

Distributed Algorithms 2020

5a

All-pairs shortest paths

All-pairs shortest paths:

*everyone knows distance
to everyone else*

SSSP

Single-source shortest paths:

*everyone knows distance
to special node s*

LOCAL: unbounded messages

- *everything* (including APSP and SSSP)
trivial to solve in $O(\text{diameter})$ rounds
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CONGEST: bounded messages

- *one message can only hold $O(\log n)$ bits*
- gathering everything way too expensive:
the description of the input graph is $\approx n^2$ bits

**All-pairs
shortest paths in
CONGEST model?**

Single-source
shortest paths in
CONGEST model

SSSP for *one source*:
 $O(\text{diam})$

SSSP for *one source*:
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SSSP for *every source*:
 $O(n - \text{diam})$

**All-pairs
shortest paths in
CONGEST model
in $O(n)$ rounds**

Preliminary steps:

- choose a leader s
- construct a BFS tree rooted at s

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Can be implemented e.g. this way:

- all nodes start to construct trees rooted at them
- ignores messages from root x if you have already seen messages from root $y < x$