Note: for simplicity, the base of “log” is always 2.

1. Compute the growth rate for $T(n)$:
   1. $T(n) = 3T(n/4) + n = \Theta(n)$;
   2. $T(n) = 4T(n/3) + n^{1/3} = \Theta(n^{\log_3 4})$.
2. Prove $\sum_{i=1}^{n} \log i = \Theta(n \log n)$. See homework 1.

3. Given an array of $n$ integers, what is the time complexity for building a heap (using $\Theta$)? Please prove it. It is $\Theta(n)$ and see the posted proof in webpage.


5. Suppose we have a sequence of input integers $8, 7, 6, 9, 3, 2, 11$, build the AVL-tree.

6. Suppose we want to insert $\{1, 5, 8, 12, 19, 15, 22\}$ into a chaining hash table with size $m = 7$. Please show the final hash table by the following hash function:
h(x)=((2x+5) \ mod\ 13) \ mod\ 7.

Figure 3

7. Given n integers, and a positive integer k much smaller than n. We want to report the k largest integers from the input, what about your idea?

Build a max heap for the n integers, and then run the first k steps for heap sort to output the k largest integers. The running time is \(\Theta(n + k \log n)\).