

Distributed algorithms for networks - List of papers

December 22, 2023

Notes.

- For most papers there exist several versions, and most of the proofs are not given in the conference version. The links should all point to full versions.
- Most papers are long, and it is not required to entirely master them. Students should try to have a global idea of the paper, and have enough content for their 20 minutes talk + 10 minutes of questions. Part of the work consists in understanding what are the key elements, and what are the more specific computations.

List.

1. A Time Hierarchy Theorem for the LOCAL Model (SIAM Journal on Computing, FOCS 2017). The paper proves several key results in the complexity landscape of the LOCAL model. A technical paper with some great ideas.
2. A Breezing Proof of the KMW Bound (SOSA 2021). A simplified (but still technical) proof of a key lower bound for vertex cover and friends, in the LOCAL model. (The original proof was in Local Computation: Lower and Upper Bounds (JACM version of the 2004 PODC paper), but is notoriously difficult).
3. Improved Deterministic Distributed Matching via Rounding (DISC 2017). An elegant use of LP rounding in distributed graph algorithms.
4. Efficient Randomized Distributed Coloring in CONGEST (STOC 2021). Coloring in Randomized CONGEST. Technical and insightful.
5. Lower Bounds for Maximal Matchings and Maximal Independent Sets (FOCS 2019). Yet another technical paper. Follows the round elimination technique studied in Lecture 4 and 5, but needs much more work to get a lower bound $\Omega(\Delta)$. Focus on sections 1, 2 and 3.
6. Distributed coloring in sparse graphs with fewer colors (PODC 2018). A more graph-theory-oriented paper, revolving around the question: how many colors do you need to color a planar graph in a local way?
7. Interactive Distributed Proofs (PODC 2018). A paper with a complexity theory flavor (inspired by IP, PCP etc.). It introduces the notion of interactive distributed proofs (which extends local certification, introduced in the lectures of December 18 and 22), and proves important results about it.
8. Beeping a Maximal Independent Set (DISC 2011 and Distributed Computing). The first paper in the beeping model (a very restrictive distributed model). Not very technical.
9. Deterministic Logarithmic Completeness in the Distributed Sleeping Model (DISC 2021) (Barenboim, Maimon). The sleeping LOCAL model is a variation of the LOCAL model, where the nodes are allowed to be asleep for some rounds. The paper proves that everything can be solved in $O(\log n)$ “awake” rounds. Simple intuition, but some care is needed to make it work.
10. Locality in Online, Dynamic, Sequential, and Distributed Graph Algorithms (ICALP 2023). A high-level perspective on the concept of locality in various models of computation. Some parts are conceptual, some are a bit more technical (in particular links with LCL landscapes).