1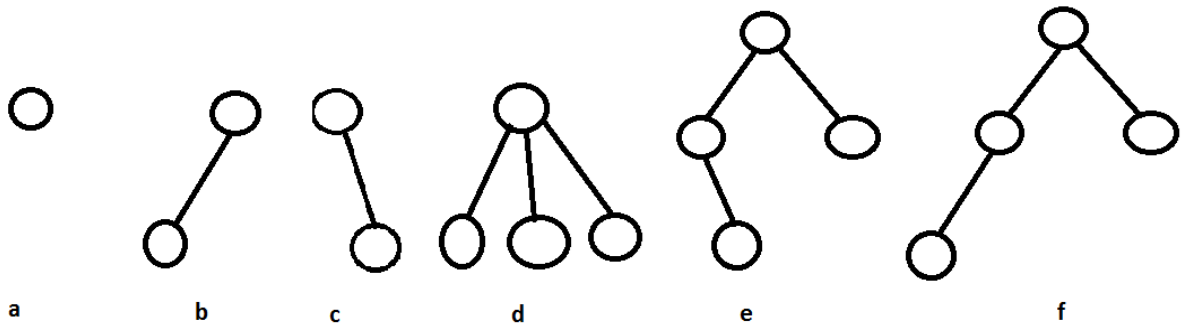. Given the following trees, a) Which are binary trees? b) Which are complete binary trees? c) What is the height of each tree?

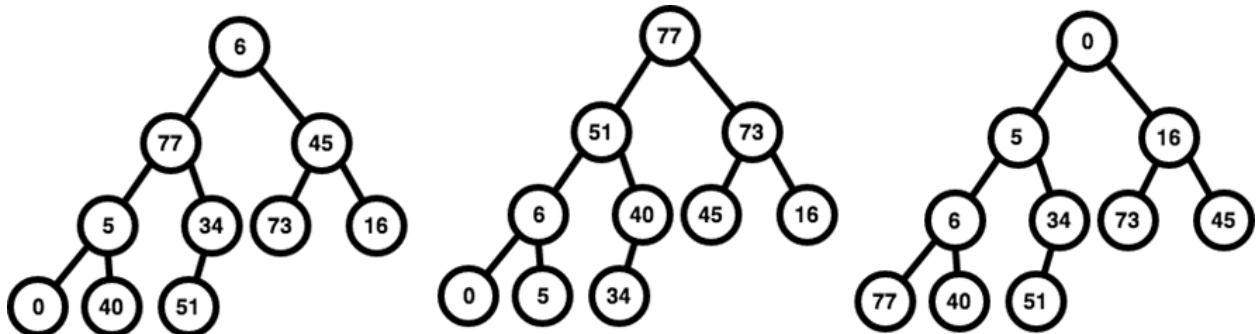a   b   c   d   e   f

Answer:
a) All are binary trees except d.
b) a, b, f are complete binary trees.
c) Height of a is 0, height of b, c, and d is 1, and height of e and f is 2.

2. Which of the following are max-heaps? Which of the following are min-heaps?

Answer:
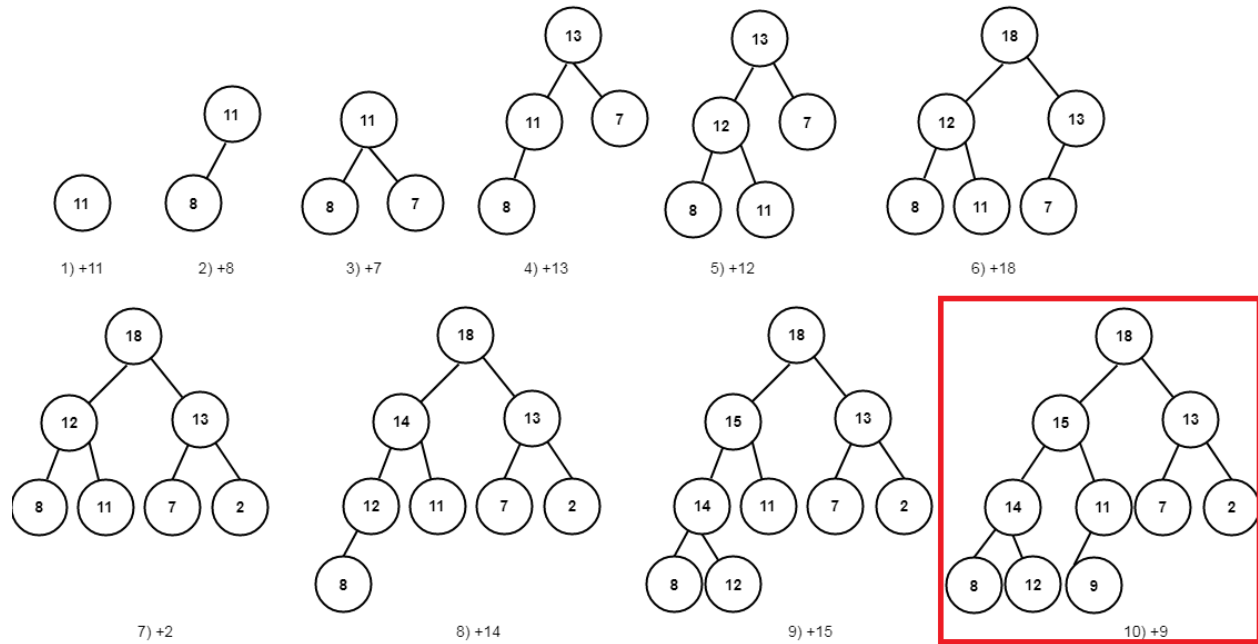The tree in the middle is a max-heap. The tree on the right is a min-heap.

3. A maxPQ is initially empty.

1) Provide the contents of the maxPQ after elements of the following array are inserted to it one by one in that order. int[] a = {11, 8, 7, 13, 12, 18, 2, 14, 15, 9}
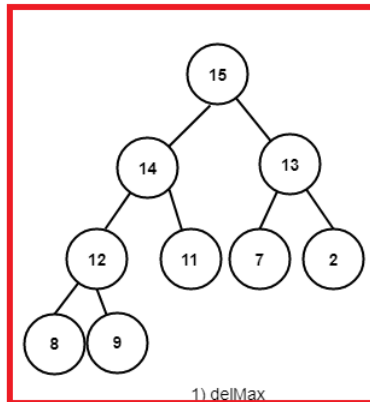
2) Provide the contents of the maxPQ after the first delMax() operation.

Answer:

1)

1) +11   2) +8   3) +7   4) +13   5) +12   6) +18

7) +2   8) +14   9) +15   10) +9

2)

1) delMax

4. Heap sort this input array, [-1, 90, 50, 51, 90, 14, 27, 58, 91, 14, 20], where element at index 0 is ignored.
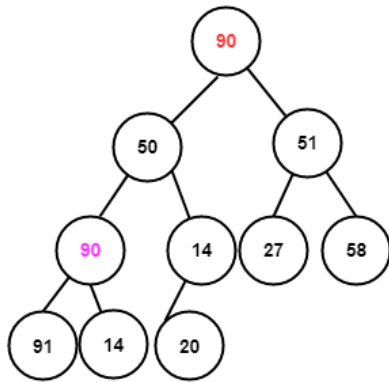a) Show the result of heap construction
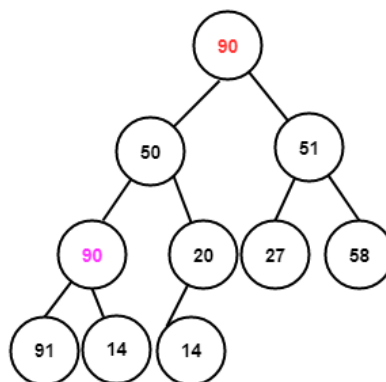b) Show the result of sort after three swap & sink operations
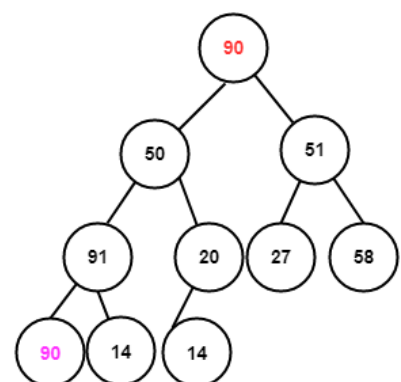c) Is Heap Sort stable?
Answer:
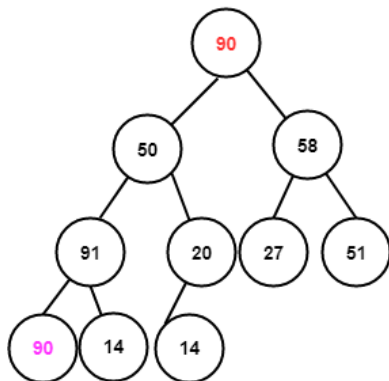a) Array contents after heap construction are {-1, 91, 90, 58, 90, 20, 27, 51, 50, 14, 14}
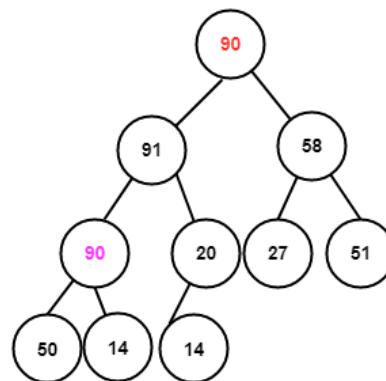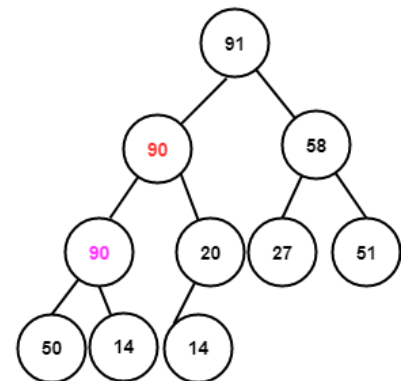

0) Original Contents

1) After sinking 14

2) After sinking 90

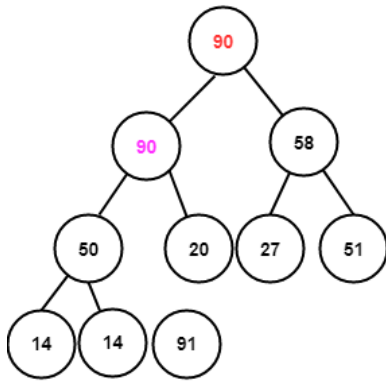3) After sinking 51

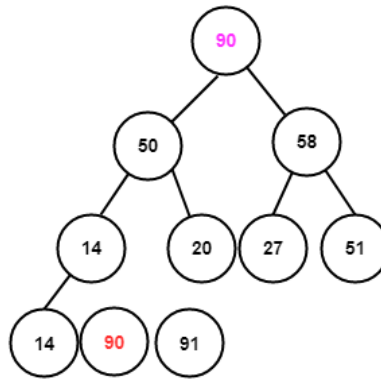4) After sinking 50

5) After sinking 90
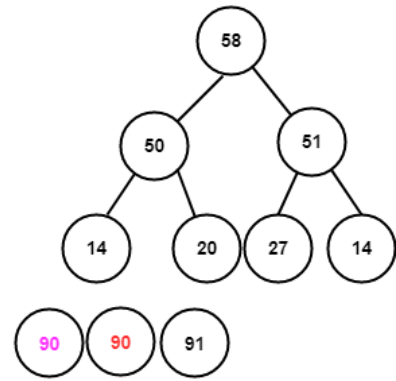
b) Array contents are three sink & swap are {-1, 58, 50, 51, 14, 20, 27, 14, 90, 90, 91}

1) After sink&swap   2) After sink&swap   3) After sink&swap

c) Heap sort is not stable. As demonstrated by the above example. Initially red 90 is before purple 90, but after heap sort purple 90 comes before red 90. The order of those two keys with the same value has been changed with heap sort, thus heap sort is not stable.