



Premium Graph Coloring

Imagine that you are an important internet service provider. You are offering different levels of service quality ranging from very basic to premium service. While some customers might be willing to spend extra money on guaranteed good service, others might be just fine with the standard package. Can you find the best way of serving all customers?

While this introduction sounds very practical, this problem can be linked to a well-studied problem in theoretical computer science, namely *graph coloring*. However, one has to extend the original graph coloring problem to obtain a realistic model of this application. Once we have this modified coloring problem, there is a wide range of new theoretical questions to study: its computational complexity, its approximability, efficient algorithms to solve the problem, interesting special cases, graphs where the problem is especially hard, and so on.



Apart from the theoretical analysis, it is also important to solve actual instances of the problem in practice. Since graph coloring is NP-hard, this often means settling for heuristic algorithms that may only find a suboptimal solution, but are able to do this quickly.

The goal of the project is to model and study the above scenario in a graph-theoretical setting. With this approach, the thesis lies somewhere between theory and practice. Our model will be motivated by the properties of a practical application area, and any heuristic solutions would have to be compared and evaluated empirically on a range of actual input graphs. However, a theoretical analysis of the new coloring problem is also essential, and any ideas behind the algorithms should come from insights and observations about this underlying problem.

Requirements: Interest in theoretical computer science, creativity in designing algorithms, and (optionally) basic programming skills. We will have weekly meetings to discuss questions and new ideas.

Interested? Please contact us for more details!

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