Nodes decide their output based on their local views

Online Algorithms with Lookaround

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LOCAL

SLOCAL

Dynamic-LOCAL

Online-LOCAL

LCLs† in paths and trees: LOCAL ≈ Online-LOCAL

Pumping lemma on paths:
Path segments can be pumped into longer segments without affecting the result near endpoints:

LCLs† in grids: LOCAL ≠ Online-LOCAL

3-coloring a grid in Online-LOCAL:
1. Greedily 2-color the grid:

2. Draw border around incompatible regions:

• $O(\log n)$ view suffices for Online-LOCAL.
• Requires $\Omega(\sqrt{n})$ view in LOCAL.

†Locally Checkable Labeling Problems (LCLs)

Every node (or edge) needs to be assigned a label from a finite set of labels. A labeling is valid for the whole graph if and only if it is valid around every node. For example, coloring with $k$ colors, maximal independent set, minimal dominating set and maximal matching are all LCL problems.