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Pre-lecture exercises will not be collected for credit. However, you will get more out of each lecture if you do them, and they will be referenced during lecture. We recommend **writing out** your answers to pre-lecture exercises before class. Pre-lecture exercises usually should not take you more than 30 minutes.

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In this pre-lecture exercise, you'll get acquainted with the  $k$ -SELECT problem which we'll see in Lecture 4.

Consider the problem  $k$ -SELECT: When given an array  $A$  of  $n$  distinct numbers, find the  $k$ 'th smallest one. For example, if the input were

$$A = [6, 4, 8, 9, 5, 2, 1],$$

then the output to 3-select should be " $A[1] = 4$ ," since 4 is the 3rd smallest item in this array.

1. Give an  $O(n \log(n))$ -time algorithm for  $k$ -SELECT (for any fixed  $k$ ).
2. Give an  $O(n)$ -time algorithm for 1-SELECT. (That is,  $k$ -SELECT for  $k = 1$ ).
3. Give an  $O(n)$ -time algorithm for 2-SELECT.
4. Question to ponder before Lecture 4: can you come up with an  $O(n)$ -time algorithm for  $k$ -SELECT for general  $k$ ? (It's okay if not—as we'll see in Lecture 4, this is tricky!)