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- Lecture notes: [WWW.WISDOM.WISZMANN.AC.IL/~odedl](http://WWW.WISDOM.WISZMANN.AC.IL/~oded/pt-lm.html)

Testing \{ Dynamic, Evolving \} Environments

- Evolving phy. environments
- Moving objects

Specific Model: $d$-dim. cellular automata

- $d = 1, 2, 3$
- Evolution rule $\Pi: \Sigma^d \to \Sigma$
- Viewing function $V: \Sigma \to \Sigma'$
  (fully visible state vs partially visible...)

Testing whether an evolution table is $\Pi$-legal (i.e., evolves) $E: [t] \times [n] \to \Sigma$

- If $E$ is $\Pi$-legal, then w.h.p accept $V \circ E$
- If $F$ is $\epsilon$-far from any $V \circ E'$ such that $E'$ is $\Pi$-legal, then w.h.p reject $F$. 
What makes this different from general P.T?

1. time-conforming observer/tester
   if queries \((j, \cdot)\) after \((i, \cdot)\)
   then \(j \geq i\) must hold

2. temporal query complexity
   \[\max_{i \in [t]} \# \text{ queries to } E_i(\cdot) \equiv E(i, \cdot)\]

**THM:** \(\exists\) evolution rule \(\Pi: \Sigma^3 \Rightarrow \Sigma\)

st. \(\Pi\)-legal evolution requires

time-conforming tester of complexity \(n^2(1)\)

but admits a non-time-conforming tester

of query complexity \(\text{poly}(\log n)\).
\[ C = \text{STILD} \]

**PROPOSITION**

\[ x' \subseteq C(x) \]

**Definition:**

\[ x' = x \oplus 10^k \]

**Delete:**

\[ x' \subseteq x' \oplus 10^k \]

**Notation:**

\[ \beta \subseteq C(y) \]

**Attacks:**

\[ i \leftarrow F(y) \]

**PPPP:**

\[ \beta \subseteq C(y) \]

**Asserting:**

\[ i = c^{-1}(\beta) \]

\[ n = \text{poly}(k) \]

**Time:**

\[ t = \theta(n) \]

**F is a nonadaptive extractor for bit-fixing sources.**