Homework 5 (計算方法設計，Design and Analysis of Algorithms)

Due date: June 3, 2022

Given a set S of n numbers and an integer k, where $1 \leq k \leq n$, the *selection problem* is to determine the kth smallest number in S. As mentioned in the class, the selection problem can be solved by the following two methods. The first method is to use the quick sort to sort the given n numbers in ascending order and pick out the kth number from the sorted array. The second method is to utilize the prune and search strategy as introduced in the class. Use a programming language you familiar with to implement these two methods for solving the selection problem and compare their performance by plotting their running times as the curves of n, where n is from 10,000,000 to 30,000,000 in steps of 1,000,000. Note that you should implement the quick sort program by yourself, instead of using the built-in quick sort function in the programming language. Note also that for each n, you should generate three problem instances and average the running time of solving these three instances. Just submit your prune and search program through the eeclass system and do not submit your program based on the first method. The formats of the input and output files are described as follows.

Input:

n, k

This line consists of n positive integer numbers.

Output:

The kth smallest number.

Constraints:

$10{,}000{,}000 \leq n \leq 30{,}000{,}000$

Each positive integer number in the input data is between 1 and 100,000,000.