Q: Give the exact height of the corresponding LLRB tree.

Q1: Given a 2-3 tree of height H, give the exact worst-case height of the corresponding LLRB tree.

Maximum Possible Height

Given a 2-3 tree of height H, give the exact worst-case height of the corresponding LLRB tree.

Q: How are 3-nodes (nodes with 2 keys) represented in the corresponding LLRB tree?

Q1: Give the exact height of the corresponding LLRB tree.
**Single Insertion**

If we add 15, which operation(s), if any, will we need to perform to maintain LLRB invariants?

- `rotateLeft(____)`
- `rotateRight(____)`
- `flip(____)`

![Tree diagram](image)

**: Draw the corresponding 2-3 tree. Then, insert 15 in to the 2-3 tree.

**Batch Insertion**

Draw the LLRB that results from inserting these items in the given order: 1, 2, 3, 7, 8, 9, 5.

**: Draw the 2-3 tree that results from inserting these items in the given order: 1, 2, 3, 7, 8, 9, 5.

**Q1: If we add 15, which operation(s), if any, will we need to perform to maintain LLRB invariants?**

**Q1: Draw the LLRB that results from inserting these items in the given order: 1, 2, 3, 7, 8, 9, 5.**