Question 1.

Complexity of isSorted is O(N).

Complexity of bubbleSort is O(N^2).

Complexity of selectionSort is O(N^2).

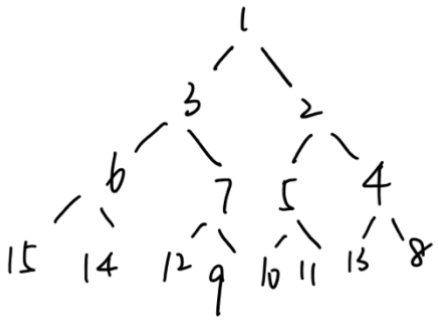
Complexity of hybridSort isO(N^2).

	1000	10000	100000	1000000
heapSort	0.0002596	0.002844	0.033576	0.419411
mergeSort	0.0003074	0.003366	0.037321	0.432612
hybridSort	0.0004348	0.004321	0.112588	12.0433
quicksort	0.0001266	0.001356	0.015454	0.185064
insertionSort	0.0025342	0.190243	19.0215	1911.63
shellSort	0.000283	0.003576	0.052711	0.764087
SROT	0.0024806	0.021318	0.244251	2.73054
selectionSort	0.0035595	0.280783	27.9319	2793.54
bubbleSort	0.0120846	1.07538	106.011	10794.1

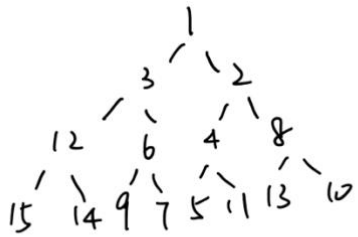
```
isSorted  ---- Passed
bubbleSort ---- Passed
selectionSort  ---- Passed
hybridSort---- Passed
%%%%%%%%%%%%%% Array size = 1000%%%%%%%%%%%%%%
heapSort ~~~~~~0.000259578
mergeSort~~~~~~0.000307419
hybridSort ~~~~~~0.000434773
quicksort~~~~~~0.000126601
insertionSort~~~~~~0.00253417
shellsort~~~~~~0.000282973
SORT~~~~~~0.00248058
selectionSort~~~~~~0.00355946
bubbleSort~~~~~~0.0120846
%%%%%%%%%%%%%% Array size = 10000%%%%%%%%%%%%%%
heapSort ~~~~~~0.0028442
mergeSort~~~~~~0.00336635
hybridSort ~~~~~~0.00432126
quicksort~~~~~~0.00135633
insertionSort~~~~~~0.190243
shellsort~~~~~~0.00357568
SORT~~~~~~0.0213176
selectionSort~~~~~~0.280783
bubbleSort~~~~~~1.07538
%%%%%%%%%%%%%% Array size = 100000%%%%%%%%%%%%%%
heapSort ~~~~~~0.0335759
mergeSort~~~~~~0.0373206
hybridSort ~~~~~~0.112588
quicksort~~~~~~0.0154544
insertionSort~~~~~~19.0215
shellsort~~~~~~0.0527109
SORT~~~~~~0.244251
selectionSort~~~~~~27.9319
bubbleSort~~~~~~106.011
%%%%%%%%%%%%%% Array size = 1000000%%%%%%%%%%%%%%
heapSort ~~~~~~0.419411
mergeSort~~~~~~0.432612
hybridSort ~~~~~~12.0433
quicksort~~~~~~0.185064
insertionSort~~~~~~1911.63
shellsort~~~~~~0.764087
SORT~~~~~~2.73054
selectionSort~~~~~~2793.54
bubbleSort~~~~~~10794.1
```

Question 2

b). insert into an initially empty heap.



Using the linear-time algorithm to build a binary heap



c)

The time complexity should be O(NlogN). In this method, I first build a heap using function insertKey for n times, thus, the complexity for this step is O(NlogN). And then, use extractMin for k times, as each time it will return the minimum value in the heap and delete it from heap. So, the complexity is O(klogN). Thus, the complexity for this function is O(NlogN).