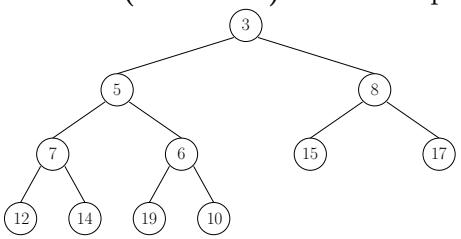
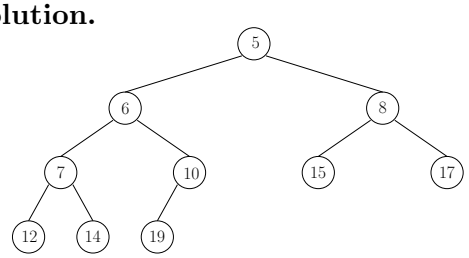
CSCI2100/ESTR2102: Quiz 3

Name: Student ID:

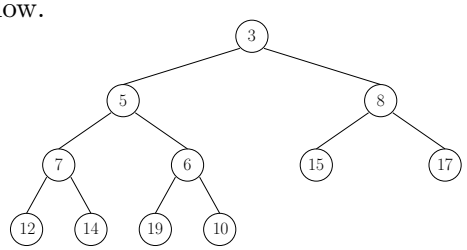
Problem 1 (15 marks). Show the priority queue after a delete-min on the priority queue below:



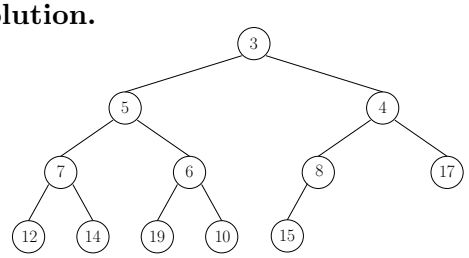
Solution.



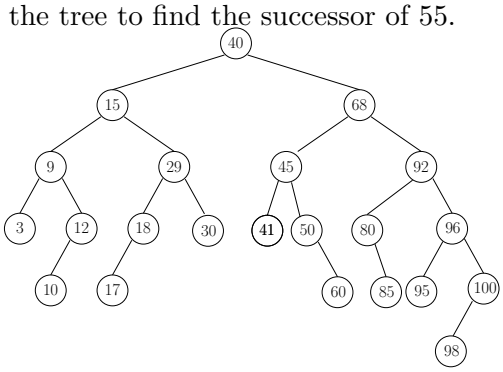
Problem 2 (15 marks). Show the priority queue after inserting the number 4 into the priority queue below.



Solution.

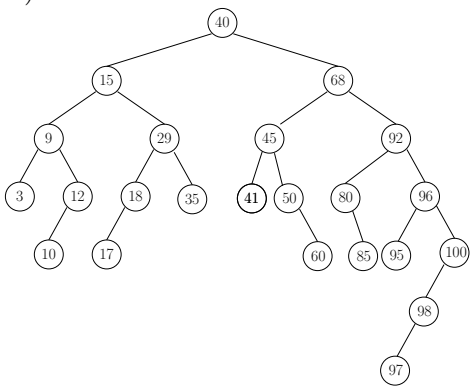


Problem 3 (15 marks). Consider the following AVL-tree. Give the sequence of nodes visited when we use the tree to find the successor of 55.



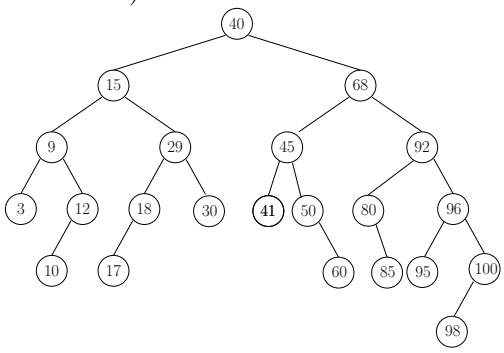
Solution. Nodes 40, 68, 45, 50, 60.

Problem 4 (15 marks). Indicate the imbalanced nodes in the following AVL-tree (there are five of them).

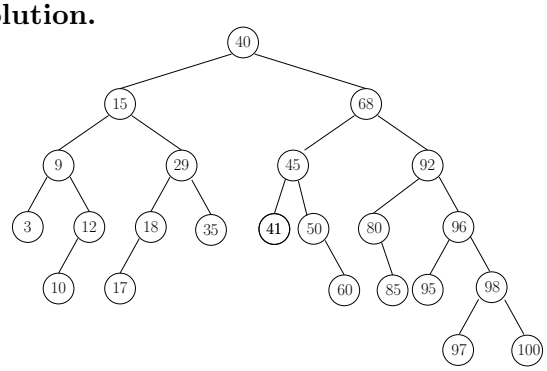


Solution. Nodes 40, 68, 92, 96, 100.

Problem 5 (20 marks). Consider the following AVL-tree. Suppose that we insert the integer 97 into the tree. Show the resulting AVL-tree after fixing the imbalanced nodes (using the algorithm we discussed in the lecture).



Solution.



Problem 6 (20 marks). Describe how to use an AVL-tree to implement a priority queue. Recall that a priority queue supports two operations on a set S of integers:

- Insert(e): add a new integer e to S.

- Deletemin: remove the smallest integer from S.

Your implementation should perform each operation in $O(\log n)$ time where $n = |S|$.

Solution. For insert(e), simply insert e into the AVL-tree. For deletemin, keep descending to the left child until reaching a node u with no left child. Delete the element stored in u.