A Heap(ing) Portion

1. Insert the items into a heap (that is initially empty) in the order given below:
   
   12, 6, 20, 11, 7, 9, 15, 10, 3

   Draw the heap after each insertion. Give a vector representation of the heap after the last item has been inserted.

2. Consider the heap given below.

   First perform two DELETEMIN operations on this heap. Then insert the element 14 into the heap. Finally perform one more DELETEMIN operation. As above, draw the heap after each step and give the final vector representation after all the operations have been performed.
Solution:
1) Here are the diagrams.

Remember that to insert an element, you put it in the right-most empty child on the bottom level, then it “bubbles up” to its proper level by swapping with its parent (if necessary, i.e. if it’s less than its parent).

The final vector representation of this heap is the vector (3, 6, 9, 7, 11, 20, 15, 12, 10),
given by reading the elements of the heap from left-to-right and top-to-bottom.

2) Here are the diagrams for the heap after performing one DELETEMIN operation. Then after the second such operation.

Recall that you remove the element at the root, then replace the root with the right-most (non-empty) child on the bottom level, then that element “filters down” to its proper level by swapping with its smallest child.

Here’s the two other pictures, the left one after inserting the element 14, and the right one is after the last DELETEMIN operation.

The vector representation of this final heap is (10, 12, 15, 14, 17, 20, 25, 29).