Lab work: Binomial heaps
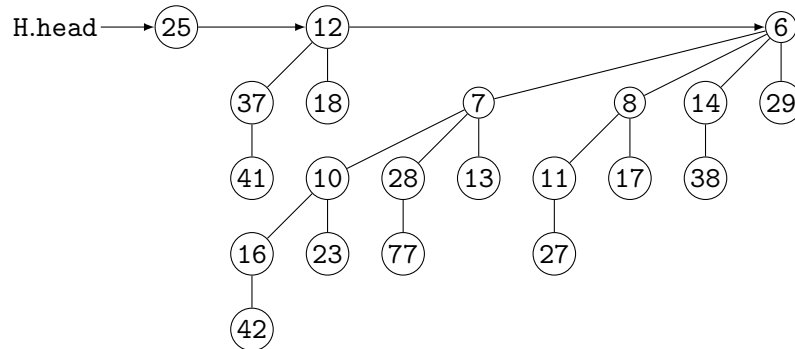
October 25, 2018

1. Suppose that x is a node in a binomial tree within a binomial heap, and assume that $x \rightarrow$ `sibling` $\neq$ `NIL`.

   (a) If x is not a root, how does $x \rightarrow$ `sibling` $\rightarrow$ `degree` compare to $x \rightarrow$ `degree`?

   (b) If x is a root, how does $x \rightarrow$ `sibling` $\rightarrow$ `degree` compare to $x \rightarrow$ `degree`?

2. Show the binomial heap that results when node with key **24** is inserted into the binomial heap shown below:

3. Show the binomial heap that results when the node with key 28 is deleted from the binomial heap shown below:
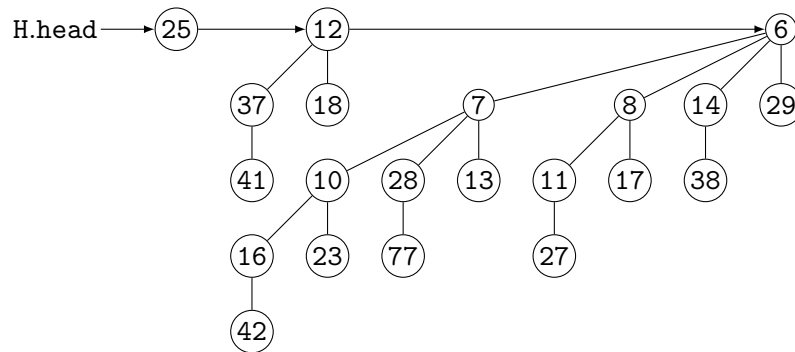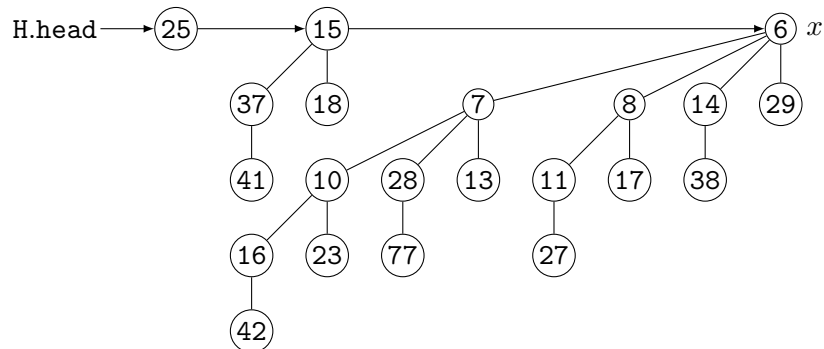
4. Suppose H is a binomial heap implemented as described in the lecture notes. Write the pseudocode for the operation

   increaseKey(H, x, k)

   which takes as inputs a pointer to a node x in H with $x \to$ key $< k$ and increases the key of x to new value k.

   (a) Draw the binomial heap that results after increasing the key of node x in the heap depicted below to new value 12.

   (b) What is the worst runtime complexity of this operation?

   (c) Indicate a binomial heap H with 16 nodes, a node x of H, and a value k such that the operation

   increaseKey(H, x, k)

   takes the longest possible time.