Distributed Algorithms 2021

Round elimination
Can we automate our own work?
Meta-algorithmics

- **Normal algorithms** — example:
  - input: graph $G$
  - output: coloring of graph $G$

- **Meta-algorithms** — example:
  - input: *computational problem* $P$
  - output: *algorithm* for solving $P$

How to represent problems or algorithms?
This week’s plan

• **Topic:** *round elimination*
  - function that maps problem $X$ with complexity $T$ to problem $X' = \text{re}(X)$ with complexity $T - 1$

• **Video:** how to *use* round elimination
  - “re” was a black box

• **Today:** how to *do* round elimination
  - what happens inside the black box and why?
Round elimination

• Basic idea already used by Linial (1987)
  • “it is not possible to 3-color cycles in $o(\log^* n)$ rounds”

• Until 2015 it was thought this is an ad-hoc trick that only works for graph coloring

• Lots of new applications since 2016

• General idea formalized in 2019
Weak 3-labeling

• **Labels:** 1, 2, 3

• **Active nodes:**
  • degree 3
  • not all labels same

• **Passive nodes:**
  • degree 2
  • both labels same