Model and Motivation

- We study sublinear computation with an online adversary.
- Adversary hides or corrupts up to \( t \) input values after each query is answered.
- Deeper understanding of structure of violations to fundamental properties.

Online-Erasure-Resilient Testers

**Theorem 1.** Linearity and quadraticity can be tested with online erasures with the same query complexity as in standard property testing.

A function \( f : \{0,1\}^d \rightarrow \{0,1\} \) is linear if it is a polynomial of degree at most 1; quadratic if polynomial of degree at most 2.

**Linearity.** BLR tester [1] optimal for no erasures.

Repeat \( O(1/\varepsilon) \) times:
- Sample pair \((x, y)\).
- Reject if \( f(x) + f(y) \neq f(x+y) \).

**Issue** with 1-online-erasure oracle: once \( x \) and \( y \) are queried, oracle erases \( x+y \).

New structural result: For all even \( k \), the fraction of \( k \)-tuples that violate linearity is at least \( \varepsilon \).

Our tester
- sample and query reserve of \( O(\log t / \varepsilon) \) points.
- query sums of \( k \) elements sampled from reserve, for some even \( k \).

**Quadraticity.** Tester of Alon et al. [2] looks for more complicated witnesses.

Lower Bounds

**Theorem 2.** For testing linearity, \( \log t \) queries are required.

**Theorem 3.** Some properties are impossible to test even with a 1-online-erasure oracle: sortedness and Lipschitz property of sequences.

Sorted sequence: \( f(x) \leq f(y) \) for all \( x < y \).

If no erasures, can be tested with \( O(\log n) \) queries [3] or \( O(\sqrt{n}) \) uniform queries.

Hard to test instances: