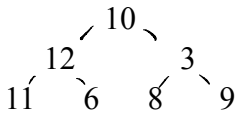
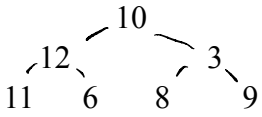
Part 4 (a):

starting array: {10, 12, 3, 11, 6, 8, 9}

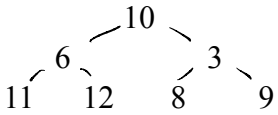


first non-leaf index = (size/2) - 1 = 7/2 - 1 = 2

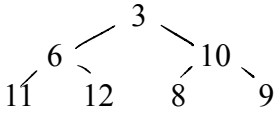
1. heapify(2): between 8 and 9, 8 is smaller, but the parent of 8 and 9, 3, is smaller than both the children, thus we don't need to swap 3 and 8



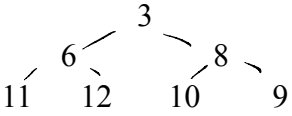
2. heapify (1): between 11 and 6, 6 is smaller, thus swap 12 and 6



3. heapify (0): a) between 6 and 3, 3 is smaller, thus swap 10 and 3



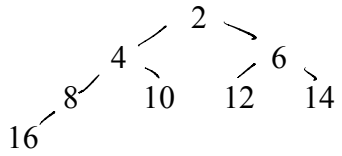
b) then we heapify (2). Between 8 and 9, 8 is smaller and is smaller than its parent, 10, thus swap 10 and 8.



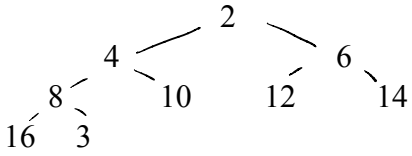
Done.

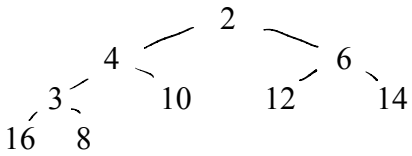
Part 4 (b):

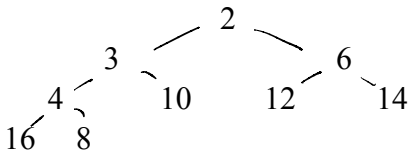
Initial Configuration:



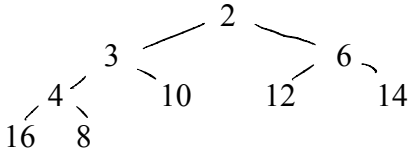
Insert 3:

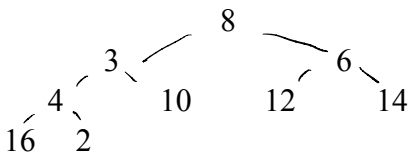


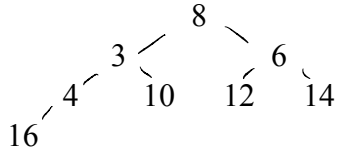


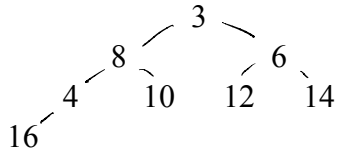


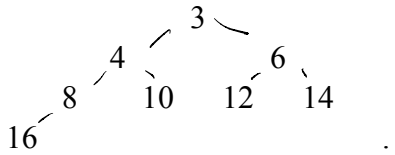
Pop (top element):



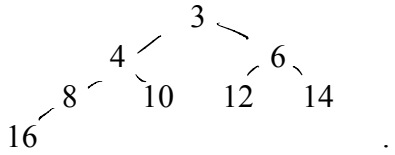


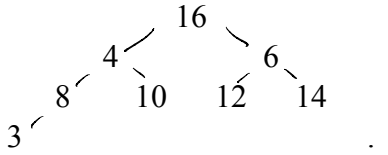


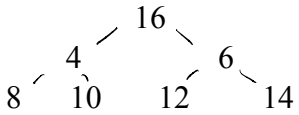


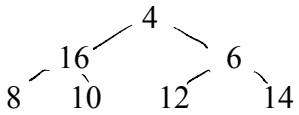


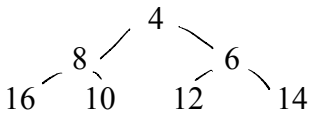
Pop (top element):



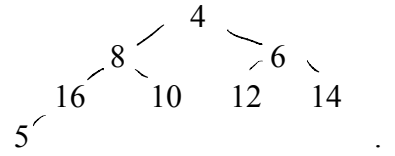


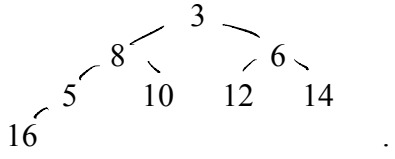


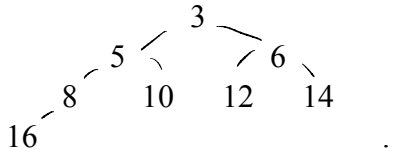




Insert 5:







Done.