**Exercise on AVL Trees**

TUTORIAL QUESTION

24, 12, 5, 30, 20, 45, 11, 13, 9, 16

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| Insert 24, 12, 5 🡪 Check Balanced Tree 🡪 Unbalanced at **24** | | |
| LEFT HEAVY  **Right** ROTATION | **C** | **N** |
| **C**  N is the child of C | | |

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| Insert 30, 20, 45 🡪 Check Balanced Tree 🡪 Unbalanced at **12** | | |
| RIGHT HEAVY  **Left** ROTATION | **C** | **N** |
|  | **C** | **N** |
| **C**    N is the child of C | | |

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| Insert 11, 13, 9 🡪 Check Balanced Tree 🡪 Unbalanced at **5** | | |
| **RIGHT-LEFT ROTATION**  **Right** ROTATION  **Left** ROTATION | **C1** | **N1** |
| **Right** ROTATION | **C1** | **N1** |
| **Left** ROTATION | **C2** | **N2** |
| **DOUBLE ROTATION** | | |

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| Insert 16 🡪 Check Balanced Tree 🡪 Unbalanced at **20** | | |
| **LEFT-RIGHT ROTATION**  **Left** ROTATION  **Right** ROTATION | **C1** | **N1** |
| **Left** ROTATION | **C1** | **N1** |
| **Right** ROTATION | **C2** | **N2** |
| **DOUBLE ROTATION** | | |

|  |  |
| --- | --- |
| INSERT | 7 |
| INSERT | 2 |
| INSERT | 8 |
| INSERT | 6 |
| INSERT | 9 |
| **INSERT** | **3** |
| **INSERT** | **4** |
| **INSERT** | **5** |
| **DELETE** | **9** |

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| Insert 7, 2, 8, 6, 9, 3 🡪 Check Balanced Tree 🡪 Unbalanced at **\_\_\_\_\_** | | |
| **RIGHT-LEFT ROTATION**  **\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_** | **C1** | **N1** |
| **\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_** ROTATION |  |  |
| **\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_** ROTATION | **C2** | **N2** |
|  | | |

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| Insert 4, 5 🡪 Check Balanced Tree 🡪 Unbalanced at **\_\_\_\_\_** | | |
| **LEFT-RIGHT ROTATION**  **\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_** | **C1** | **N1** |
| **\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_** ROTATION |  |  |
| **\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_** ROTATION | **C2** | **N2** |
|  | | |

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| DELETE 9 🡪 Check Balanced Tree 🡪 Unbalanced at **\_\_\_\_\_** | | |
| **LEFT-RIGHT ROTATION**  **\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_**  **\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_** | **C1** | **N1** |
| **\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_** ROTATION |  |  |
| **\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_** ROTATION | **C2** | **N2** |
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