

# Tree Data Structures

July 16, 2014

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# Tree Data Structures

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3. The path from the root to any node is unique. The number of edges traverse is called the *path length*.

# Tree Data Structures

Yeah And...

- ▶ In a *Binary Tree* no node can have more than two children.
- ▶ There are a special class of trees called *Binary Search Trees*.

# Tree Data Structures

## But Why Trees?

Because finding things in LinkedLists is sloooooow when the lists are large.

*Hint:* Remember the main difference between arrays and linked lists.

# Tree Data Structures

## Examples of Binary Trees

- ▶ Filesystems
- ▶ Expression Trees (Wut?)
- ▶ Indexing/Finding stuff

# Tree Data Structures

## Binary Tree Insertion

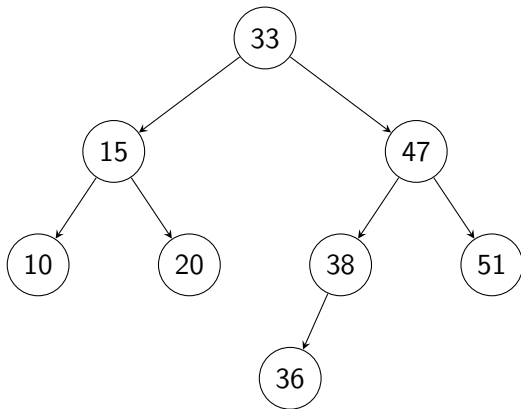
For every node  $X$ , all nodes on the left subtree have smaller values than  $X$ , and all nodes in the right subtree have values larger than  $X$ .



# Tree Data Structures

## Binary Tree Traversal

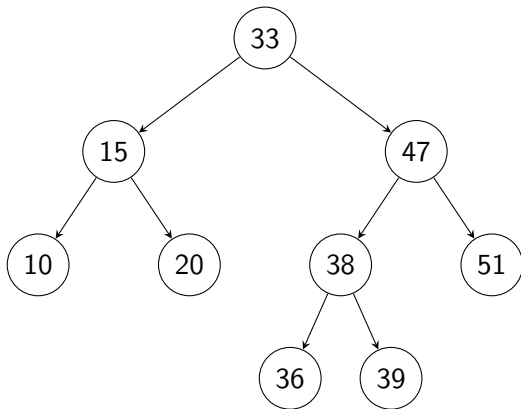
Insert 39



# Tree Data Structures

## Binary Tree Traversal

Insert 39





# Conway's Game of Life

A Dive into Test Driven Development

# Conway's Game of Life

## Our Goal

- ▶ Learn how to work in a small team.
- ▶ Learn how to digest a problem with little guidance.
- ▶ Learn how to use testing to solve a problem.

# Conway's Game of Life

## The *How* and *What* of Testing

- ▶ What does a testing suite look like?
- ▶ What should you test?
- ▶ What things should one consider before writing your first test?
- ▶ How many asserts should you have per test?

# Conway's Game of Life

## The Rules

1. Any live cell with fewer than two live neighbours dies, as if caused by under-population.
2. Any live cell with two or three live neighbours lives on to the next generation.
3. Any live cell with more than three live neighbours dies, as if by overcrowding.
4. Any dead cell with exactly three live neighbours becomes a live cell, as if by reproduction.

# Conway's Game of Life

## Rules of Engagement

- ▶ Work in pairs
- ▶ You have 45 minutes per session
- ▶ Erase all your code at the end of each session and switch partners.



# Conway's Game of Life

## How to Win

- ▶ Implement Conway's rules
- ▶ Verify correctness using 2 Still Lives and 2 Oscillators (i.e. passing tests).

# Conway's Game of Life

## Bootstrap

- ▶ Focus on how you want to store the data.
- ▶ How will you define a live cell?
- ▶ How will you define a 'world'?