

Algorithms, Spring 2022 at CIS – Homework 2

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Please answer the following questions and submit a **pdf** file to neoscholar education platform before **2022/3/12 23:59pm**.

Problem 1

Show that at the end of the streaming algorithm for finding a majority element, if the counter is 0, then there is no majority element in the stream. Also, when the counter is 1 at the end of the stream, write two example streams:

- when there is a majority element in the stream.
- when there is no majority element in the stream.

Problem 2

Given a stream of distinct integers each in $\{-2^b + 1, -2^b + 2, \dots, 2^b - 1\}$, give a 1-pass streaming algorithm to find the k -th largest element in the stream. The memory of your algorithm should be $O(kb)$ bits.

Problem 3

You are given a stream A of elements a_1, \dots, a_k , followed by another stream B of elements b_1, \dots, b_k . You are promised that there is exactly one element x that occurs in A and not in B , and exactly one element y that occurs in B and not in A . Show how to find x and y in small memory in a stream.