Weekplan: Distributed Algorithms I

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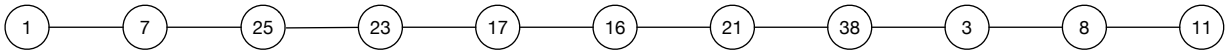
References and Reading

[1] Distributed Algorithms Chapter 1. By Jukka Suomela.

Exercises

1 PC3 algorithm

1.1 [w] Run the P3C algorithm on the following example:



1.2 [w] Give an instance where the algorithm PC3 runs in n rounds.

1.3 Rewrite the algorithm so nodes do not keep sending messages.

2 Simpler path coloring algorithm Consider a simpler algorithm idea for 3-coloring a path: all nodes pick the smallest color that is not used by their neighbors. Construct an example in which this algorithm fails.

3 Faster coloring algorithm Consider the following questions aboutt he faster path coloring algorithm:

3.1 What would go wrong if the new color was just b? Construct an example in which it fails.

3.2 What would go wrong if the new color was just i? Construct an example in which it fails.

4 Exercises from the book Solve the following exercises from the book [1]: Quiz 1.7, exercise 1.1, 1.3, and 1.5.

5 LOCAL model In the LOCAL model we have each node $v \in V$ has *unique* identifier $\mathrm{id}(v) : V \to \{1, 2, \ldots, |V^c|\}$ for some constant $c > 1$. In the CONGEST model we further have the following *bandwidth restriction*: in each communication round, over each edge, we can only send $O(\log n)$-bit messages, where n is the number of nodes in V.

Assume the network is connected.

5.1 Give an algorithm in the LOCAL model that ensures that after $O(\mathrm{diam}(G))$ rounds every node in the network knows everything about the graph G.

5.2 Explain how the algorithm from exercise **5.1** can be used to solve any graph problem for which there is a non-distributed algorithm in $O(\mathrm{diam}(G))$ rounds in the LOCAL model.

5.3 Give an example of a graph where the algorithm from exercise **5.1** does not work in the CONGEST model.