The quicksort algorithm is one of the most frequently used sorting algorithms. It provides highly efficient sorting and simple implementation logic. The essence of quicksort is to choose a pivot value, and partition input array into 2 sub-arrays, with one sub-arrays containing values greater than pivot value, and another sub-arrays containing values less than pivot value. Then quicksort is called recursively on these 2 smaller sub-arrays, until every element is sorted.

The choice of pivot value has great impact on partition layout, thus affects the overall efficiency of the quicksort algorithm’s running time.

A few methods for choosing pivot value are given below. Please give a brief remark on the pro & cons of them.

1. Choose pivot value from fixed positions, such as the first element in the input array.
2. Find the first, middle, and last element in the input array, and use median value of these 3 numbers as pivot value. (NOTE: when there are 2k elements in the input array, either the k-th or the (k+1)-th element could be used as the middle element)
3. Use the SELECT algorithm discussed in course (and also in text book “Introduction to Algorithms”), select the exact median value of input array as pivot value, in O(n) time.