

# Longest Increasing Subsequences in Windows based on Canonical Antichain Partition

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**Abstract.** We consider the LISW problem, which is to find the longest increasing subsequences (LIS) in a sliding window of fixed-size  $w$  over a sequence  $\pi_1\pi_2\dots\pi_n$ . Formally, it is to find a LIS for every window in a set  $S_{\text{FIX}} = \pi\langle i+1, i+w \rangle \mid 0 \leq i \leq n-w \cup \pi\langle 1, i \rangle, \pi\langle n-i, n \rangle \mid i < w$ , where a window  $\pi\langle l, r \rangle$  is a subsequence  $\pi_l\pi_{l+1}\dots\pi_r$ . By maintaining a *canonical antichain partition* in windows, we present an optimal *output-sensitive* algorithm to solve this problem in  $O(\text{OUTPUT})$  time, where  $\text{OUTPUT}$  is the sum of the length of the  $n+w-1$  longest increasing subsequences in those windows of  $S_{\text{FIX}}$ . In addition, we propose a more generalized problem called  $\text{LISSET}$ , which is to find the LIS for every window in a set  $S_{\text{VAR}}$  containing *variable-size* windows. By applying our algorithm, we provide an efficient solution for  $\text{LISSET}$  problem which is better than the straight forward generalization of classical LIS algorithms. An upper bound of our algorithm on  $\text{LISSET}$  is discussed.