Assignment 2 is due October 30 (Monday), 23:30.

Submission A pdf copy (at most 3 pages) of your own solutions to Problems 1 and 2 should be submitted at SUCourse+.

Grading Full credit will be given to correct solutions that are described clearly.

Problem 1 (Order statistics) Suppose that you are given a set of n numbers. The goal is to find the k smallest numbers in this set, in sorted order. For each method below, identify relevant algorithms with the best asymptotic worst-case running time (e.g., which sorting algorithm? which order-statistics algorithm?), and analyze the running time of the overall algorithm in terms of n and k.

(a) First sort the numbers using a comparison-based sorting algorithm, and then return the k smallest numbers.

(b) First use an order-statistics algorithm to find the k'th smallest number, then partition around that number to get the k smallest numbers, and then sort these k smallest numbers using a comparison-based sorting algorithm.

Which method would you use if k is $\lceil lgn \rceil$? Please explain why.

Problem 2 (Linear-time sorting) (a) How can you modify the radix sort algorithm for integers, to lexicographically sort a list of tuples? Please explain the modifications.

(b) Consider a robot that detects the toys on the floor, and describes each toy with an id, character, color, size, and texture, as in the example below:

$[\langle 7, bird, blue, small, soft\rangle, \langle 4, fish, red, medium, hard\rangle,$
$\langle 3, bear, blue, big, soft\rangle, \langle 6, rabbit, red, small, hard\rangle,$
$\langle 5, fish, blue, medium, soft\rangle]$.

Illustrate how your algorithm sorts this list of tuples. Please show every step of your algorithm.

(c) Analyze the running time of the modified algorithm.