

**Question 1 (30 points)** Assume that you have the following balanced-searched tree implementations:

a) AVL tree b) 2-3 tree c) 2-3-4 tree

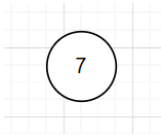
Starting with an empty balanced search tree, insert the following keys into the tree in the given order:

**7, 91, 3, 24, 12, 33, 45, 61, 57**

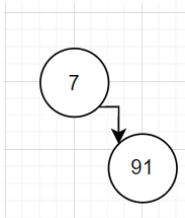
*I used draw.io website to draw the diagrams*

**a) AVL tree**

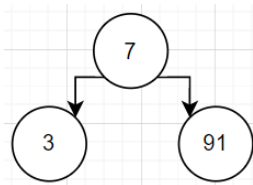
**Inserting 7:**



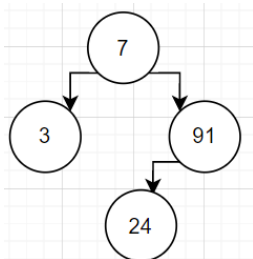
**Inserting 91:**



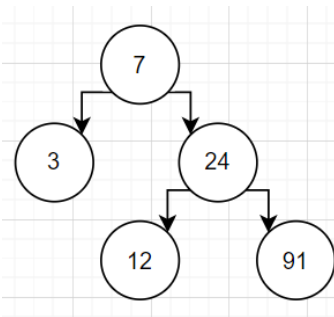
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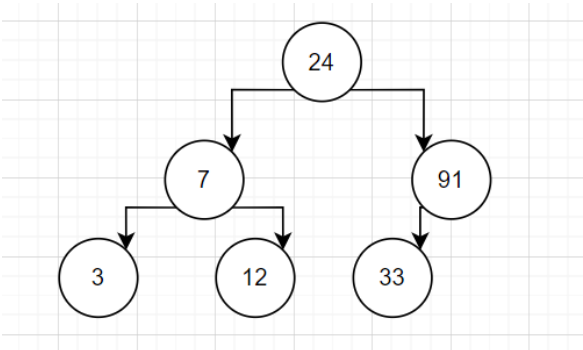
**Inserting 24:**



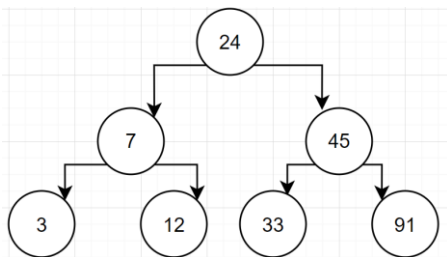
**Inserting 12:**



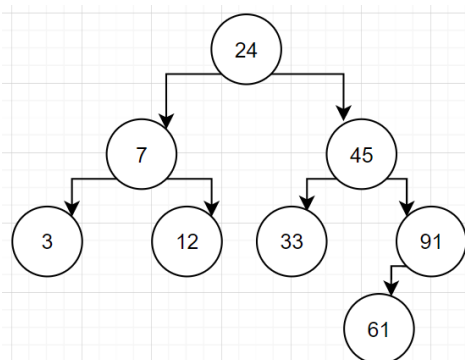
**Inserting 33:**



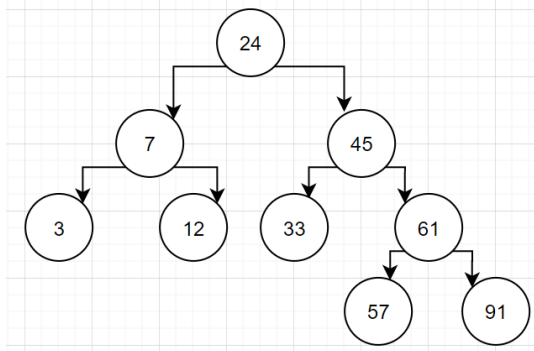
**Inserting 45:**



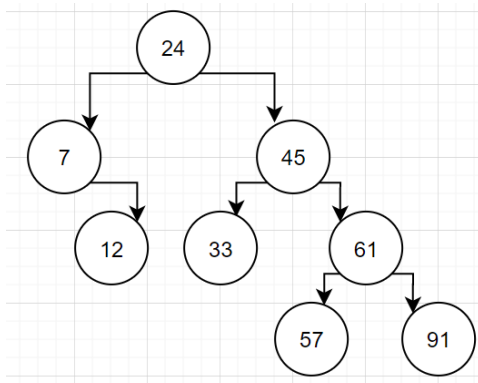
**Inserting 61:**



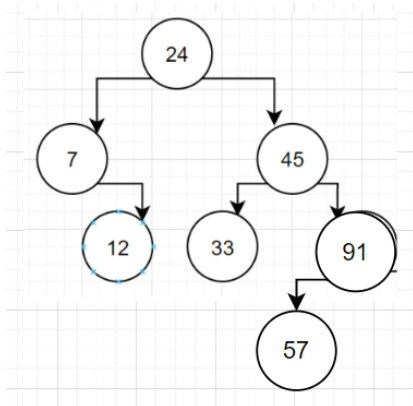
**Inserting 57:**



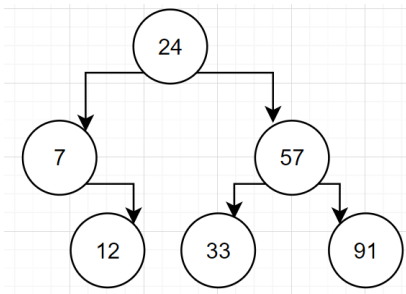
**Deleting 3:**



**Deleting 61:**



**Deleting 45:**

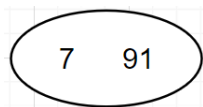


**b) 2-3 tree**

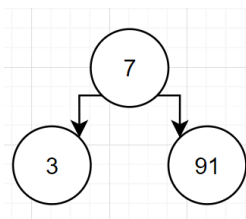
**Inserting 7:**



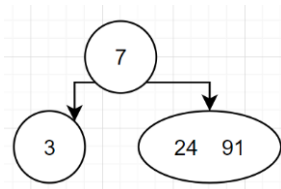
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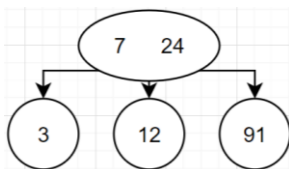
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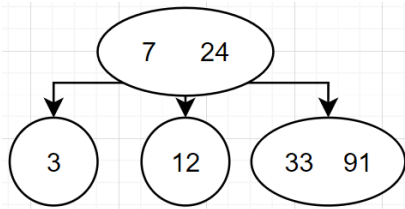
**Inserting 24:**



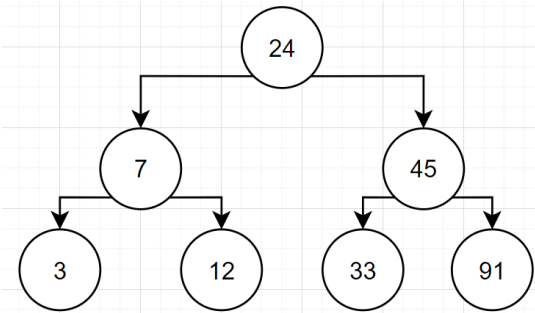
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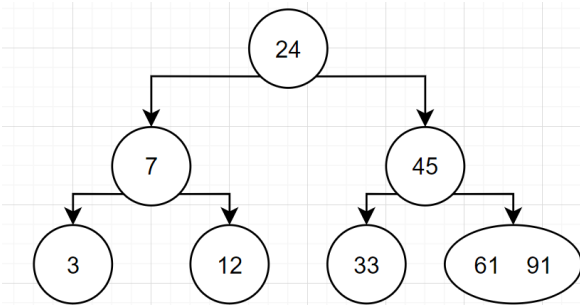
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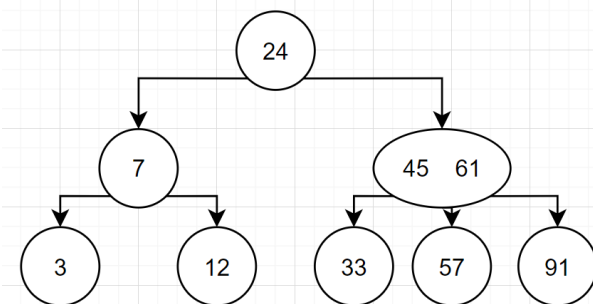
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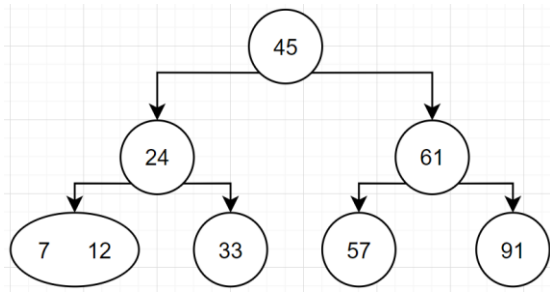
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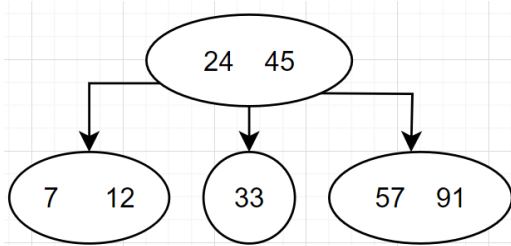
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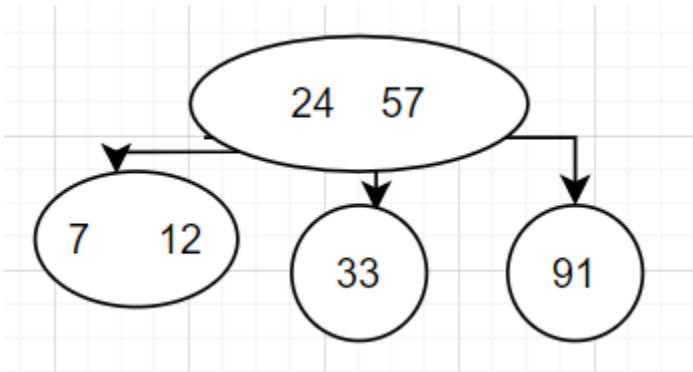
**Deleting 3:**



**Deleting 61:**

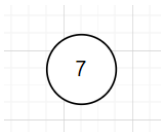


**Deleting 45:**

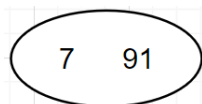


**c) 2-3-4 tree**

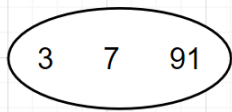
**Inserting 7:**



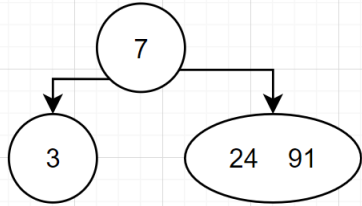
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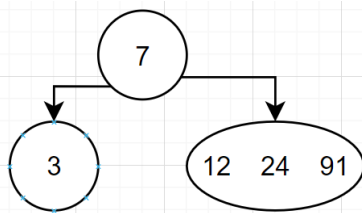
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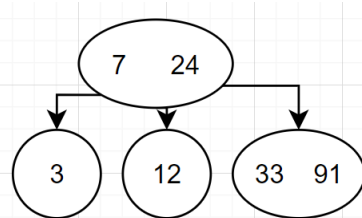
**Inserting 24:**



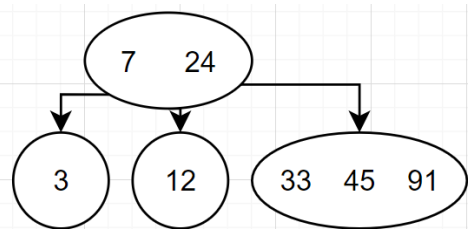
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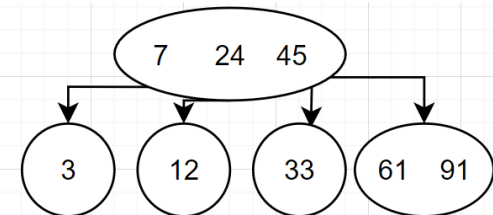
**Inserting 33:**



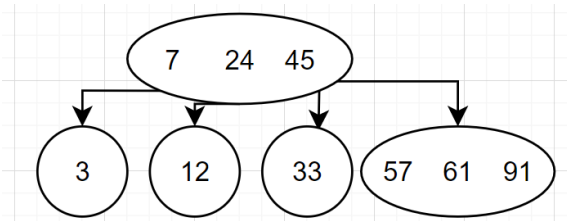
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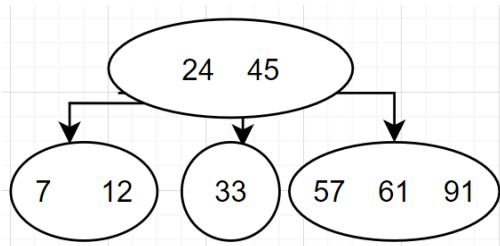
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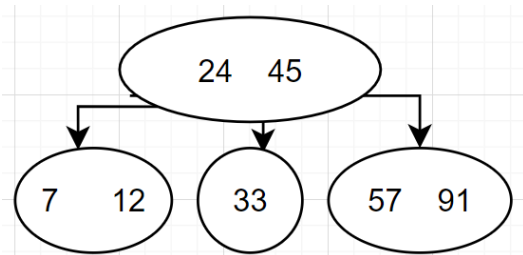
**Inserting 57:**



**Deleting 3:**



**Deleting 61:**



**Deleting 45:**

