Algorithms Design and Analysis

Exercises
Tree-Based Data Structures

2015, AUT-CJLU

Question 1.

The following is an array implementation of a **heap** that stores a collection of *distinct* integers. Find out what the missing numbers are, and draw the heap.

8	9	12	10	?	17	?	?	21	13	19	20	23	18	22	15
				(i)		(ii)	(iii)								

(i) _____

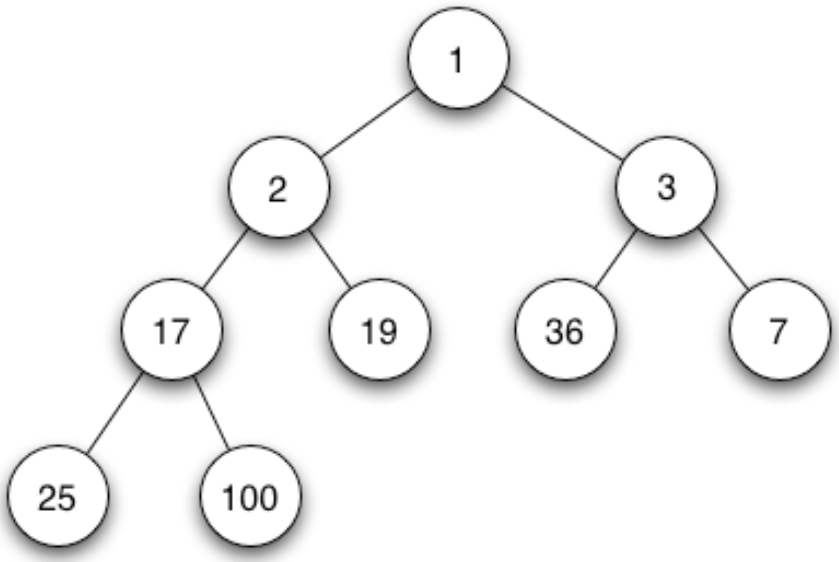
(ii) _____

(iii) _____

(iv) Display the heap:

Question 2.

Show the detailed steps for removing the value 1 from the following heap.



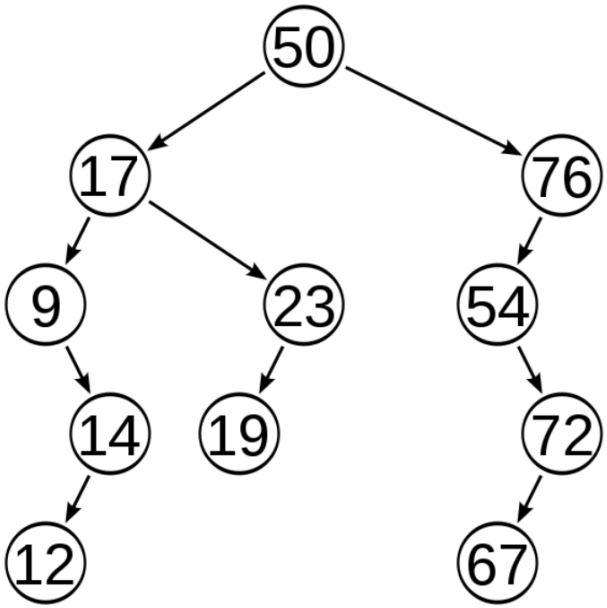
Question 3.

Suppose a program iteratively adds the following numbers (from left to right) to a **binary search tree** (which is initially empty, and uses the simple non-rotational based implementation). Draw the resulting binary search tree.

$$14, 34, 20, 2, 15, 23, 17, 6, 19, 9$$

Question 4.

Consider the following splay tree.



Show the detailed steps of removing the node 19.

Question 5.

Illustrate the steps we take to insert a new element with key 6, and then another new element with key 19 to the following red-black tree (Note that all NIL leaves are omitted in the picture below).