

Precept 3

These problems (or a subset of them) will be solved in precept.

1. EXERCISE 5.1 in Kleinberg-Tardos. (*median of two sorted arrays*)
2. EXERCISE 5.3 in Kleinberg-Tardos. (*majority of elements are equal*)
3. EXERCISE 9-2 in CLRS. (*weighted median*)

Given n elements x_1, \dots, x_n with positive weights w_1, \dots, w_n such that $\sum_i w_i = 1$, the *weighted median* is the element x_k satisfying both

$$\sum_{x_i < x_k} w_i < \frac{1}{2}$$

and

$$\sum_{x_i > x_k} w_i \leq \frac{1}{2}$$

For example, if the 7 elements are $\{0.1, 0.35, 0.05, 0.1, 0.15, 0.05, .2\}$ and each element equals its weight, then the median is 0.1 but the weighted median is 0.2.

- (a) Design an $\mathcal{O}(n \log n)$ algorithm to compute the weighted median of n elements using sorting.
- (b) Design an $\mathcal{O}(n)$ algorithm to compute the weighted median of n elements using a linear-time median algorithm as a subroutine.