Title: Graph coloring problems
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Abstract:
As the title suggests, the central topic of this thesis is graph coloring. The thesis is divided into three parts where each part focuses on a different kind of coloring. The first part is about 6-critical graphs on surfaces and 6-critical graphs with small crossing number. We give a complete list of all 6-critical graphs on the Klein bottle and complete list of all 6-critical graphs with crossing number at most four.

The second part is devoted to list coloring of planar graphs without short cycles. We give a proof that planar graphs without 3-, 6-, and 7-cycles are 3-choosable and that planar graphs without triangles and some constraints on 4-cycles are also 3-choosable.

In the last part, we focus on a recent concept called packing coloring. It is motivated by a frequency assignment problem where some frequencies must be used more sparsely than others. We improve bounds on the packing chromatic number of the infinite square and hexagonal lattices.

Keywords: critical graphs, list coloring, packing coloring, planar graphs, short cycles