Distributed Algorithms 2022

9 Round elimination
Can we automate our own work?
Meta-algorithms

• Normal algorithms — example:
  • input: graph \( G \)
  • output: coloring of graph \( G \)

• Meta-algorithms — example:
  • input: \textit{computational problem} \( P \)
  • output: \textit{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