String Sanitization: A Combinatorial Approach

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The goal: String sanitization

Conceal **sensitive patterns** in W while maintaining **data utility**.

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Construct the **shortest** string X that satisfies **P1**, **P2**, and **C1**.

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Theorem

The **length** *of* X *is in* $\Theta(k|W|)$. **TFS-ALGO** *solves* **TFS** *in the optimal* $O(k|W|)$ *time.*

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PFS-ALGO *solves* **PFS** *in the optimal* $O(|W| + |Y|)$ *time.*

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We also develop **MCSR-ALGO**, an effective heuristic to solve **MCSR**.

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  - Then X is of length $\Omega(k|W|)$ because no overlap exists.

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  - Solve SCS for two-letter strings [Gallant et al., JCSS, 1980].

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- **Looks bad**: Shortest Common Superstring (SCS) is NP-complete.
- **Observation**: Overlaps allowed are of fixed length $k-1$.
- **Idea**:
  - Assign **ids** to blocks' prefixes and suffixes of length $k-1$.
  - Ignore the middle part of the blocks (it plays no role).
  - Solve SCS for two-letter strings [Gallant et al., JCSS, 1980].
- **Result**: Linear time!

String Sanitization: MSCR-ALGO

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OLD	Movement	85,563	100	$[30, 240]$ (**60**)	$[600, 6103]$	$[3, 7]$ (**4**)
TRU	Transportation	5,763	100	$[30, 120]$ (**10**)	$[324, 2410]$	$[2, 5]$ (**4**)
MSN	Web	4,698,764	17	$[30, 120]$ (**60**)	$[6030, 320480]$	$[3, 8]$ (**4**)
DNA	Genomic	4,641,652	4	$[25, 500]$ (**100**)	$[163, 3488]$	$[5, 15]$ (**13**)
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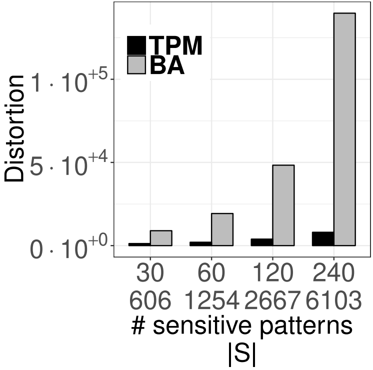
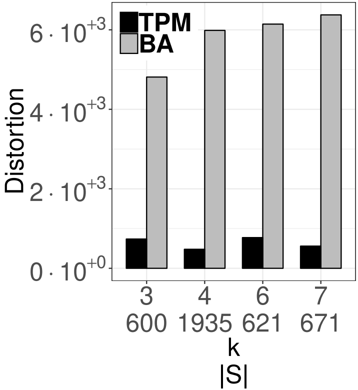


OLD



OLD

S denotes the set of occurrences of sensitive patterns.

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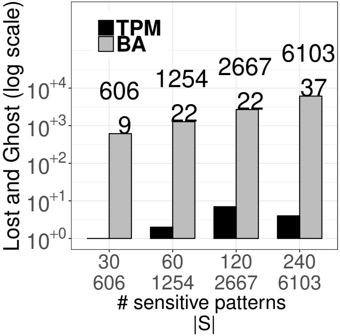
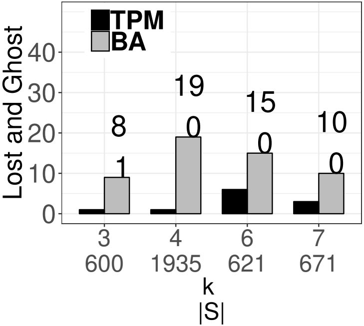


OLD



OLD

$^{x}_{y}$ on the top of each bar for **BA** denotes x τ-lost and y τ-ghost.

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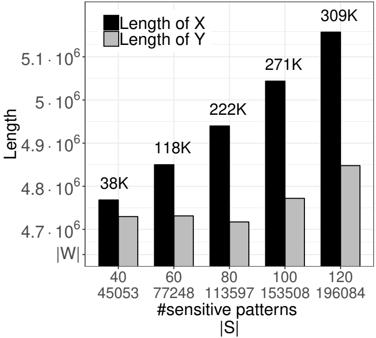
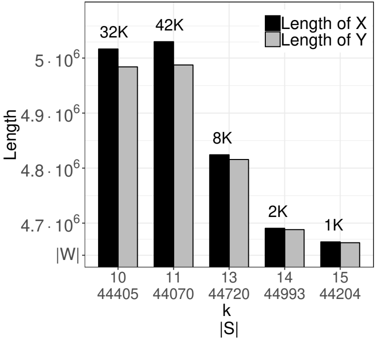


DNA



DNA

On the top of each pair of bars we plot $|X| - |Y|$.

Experiments: Speed

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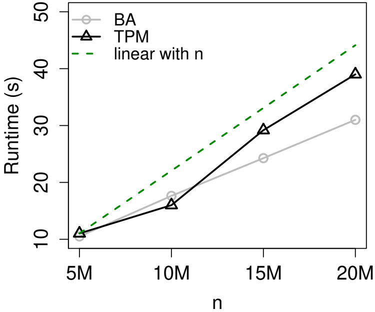
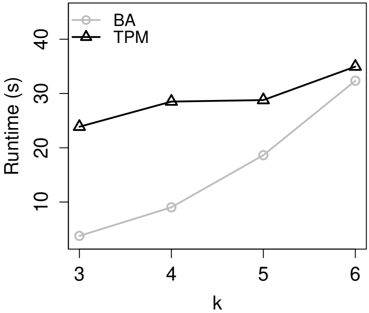


Prefixes of SYN



SYN

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Full version: `arxiv.org/abs/1906.11030`