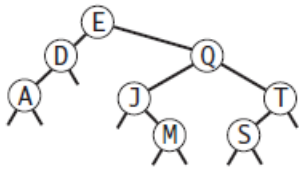
Exercise 3.2.15

3.2.15 Give the sequences of nodes examined when the methods in BST are used to compute each of the following quantities for the tree drawn at right.

a. `floor("Q")`
b. `select(5)`
c. `ceiling("Q")`
d. `rank("J")`
e. `size("D", "T")`
f. `keys("D", "T")`



Solution:

1. floor("Q"). Recall floor represents largest local key $\leq$ given key. SOLN: E,Q

2. select(5): Recall selection is the process of seeking the key node of the rank. The key k such that precisely k other keys in BST are smaller. So it checks right sub-tree of E as has more than 5 keys. Two on the left subtree, 2 on the right, and itself counts as 1). Therefore, the sequence checked for select(5) is E,Q

3. Ceiling("Q"). Recall Ceiling is the smallest local key $\geq$ given key. Ceiling checks E,Q *AND* stops as smallest key $\geq$ given key(Q) since Q itself is smallest possible value we can get.

4. rank("J"): Rank is somewhat similar to floor, except returns the number of nodes that satisfy a given condition. So finds the number of child nodes that are less than a given node. Goes through E,Q then J and then finds number of child nodes of J. Therefore, the sequence checked is: E,Q,J

5. size("D", "T"): E,D,Q,J,M,S

6. keys("D", "T"): E,D,Q,J,M,S