1. Determine the order of the following list after each iteration of quicksort $23, 20, 6, 17, 13, 25, 14$, assume you have a way to take the median of the list as the pivot in each iteration.

2. Convert the array $a = [10, 24, 42, 66, 33, 9, 2, 30, 80, 48]$ into a minimum heap using the linear time heap building algorithm. Show the order of all items after each iteration.

3. Consider the following maximum heap: 39, 20, 37, 18, 6, 32, 13, 3, 14

   a) Insert 25 into the heap.

   b) Delete 39 from the heap.

4. Prof X claims to have invented a sorting algorithm that sorts n items in time $\Theta(n)$.

   A. It is not in-place

   B. It is not comparison-based

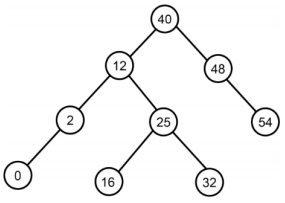
   C. It is only doing it on average, not in the worst case

   D. It is not stable

   E. Prof X is wrong

5. Assuming that all keys involved are different, a max-heap that is also a binary search tree must consist of (choose the most accurate answer):
   A. at most 2 nodes
   B. a root node, or be empty
   C. a root node
   D. a root node, or root with one child
   E. a root node, or root with left child, or be empty

6. Given the binary search tree below:



   a) Delete node 48 in the tree.
   b) Delete node 16 in the tree.
   c) Delete node 12 in the tree by using the minimum key in the right subtree.
   d) Delete node 12 in the tree by using the maximum key in the left subtree.

7. Professor Bunyan thinks he has discovered a remarkable property of binary search trees. Suppose that the search for key k in a binary search tree ends up in a leaf. Consider three sets: A, the keys to the left of the search path; B, the keys on the search path; and C, the keys to the right of the search path. Professor Bunyan claims that any three keys $a \in A$, $b \in B$, and $c \in C$ must satisfy $a \leq b \leq c$. Is this true? If so, explain how this is the case. If not, give a possible counterexample to the professor's claim.