CS 225

Data Structures

Feb. 26 – BST Balance

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Course Logistics Update

CBTF exams will go on as-scheduled:

- Theory Exam 2 starts tomorrow
- Sample Exam available on PL

MPs and Lab assignments will be released on schedule:

- MP3 is due tonight (11:59pm)
- MP4 will be released tomorrow
- lab_huffman will be released on Wednesday

We'll chat about additional logistics on Wednesday regarding lab sections *(if necessary)*

Interactive Lecture Questions

- **Ask Questions**: Ask in-lecture questions using this Google Form! Questions are reviewed and answered live during lec
- **Detailed Answers After Lecture**: If we didn't get to answer your question in lecture, we provide detailed answers to co questions here>.
- You must be logged in with an ate tab and be asked to log in.

Lecture Videos

- Recorded on echo360.org, log

Schedule

Monday

January 15
MLK Day

January 22
Memory
slides | handout | pointers.pdf | code | TA Notes

slides | handout | Binky Pointer Fun | code | TA Notes

slides | handout | arrays.pdf | parameters | code | TA Notes

otes

CS 225 - Lecture Questions

Your email address (**waf@illinois.edu**) will be recorded when you submit this form. Not you? Switch account

* Required

Question for Lecture: *

Your answer

SUBMIT

Never submit passwords through Google Forms.

BST Analysis

Therefore, for all BST:

Lower bound: O(lg(n))

U**pper bound: O(n)**

BST Analysis

The height of a BST depends on the order in which the data is inserted into it.

ex: 1 3 2 4 5 7 6 vs. 4 2 3 6 7 1 5

Q: How many different ways are there to insert keys into a BST?

Q: What is the average height of all the arrangements?

BST Analysis

Q: How many different ways are there to insert keys into a BST?

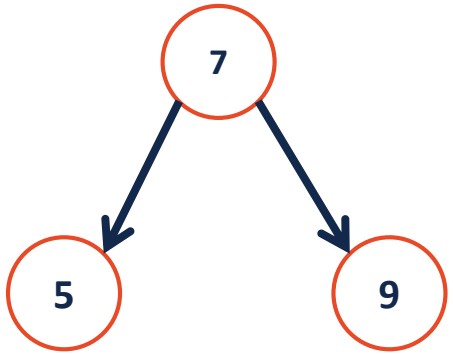
Q: What is the average height of all the arrangements?

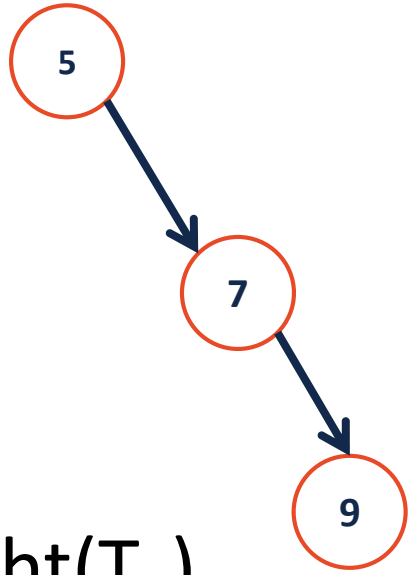
BST Analysis – Running Time

Operation	BST Average case	BST Worst case	Sorted array	Sorted List
find				
insert				
delete				
traverse				

Height-Balanced Tree

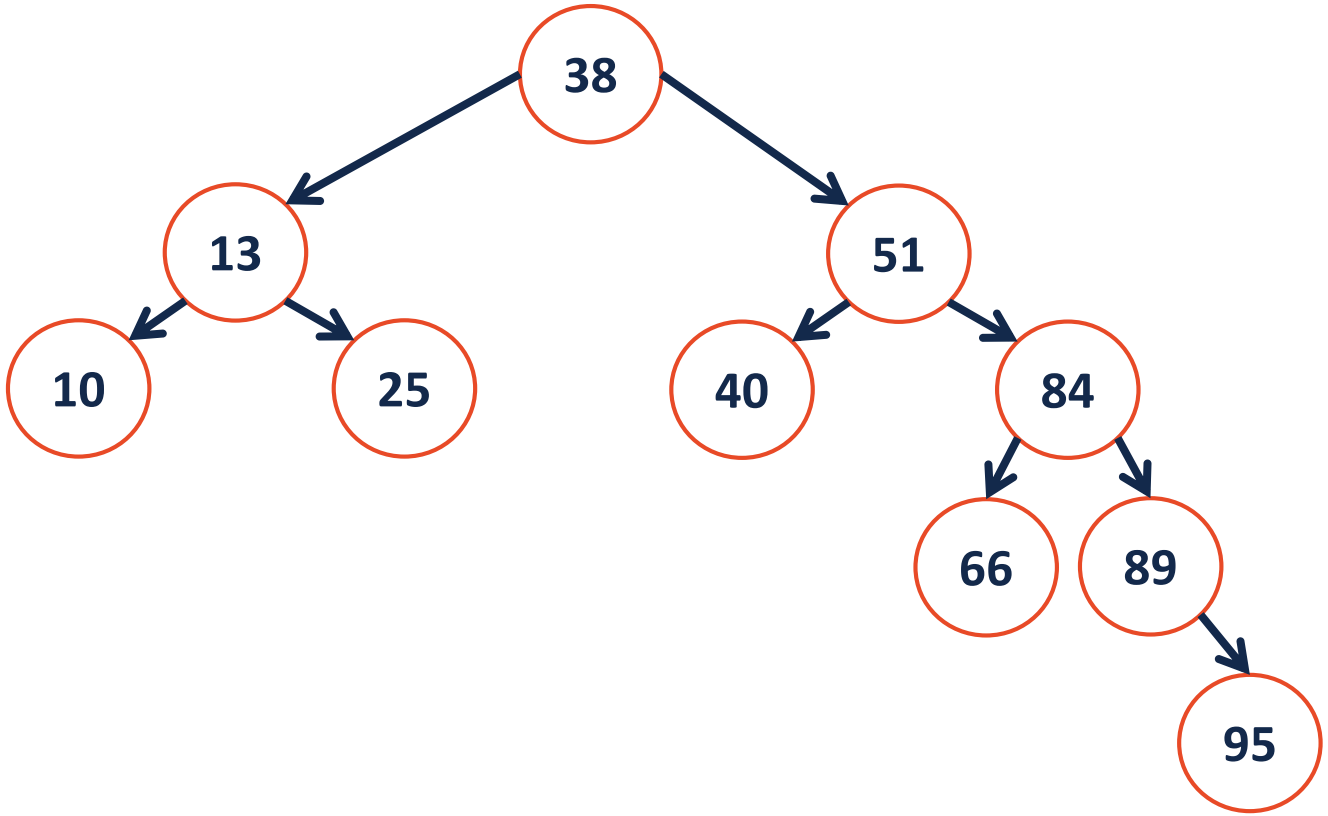
What tree makes you happier?





Height balance: $b = height(T_L) - height(T_R)$

A tree is height balanced if: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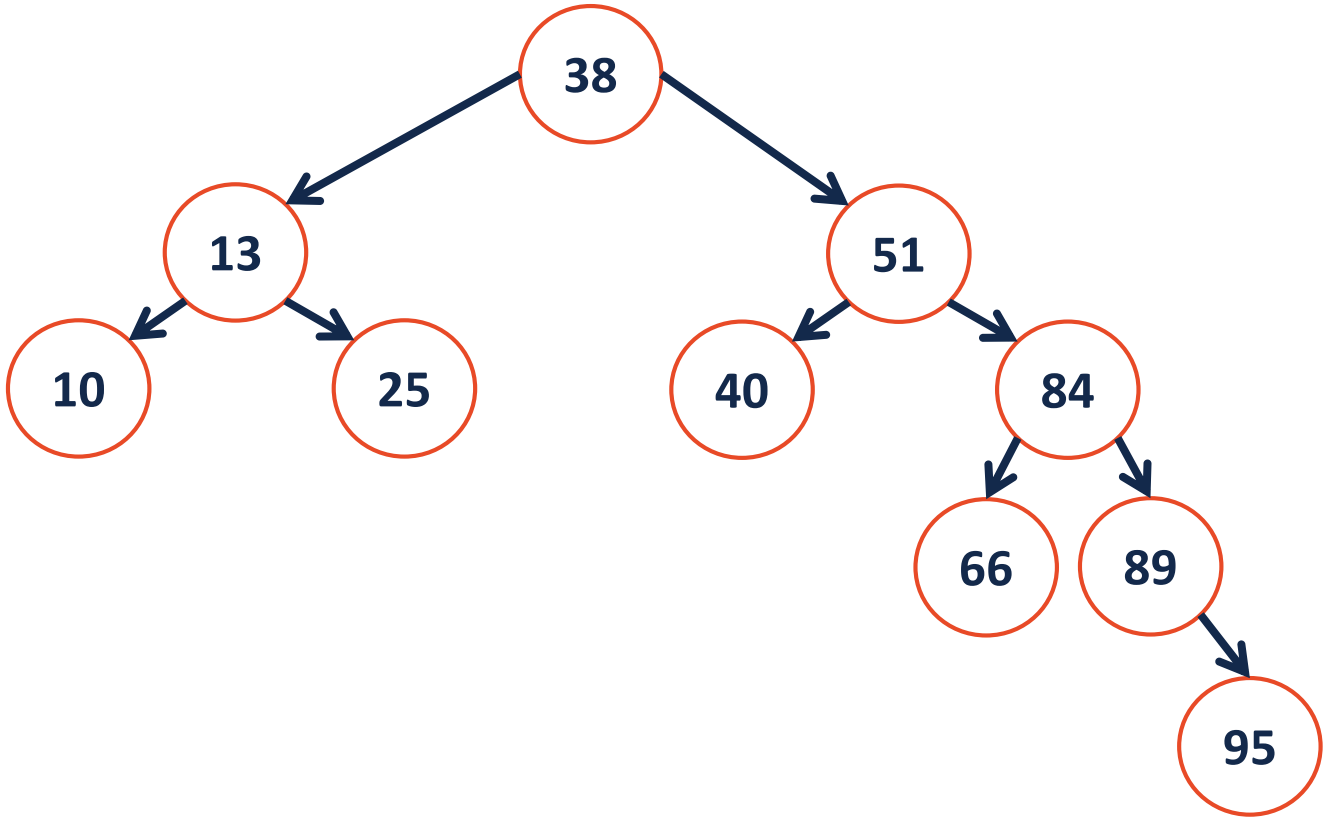
BST Rotation

We will perform a rotation that maintains two properties:

1.

2.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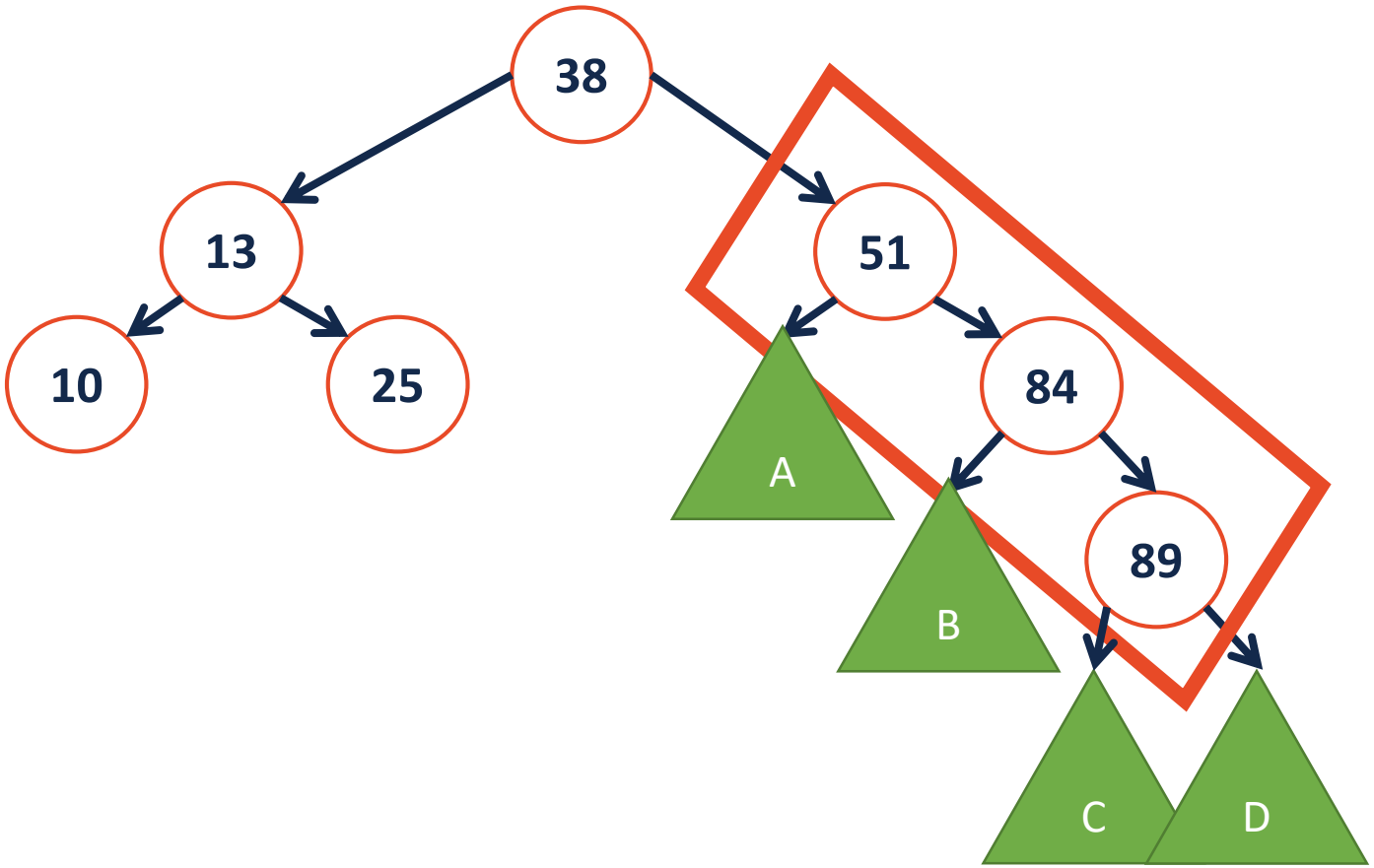
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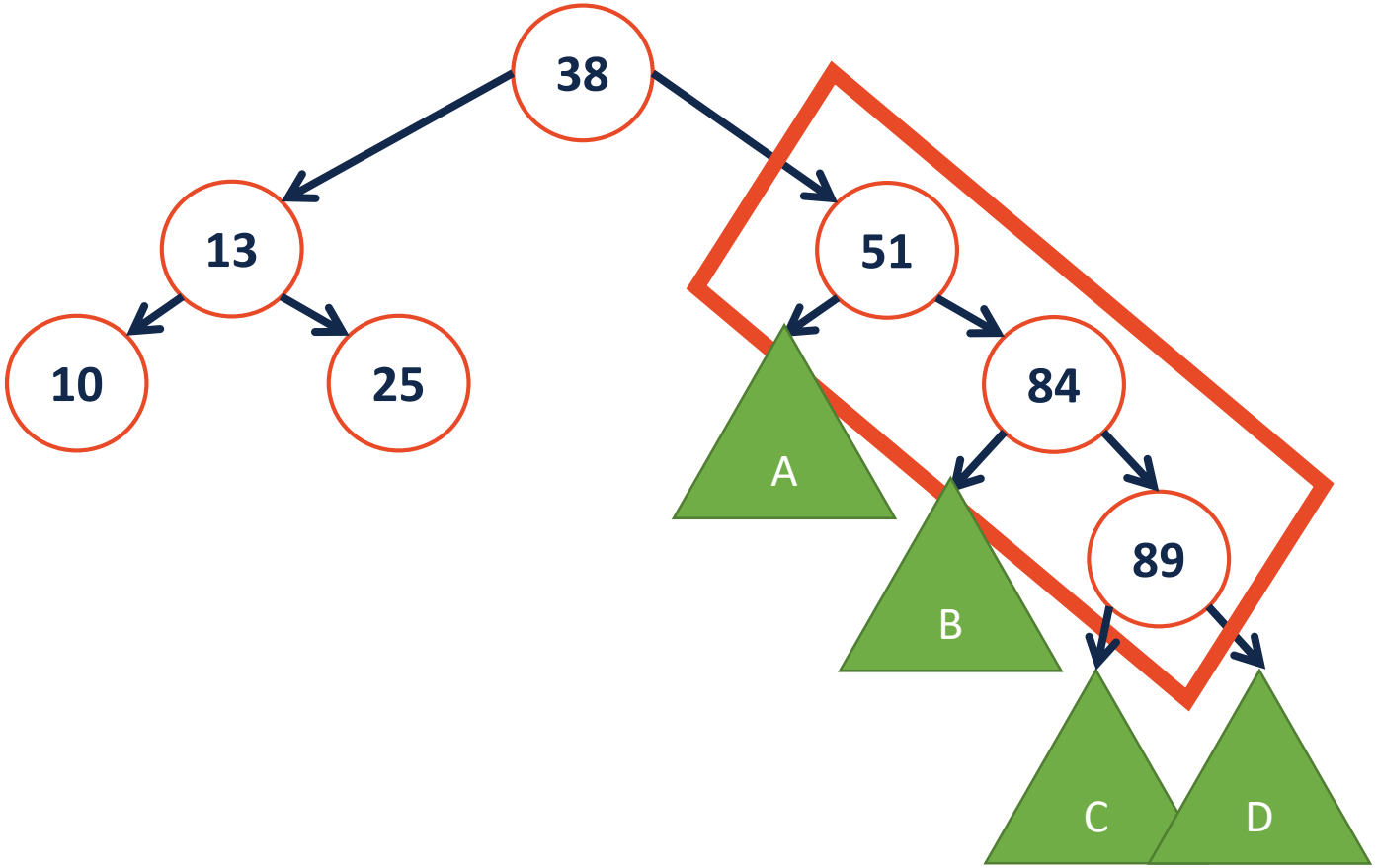
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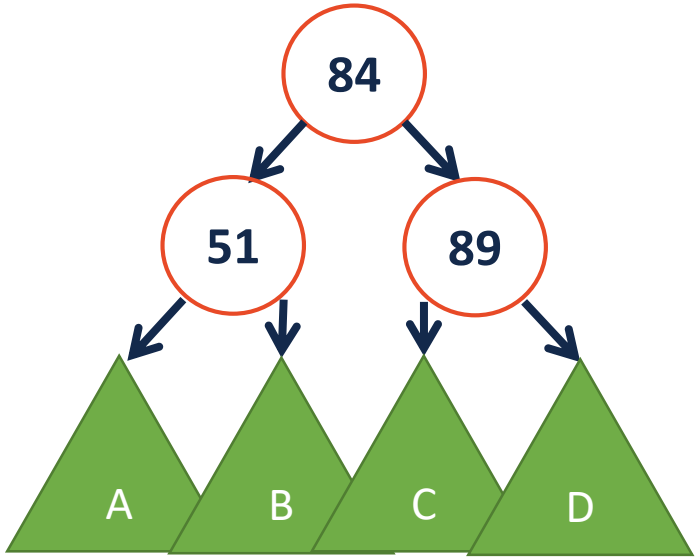
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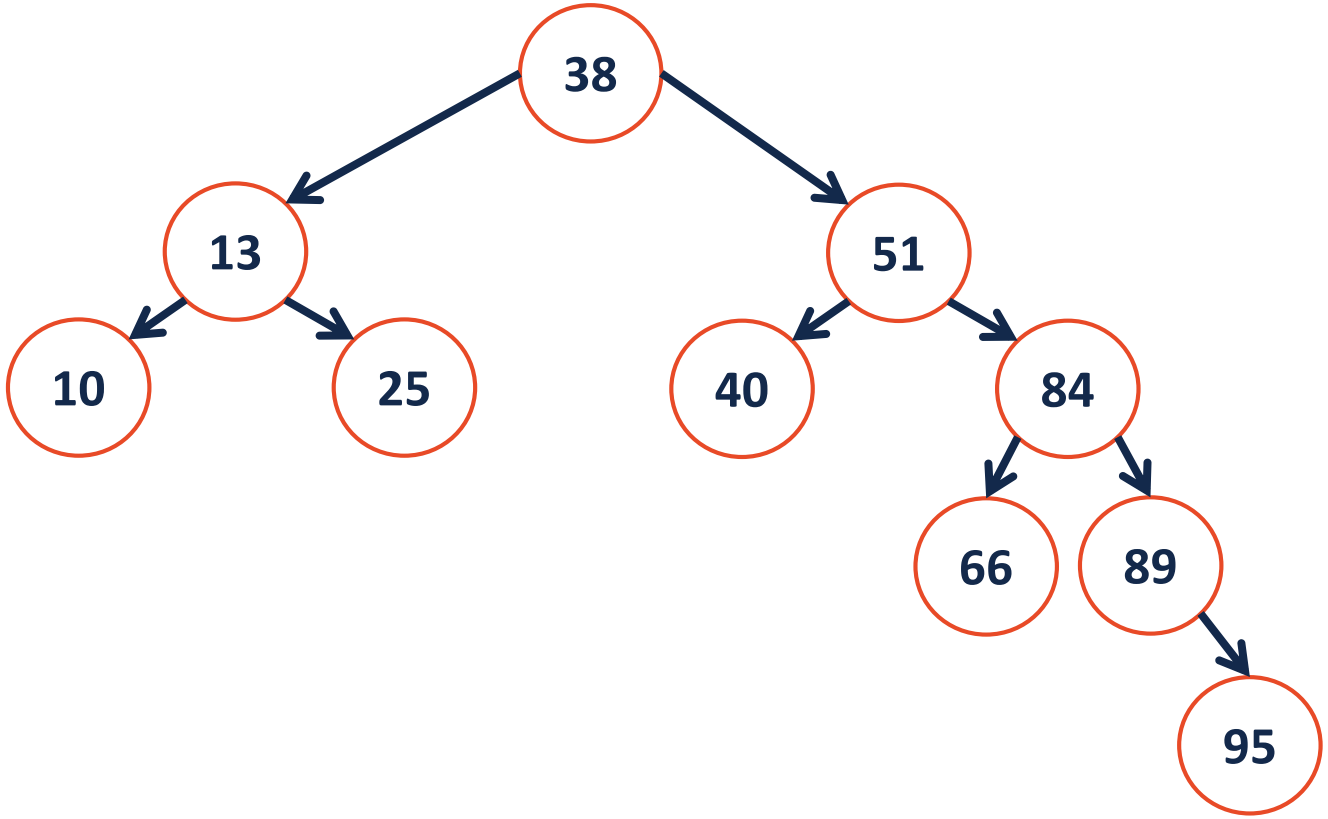
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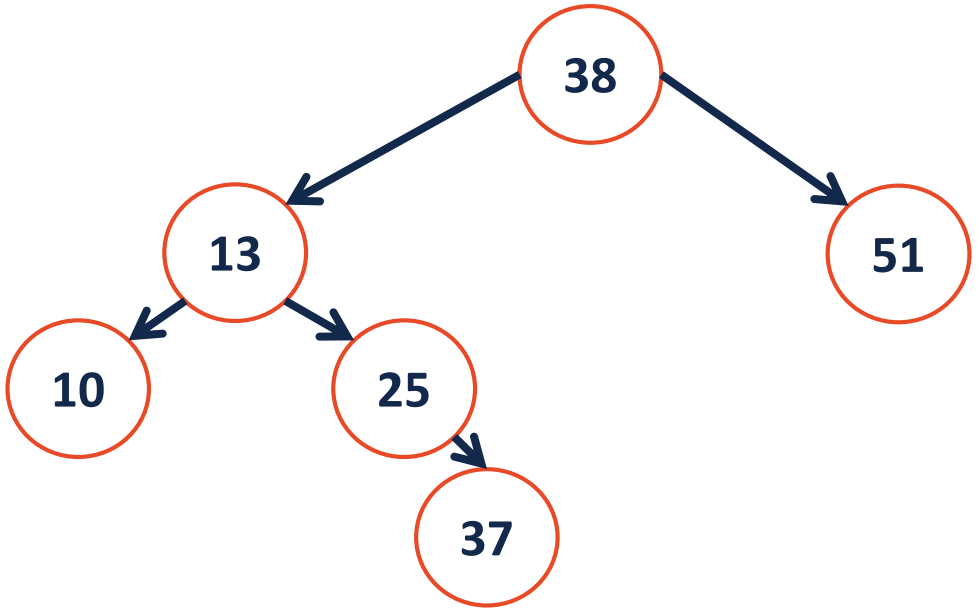
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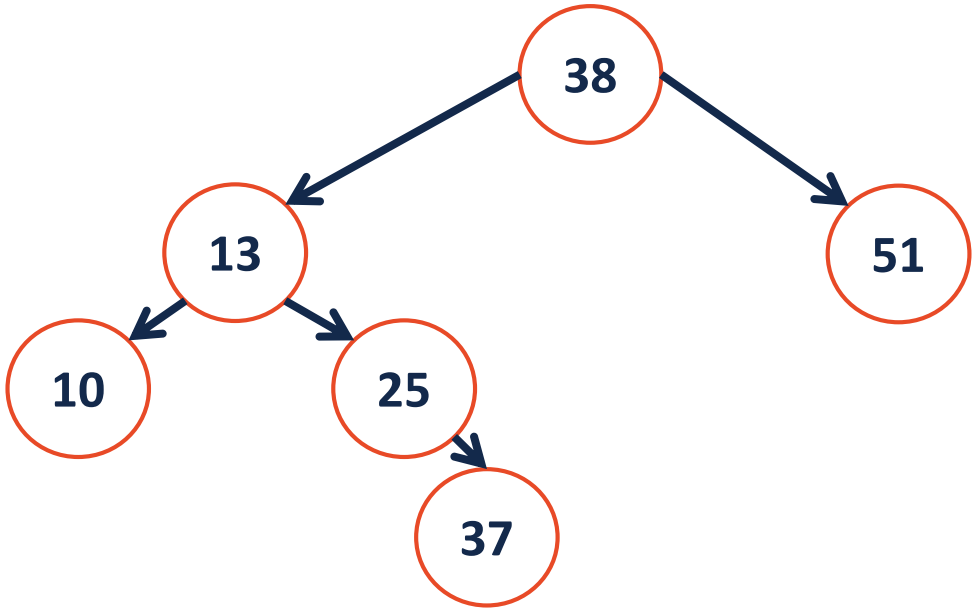
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BST Rotation Summary

- Four kinds of rotations (L, R, LR, RL)
- All rotations are local (subtrees are not impacted)
- All rotations are constant time: O(1)
- BST property maintained

GOAL:

We call these trees:

AVL Trees

Three issues for consideration:

- Rotations
- Maintaining Height
- Detecting Imbalance