Solution Review: Find k Largest Elements in the List

> **We'll cover the following**   ⌃
>
> - Solution #1: Creating a Max-Heap and removing max k times
>   - Time Complexity
> - Solution #2: Using Quickselect
>   - Time Complexity

Solution #1: Creating a Max-Heap and removing max k times#

```python
main.py
MaxHeap.py

1   from MaxHeap import MaxHeap
2
3
4   def findKLargest(lst, k):
5       heap = MaxHeap()  # Create a MaxHeap
6       # Populate the MaxHeap with elements of lst
7       heap.buildHeap(lst)
8       # Create a list such that:
9       # It has k elements where
10      # the k elements are the first k
11      # elements received from calling removeMax()
```

```
12      kLargest = [heap.removeMax() for i in range(k)]
13      return kLargest
14
15
16  lst = [9, 4, 7, 1, -2, 6, 5]
17  k = 3
18  print(findKLargest(lst, k))
19
```

We first create a max-heap out of the given list by inserting the list elements into an empty heap on **line** 7. We then call `removeMax()` on the heap k times, save the output in a list, and return it.

Time Complexity#

The time complexity of creating a heap is $O(n)$ and removing max is $O(klogn)$. So the total time complexity is $O(n + klogn)$ which is the same as $O(klogn)$.

Solution #2: Using Quickselect#

You can optimize this further by calling the Quick Select algorithm on the given list k times where the input to the algorithm goes from n till $n - k$. We have not presented the code here because it is not relevant to heaps, but we felt that the optimal solution should be mentioned.

Time Complexity#

The *average-case* complexity of quick select is $O(n)$. So when called k time it will be in $O(nk)-> O(n)$.

Note: By looking at this problem, we can see how the heap can be
to solve the Find Second Maximum Value in a List. All we have to do is
set k to 2 and pick the second value!

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