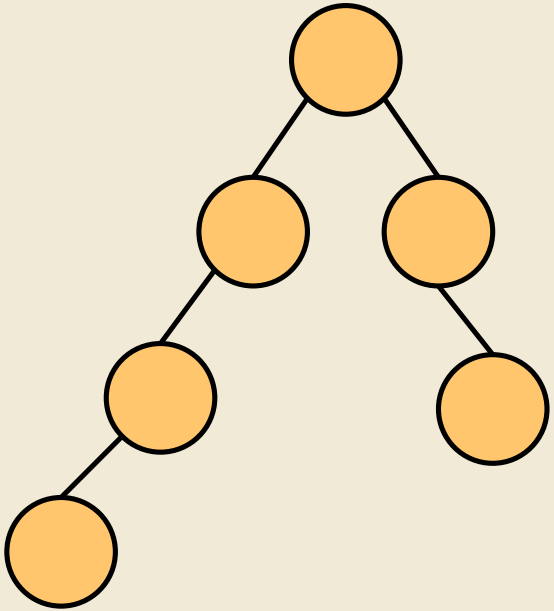

breadth first search (algorithm)

breadth first search (algorithm)

- put the starting node in the queue

breadth first search (algorithm)

- put the starting node in the queue
- pop the first item from the queue (the starting node) and visit it
  - when you visit a node, add all its children/”neighbors” to the queue

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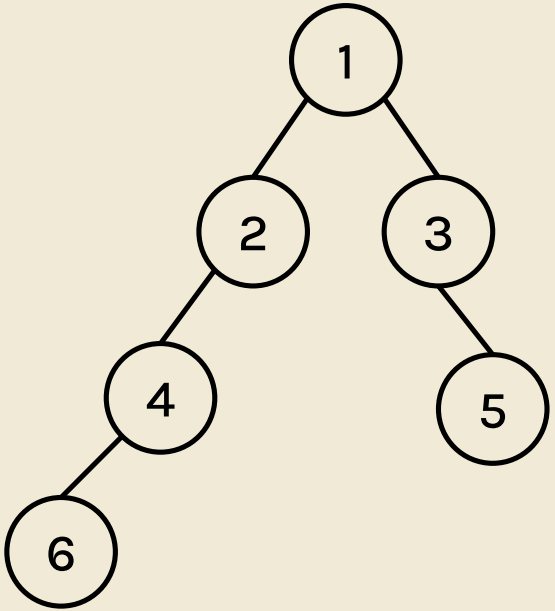
breadth first search (algorithm)

- put the starting node in the queue
- pop the first item from the queue (the starting node) and visit it
  - when you visit a node, add all its children/"neighbors" to the queue
- pop and visit the next item in the queue

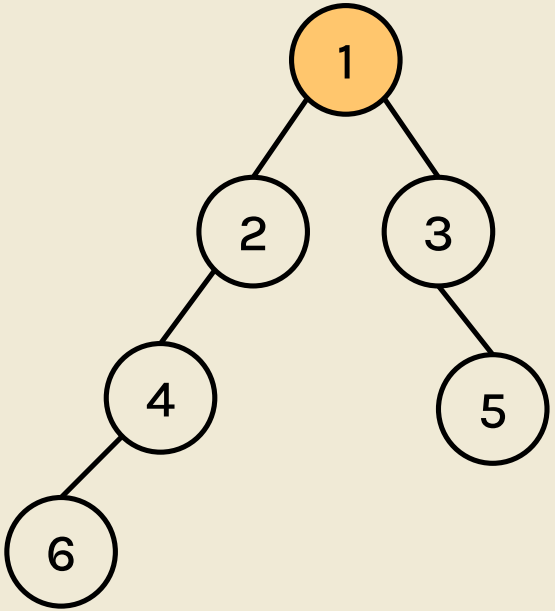
continue until there are no more items in the queue!

breadth first search



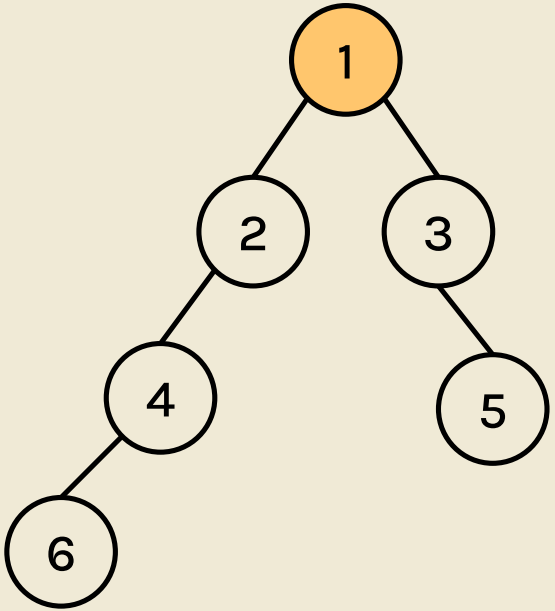
queue: {1}

breadth first search



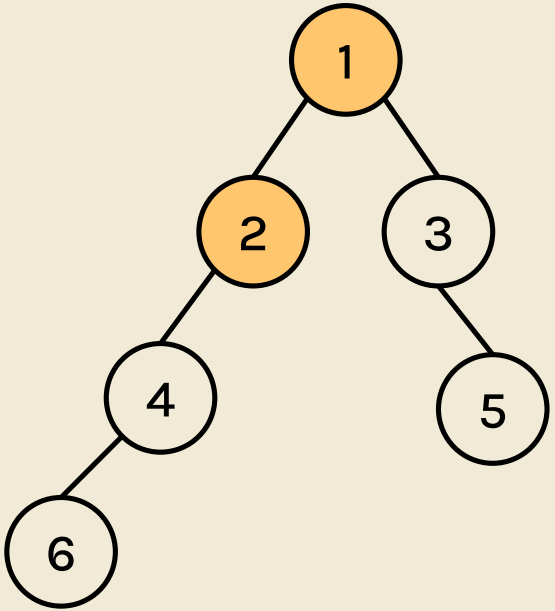
queue: {~~1~~, 2, 3}

breadth first search



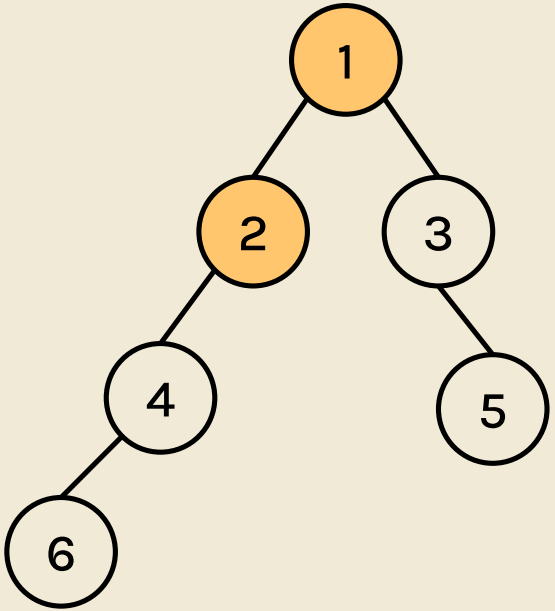
queue: {2, 3}

breadth first search



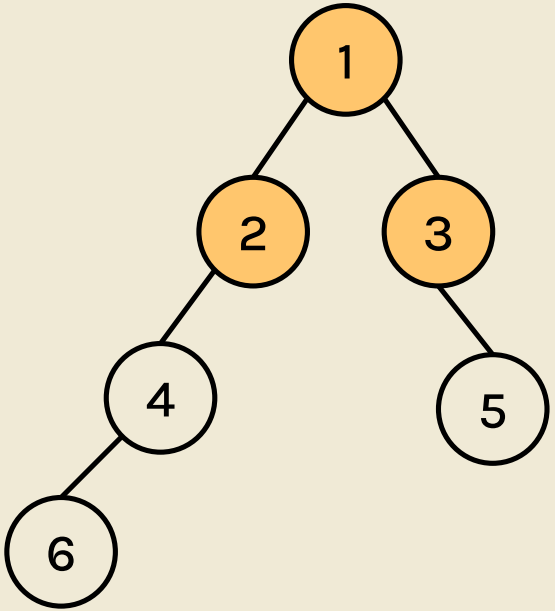
queue: {~~2~~, 3, 4}

breadth first search



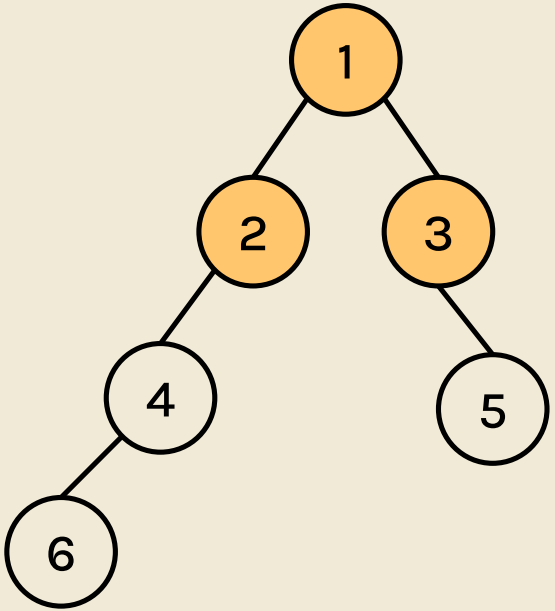
queue: {3, 4}

breadth first search



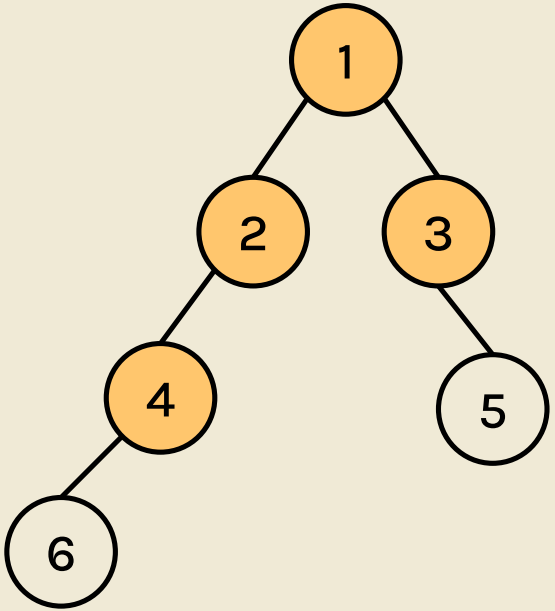
queue: {~~3~~, 4, 5}

breadth first search



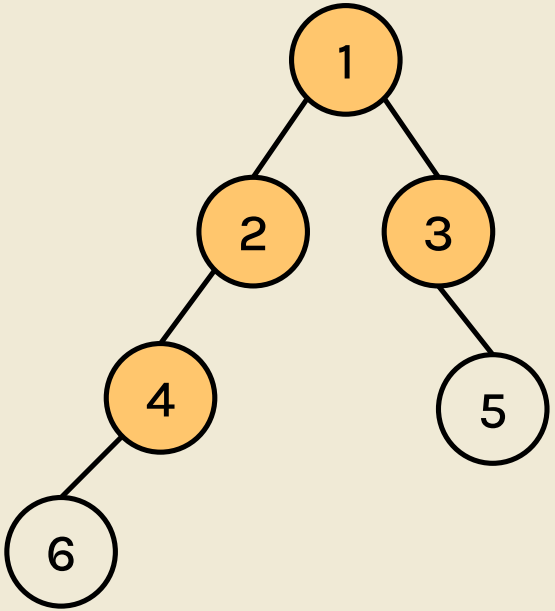
queue: {4, 5}

breadth first search



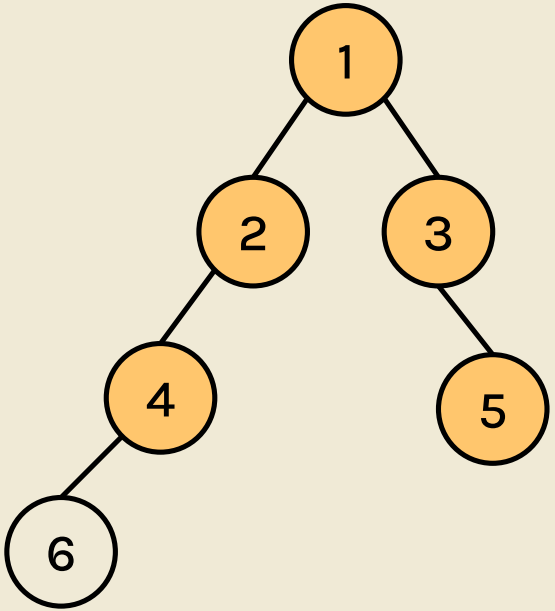
queue: {~~4~~, 5, 6}

breadth first search



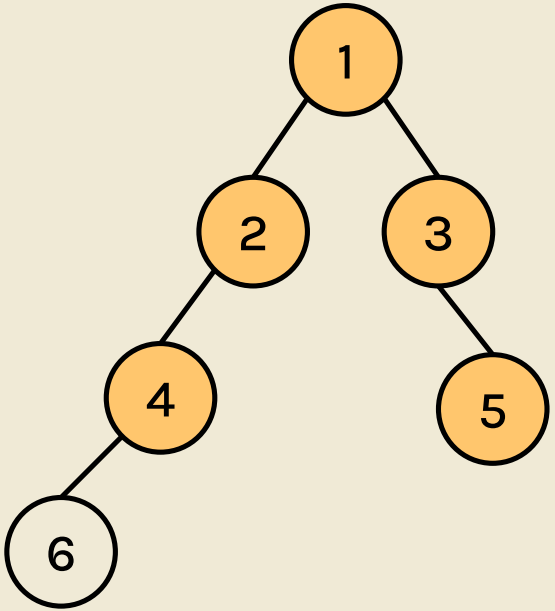
queue: {5, 6}

breadth first search



queue: {~~5~~, 6}

breadth first search



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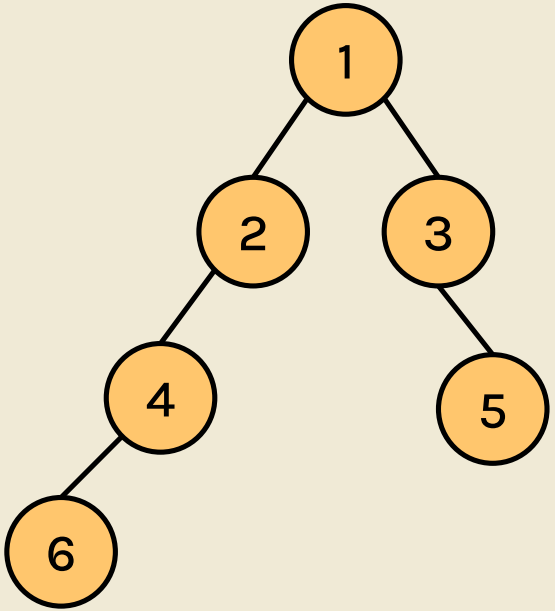
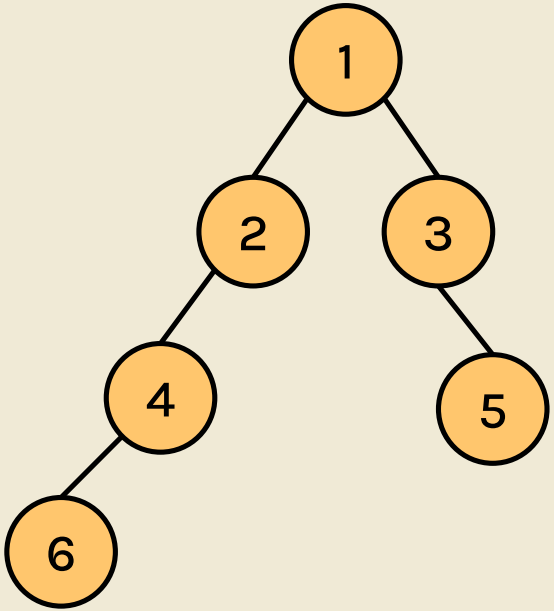
breadth first search



queue: {~~6~~}

breadth first search



queue: {}

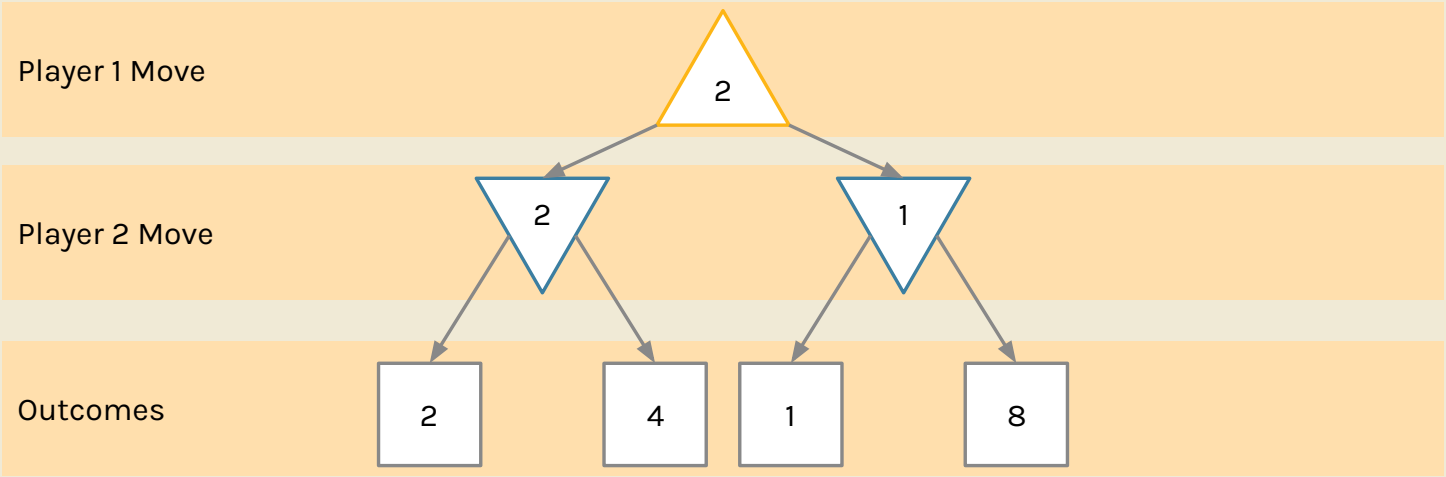
end of iteration!

game trees/min-max trees

- showcases the outcomes of a two player game
  - one player tries to maximize the total score, the other player tries to minimize it

game trees/min-max trees

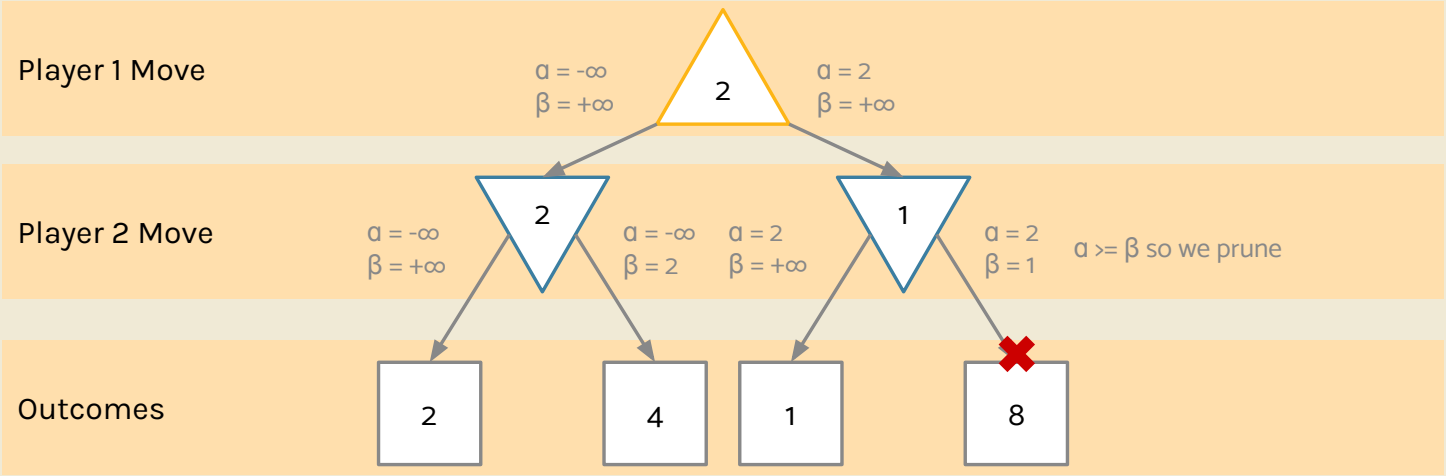
- showcases the outcomes of a two player game



alpha-beta pruning

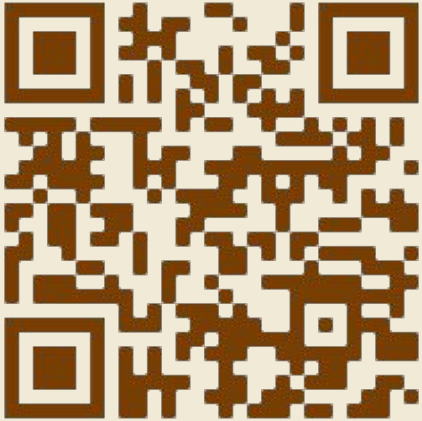
- reduces the number of nodes needed to visit to determine the best possible move for player one
- trees get combinatorially large!

alpha-beta pruning



worksheet
(on 61B website)

attendance
bit.ly/abhi-attendance



feedback
bit.ly/abhi-feedback

slides: **bit.ly/abhi-disc**