Erasure-Resilient Graph Property Testing

Workshop on Local Algorithms 2018
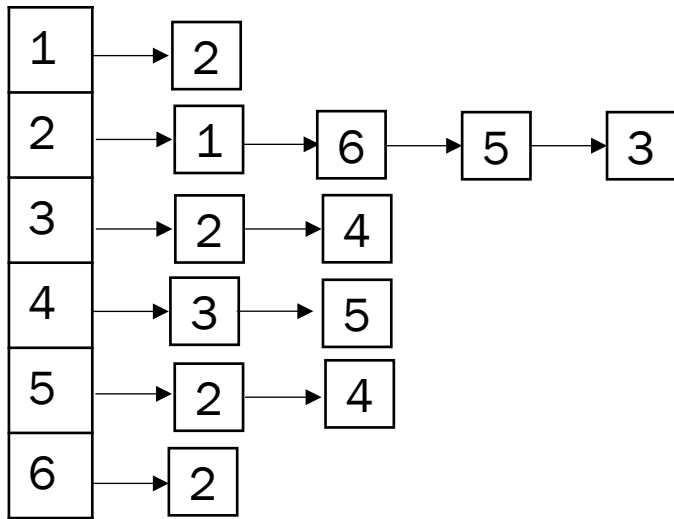
Nithin Varma

Joint work with Amit Levi, Ramesh Pallavoor, and Sofya Raskhodnikova
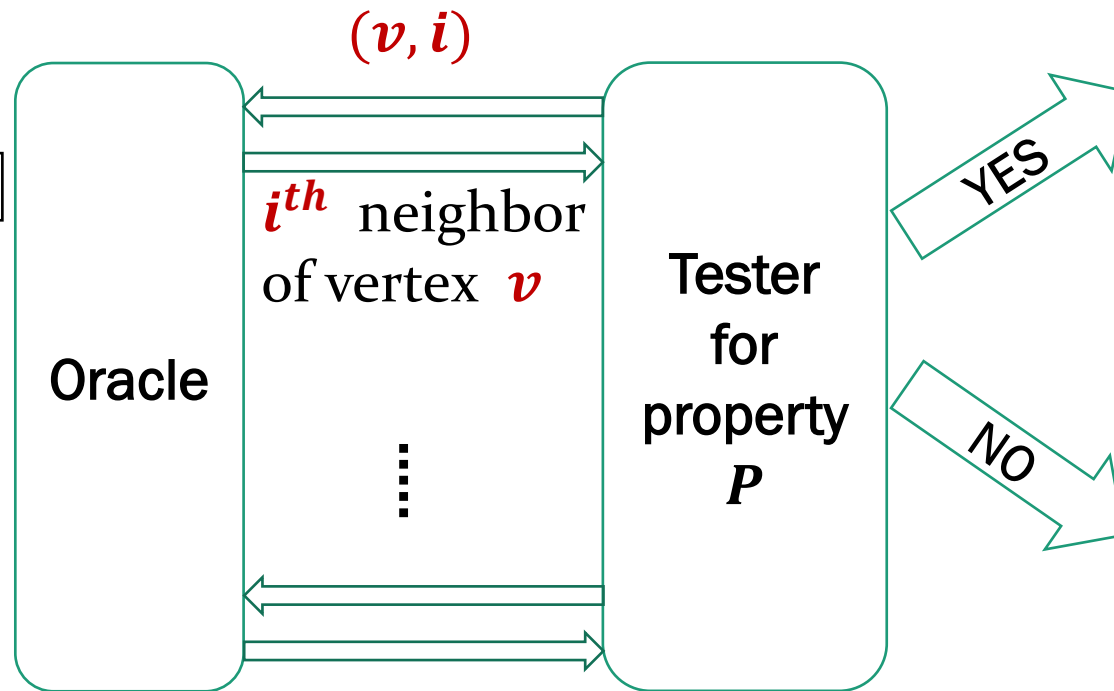
Graph property testing

Graphs are represented as adjacency lists.

Graph $G = (V, E)$ with n vertices and m edges.

(v, i)

i^{th} neighbor of vertex v

Oracle

Tester for property P
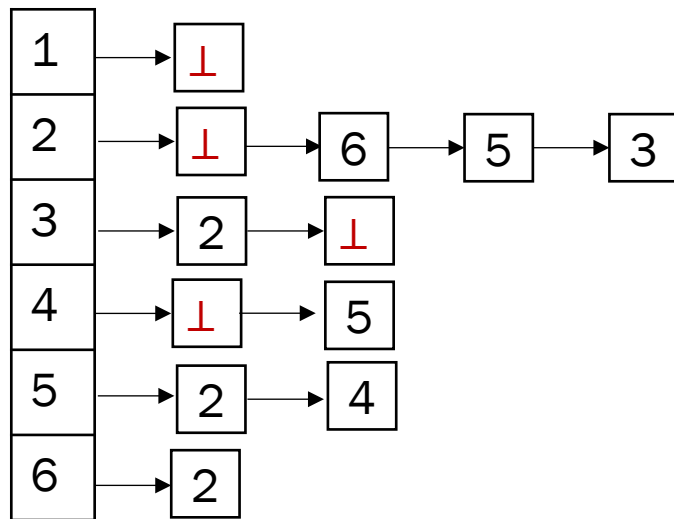
YES

NO

If G satisfies property P.

If G has to be modified in at least $\epsilon \cdot m$ edges to satisfy P.
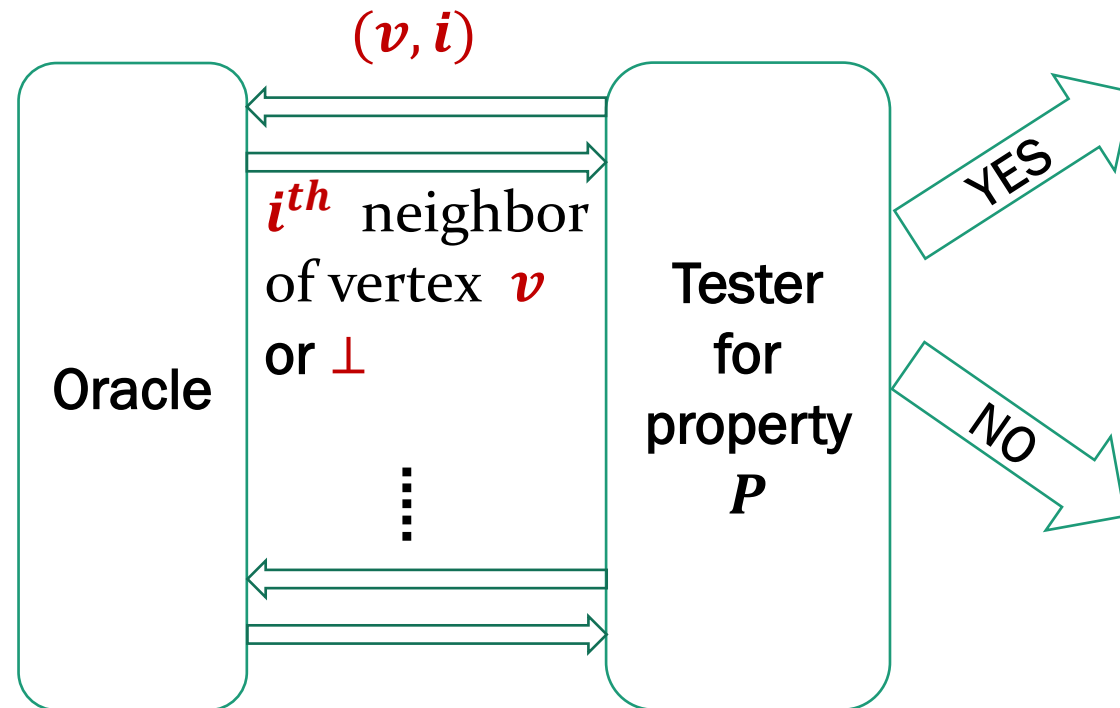
Erasure-resilient graph property testing

Erasure-resilient (function) property testing
[Dixit Raskhodnikova Thakurta Varma 18]

$\leq \boldsymbol{\alpha} \cdot \boldsymbol{m}$ edges are erased.

$(\boldsymbol{v}, \boldsymbol{i})$

$\boldsymbol{i^{th}}$ neighbor of vertex $\boldsymbol{v}$ or $\perp$

Oracle

Tester for property $\boldsymbol{P}$

YES

NO

Exists completion of $\boldsymbol{G}$ satisfying property P.

Every completion of $\boldsymbol{G}$ has to be modified in at least $\epsilon \cdot m$ **edges to satisfy** P.

Graph $G = (V, E)$ with n vertices and m edges **(erased and nonerased).**

Erasure-resilient testing connectedness

- α-erasure-resilient ϵ-tester for connectedness with query complexity

Constant query complexity!

$$O\left(\left(\frac{1}{(\epsilon-\alpha)d}\right)^2\right) \text{ whenever } \alpha < \epsilon, \text{ where } d = \frac{m}{n}.$$

- Every α-erasure-resilient ϵ-tester for connectedness

Threshold phenomenon!

Linear query complexity!

$$\Omega(m) \text{ queries when } \alpha \geq \frac{2\epsilon}{1+\epsilon}.$$