PRESENTATION OUTLINE: Distributed Graph Coloring

David Worley
School of Computer Science
University of Ottawa
Ottawa, Canada
dworley@uottawa.ca

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1 What is Graph coloring

- Explaining the problem statement for graph coloring
- What is the goal of graph coloring algorithms
- The definition of k-coloring

2 An Example

- A diagram showing a proper graph coloring of the peterson graph
- An explanation of what this coloring is (3-coloring of specific graph)

3 Distributed Graph coloring

- Brief explanation of distributed graph coloring
- Pose question: What is the ideal trade-off between minimal colors and minimal run-time?
- Ask why these colorings are useful (set up for next slide)

4 Applications

- Applications in job scheduling
- Application in network analysis (social networks, lte networks, etc)

5 What Makes a Good coloring?

- Motivate wanting bounds on the size of the colorings for graph coloring algorithms
- introduce the concept of reducing the number of colors in a larger coloring

6 A Lower Bound for Graph coloring

- Mention the greedy sequential algorithm that generates an $O(\Delta + 1)$ coloring.
- Introduce this coloring as a suitable lower bound for distributed graph coloring.

7 An Upper Bound by Linial

- Introduce Linials paper presenting the $O(\Delta^2)$ coloring algorithm in $O(\log^* n)$
- Discuss how color reduction algorithms can use Linials algorithm to generate a coloring to reduce
- Motivate where this can lead regarding future improvements

8 Linial's Algorithm

- Short explanation of how Linials algorithm works

9 Algorithm Optimality

- Discuss Linial's result that $O(\log^* n)$ is optimal for distributed graph coloring algorithm
- Talk about how this has shifted research towards color reduction algorithms

10 color Reduction

- Detail color reduction, the typical round based approach to it, and its goal

11 Improving color Reduction

- Discuss the SV barrier and the algorithm that breaks it

12 A round-based scaleable algorithm for color reduction

- Introduce Maus's algorithm that scales between the two bounds

13 Maus's Algorithm

- Discuss how the algorithm works

14 Explanation of Algorithm

- Walkthrough of how Maus's algorithm reduces a coloring for a given small Δ and k

15 Implementation

- Short description of how the algorithm was implemented

16 Example of Algorithm

- Multiple slides showing a color reduction using Maus's algorithm on a simple example

  This will stretch over multiple slides

17 Experimental Results

- Detail the execution time of the algorithm and reduction amount on large colorings in practice.

18 Questions For Audience

- Why is research focusing on color reduction algorithms instead of coloring algorithms?
- Why do we have a lower bound of $O(\Delta + 1)$ for our colorings?
- Could an $O(1)$ coloring algorithm (not color reduction) be possible?

19 Thanks

- Thank the audience and prompt for questions

20 References

- Slide showing references used throughout the presentation