2-4 Trees

Yet Another BBST

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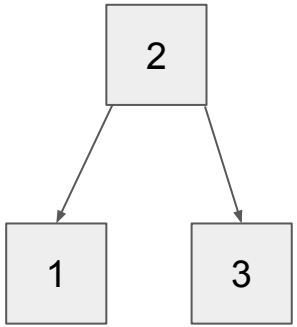

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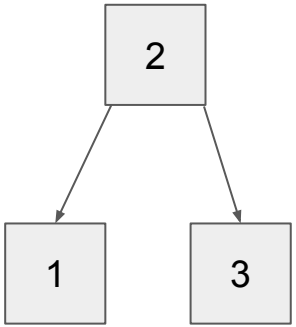
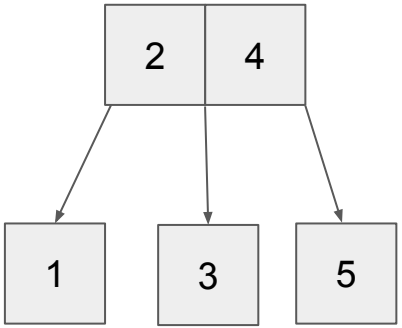


3-Node



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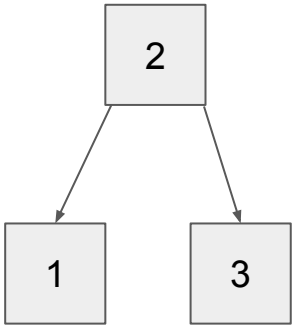

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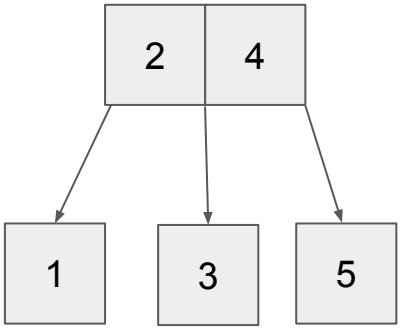
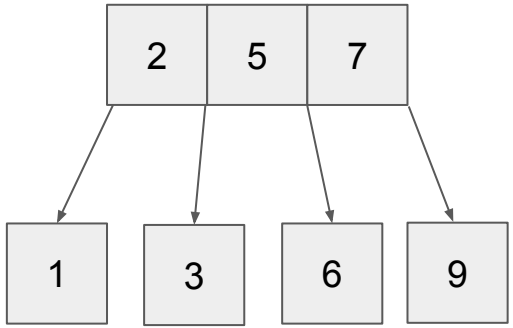


4-Node



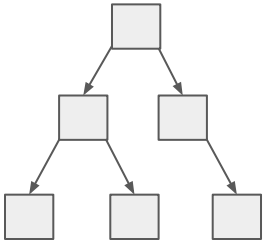
Yet Another BBST

2 rules

- Every node is either a 2, 3, or 4-Node
- All NULL nodes are on the same level of the tree

2-4 Tree Examples?

Some of these are 2-4 and some are not!



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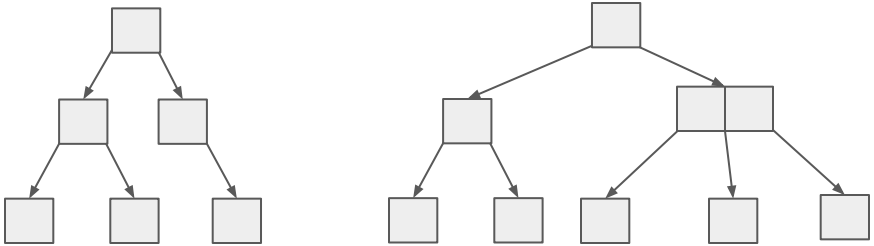

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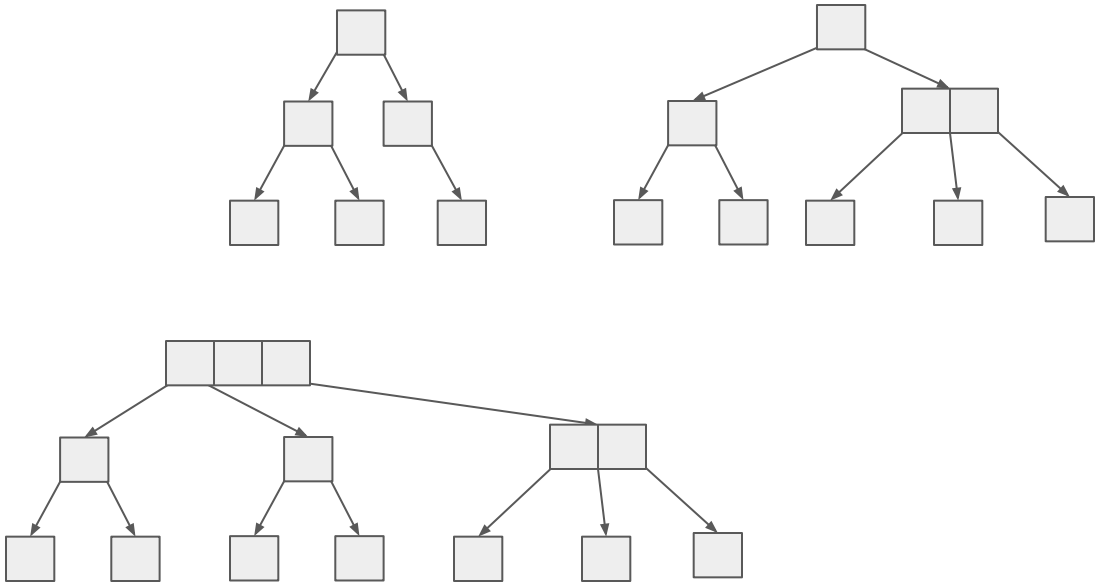

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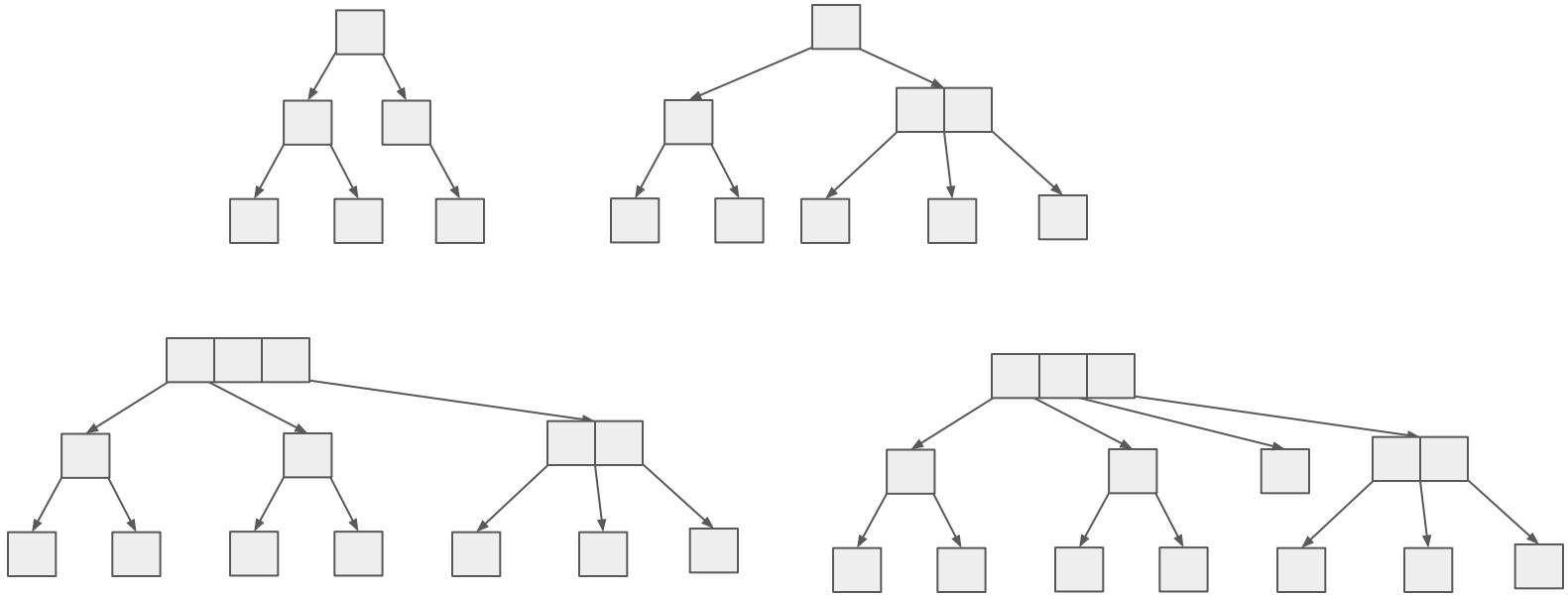

R-B / 2-4 Isomorphism

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- All 3 nodes have one value become a black node and the other a red child of the black node.
- All 4 nodes have the middle value become a black node and the other two a red child of the black node.

In all cases the parent of the node points to the black node.

2-4 Insertion

Insert()

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- Fix if the node is a 5-Node

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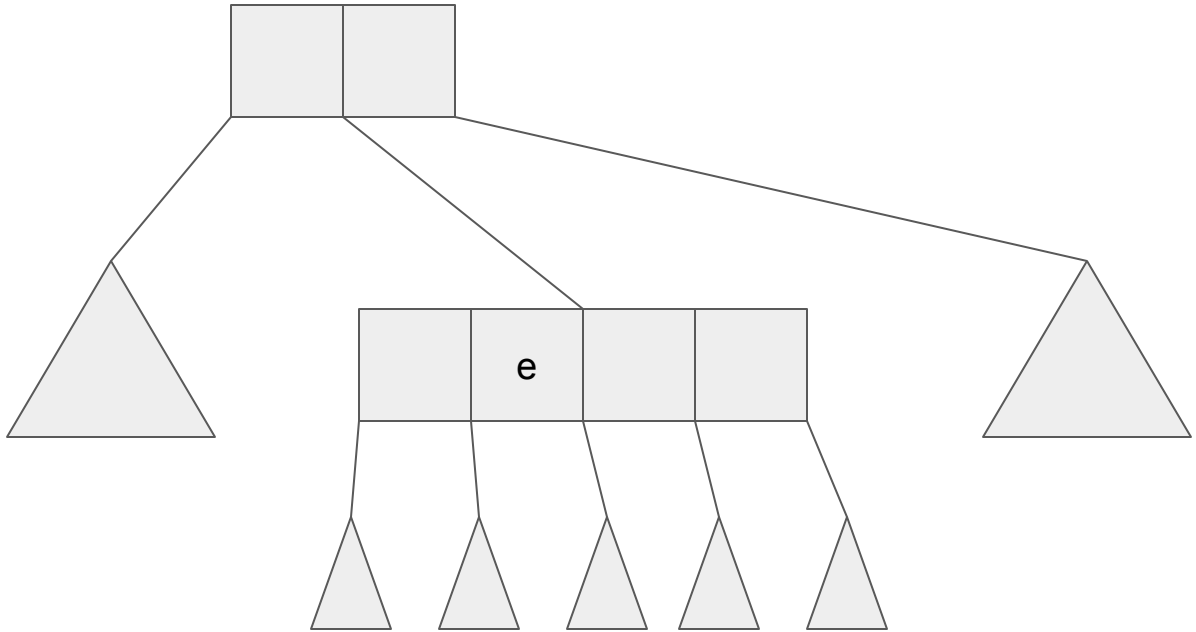
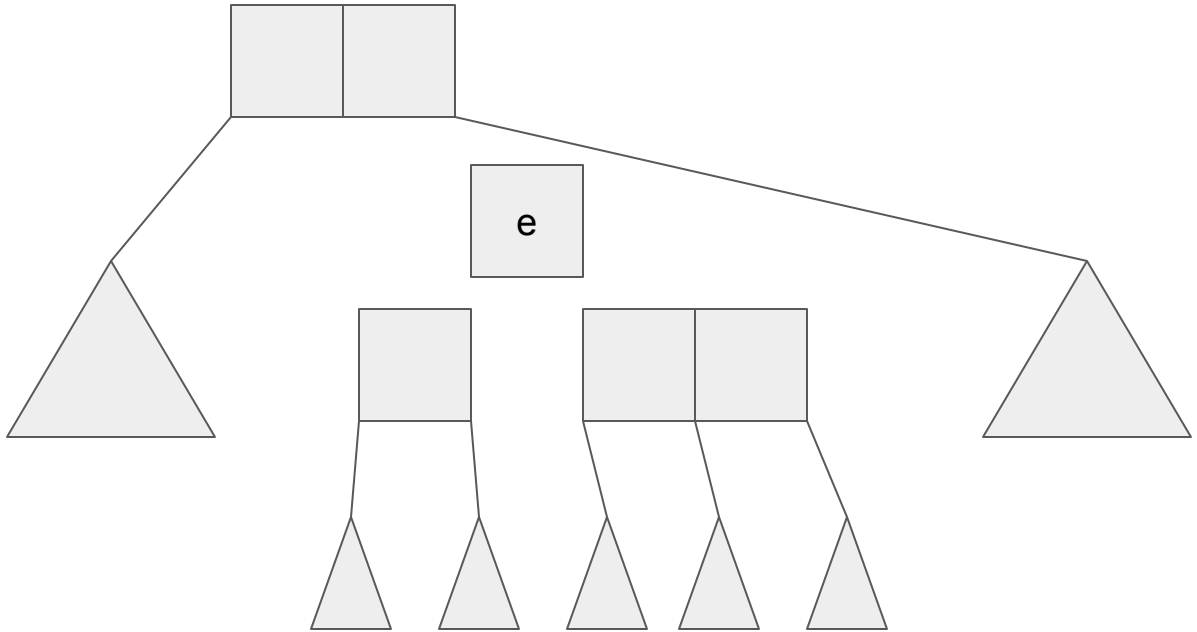
One of the middle values can be moved up into the parent.

Eviction (cont.)



Eviction (cont.)



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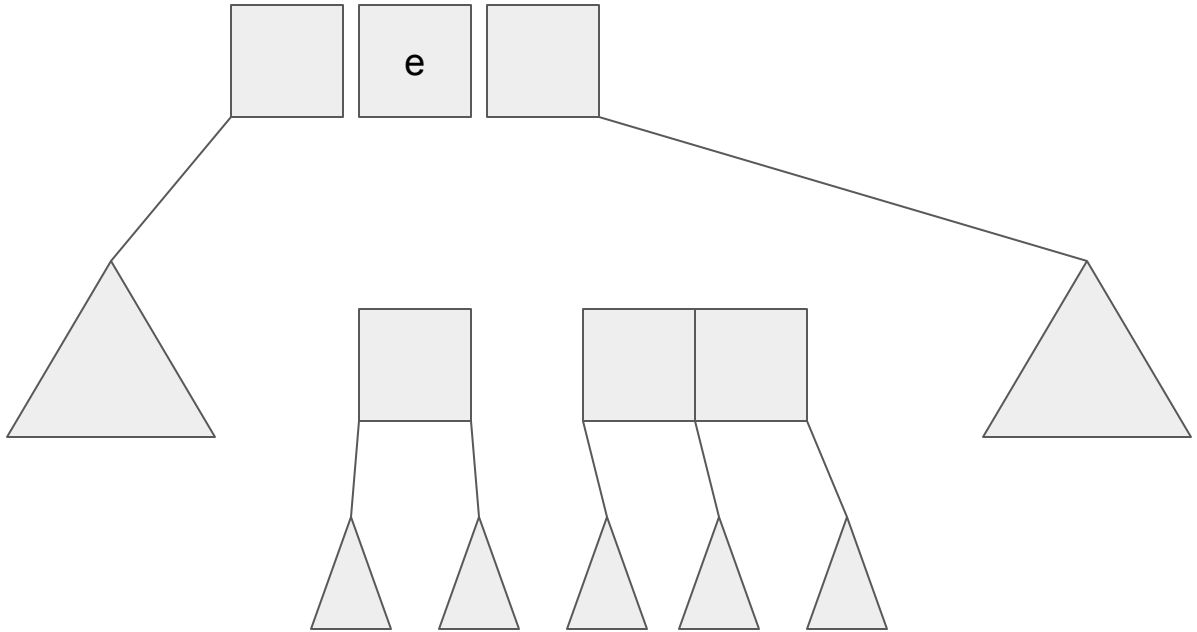

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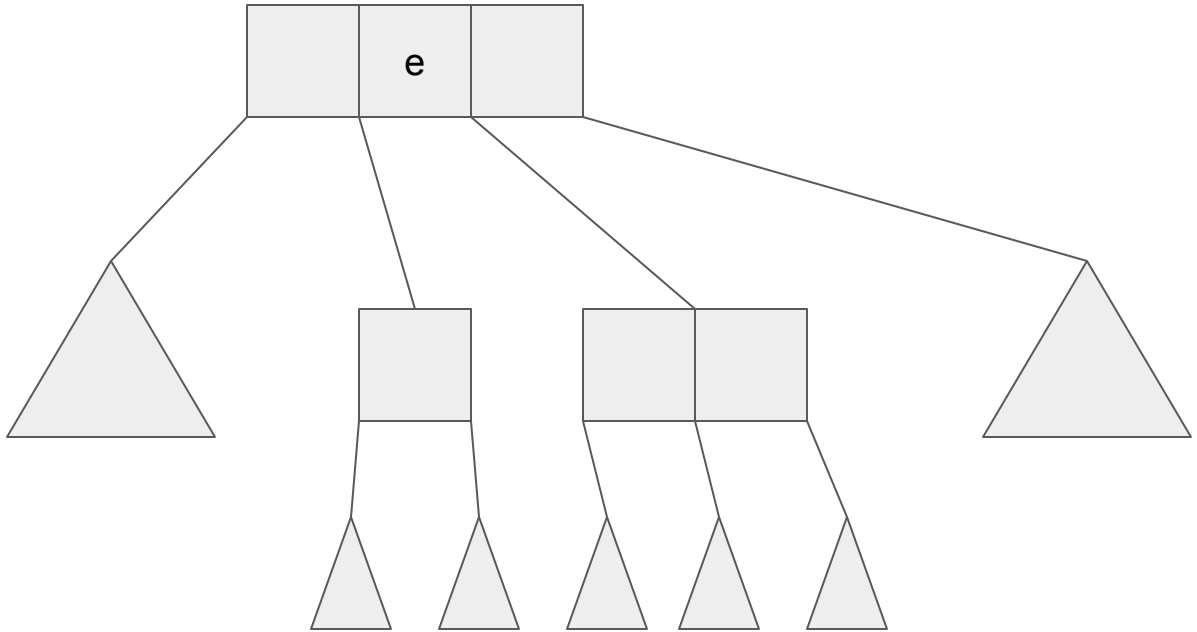

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We could create another 5-node so this is repeated until…

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- A non-5-node is made

Eviction (cont.)

We could create another 5-node so this is repeated until…

- A non-5-node is made
- A new root is made

Removal

Could be described as a case heavy nightmare

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If I have time at the end of the course (not lecture), I will go over 2-4 Removal

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2-4 Removal won’t be tested on in the first exam