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Distributed Systems, Summer Term 2019
Exercise Sheet 7

1 3^Δ-Coloring

a) Describe an algorithm that colors a directed graph with out-degree at most 1 with 6 colors in $O(\log^* n)$ rounds.

Hint: Use the ring coloring algorithm from the lecture.

b) Given a directed graph with out-degree at most 1 which is colored with $m > 3$ colors, describe a method to recolor the graph in one round using $m - 1$ colors.

c) Use part a) and b) to develop an algorithm that colors an (undirected) graph with at most 3^Δ colors in time $O(\log^* n)$. You can assume that Δ is known to all nodes.

2 Color Reduction

a) Given a graph which is colored with $m > \Delta + 1$ colors, describe a method to recolor the graph in one round using $m - \lfloor \frac{m}{\Delta+2} \rfloor$ colors.

Hint: Partition the set of colors into sets of size $\Delta + 2$ and recall the color reduction method from the lecture.

b) Show that after $O(\Delta \log(m/\Delta))$ iterations of step a), one obtains a $O(\Delta)$ coloring.