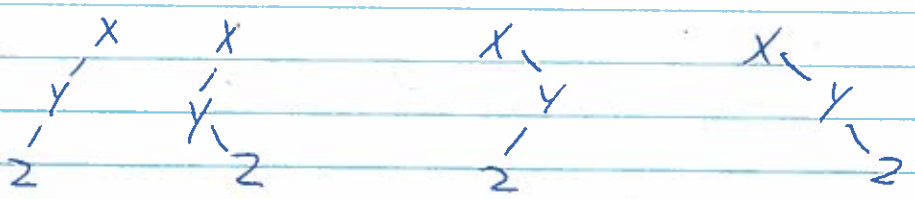
Andrew Pan

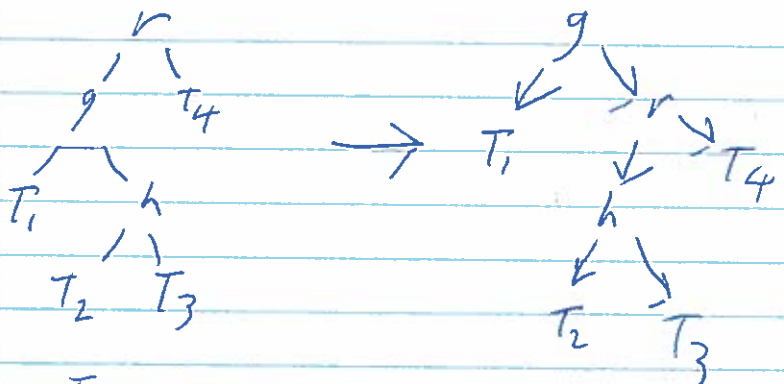
Completed without assistance or external resources

1. 0. $T_1 < T_2$
   1. $T_1 < c <= T_2 < b <= T_3$
   2. $T_1 < d <= T_2 < e <= T_3$
   3. $T_1 < g <= T_2 < h <= T_3 < r <= T_4$

4. 

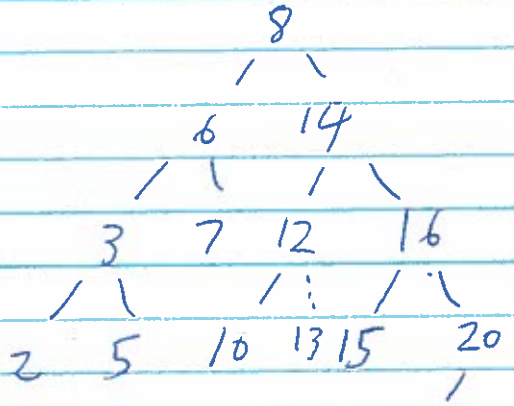
$Z < Y < X$, $Y <= Z < X$, $X <= Z < Y$, $X <= Y <= Z$

5. The property does not hold true for the tree from problem 3, as there are subtrees ($T_2$ vs. $T_4$) that begin 2 levels apart, so the tree is unbalanced, there are no other three-internal-node trees given, so none are balanced (almost-balanced).

6. 

To rebalance the tree, I selected the next smallest child of r to make the new root, and made r g's right-child, and moved g's right child subtree to r's new left subtree.

7.

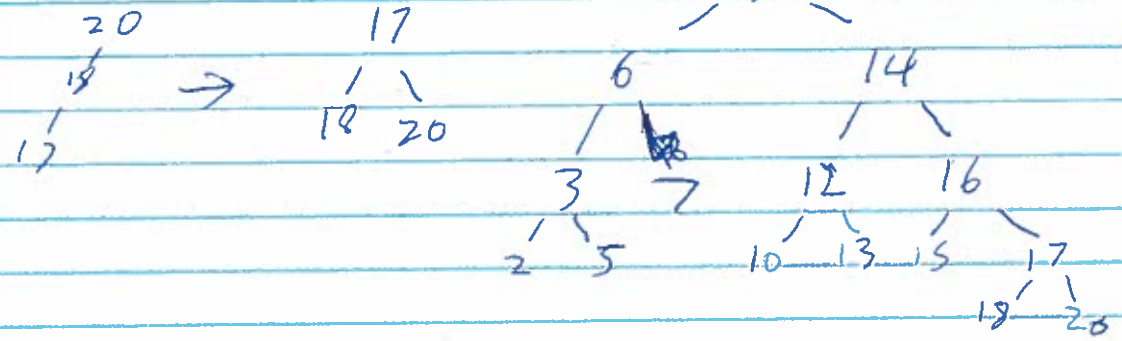



| Node | Depth Difference |
|---|---|
| 8 | 1 |
| 6 | 1 |
| 3 | 0 |
| 14 | 1 |
| 12 | 1 |
| 16 | 1 |
| 20 | 1 |

8. Right child of 12, yes

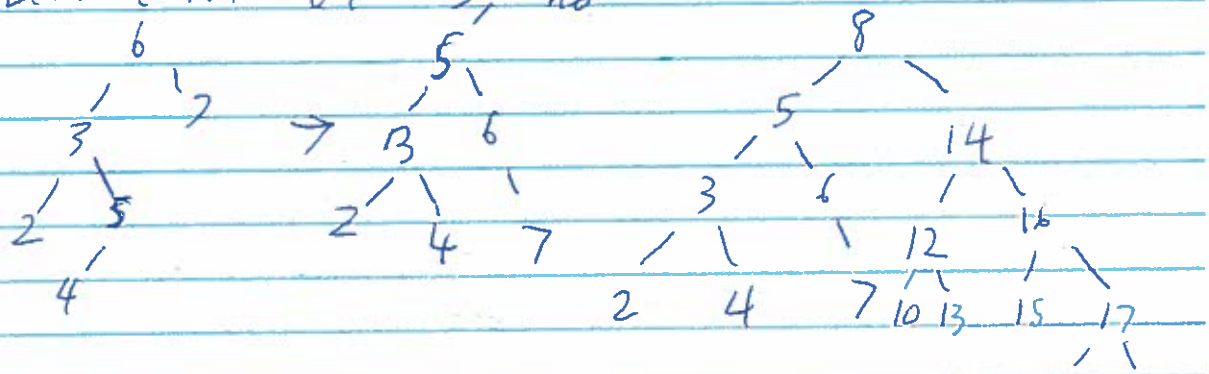
9. Left node of 18, no

11.




10. Left child of 5, no

11.




12. No because rebalancing a tree that was made unbalanced by a single insertion will only reduce the depth of the subtree, making it the same depth as before the insertion, so only that one branch will need to be changed.