

DISCRETE MATHEMATICS

Completely normal distributive lattices.

supervisor: doc. RNDr. Miroslav Ploščica, CSc. (miroslav.ploscica@upjs.sk)

study form: full time

Annotation: Completely normal distributive lattices have been discovered in connection with spectral spaces of abelian lattice-ordered groups and related structures. Up to now, they have been studied mainly with respect to their topological representation. The aim of the proposed research is to analyse these objects from the point of view of universal algebra. Typical problems can concern, for instance, the description of subdirectly irreducible algebras, free algebras or the subvarieties lattice.

Generalised graph colourings.

supervisor: doc. RNDr. Roman Soták, PhD. (roman.sotak@upjs.sk)

study form: full time

Annotation: To study different chromatic characteristics of graphs, among other things DP-chromatic number and Alon-Tarsi number. To investigate their generalisations corresponding to the list version or its analogies, respectively. To focus on new proof techniques in this area as are Nullstellensatz or else entropy compression.

From proper to strong edge colouring of graphs.

supervisor: doc. RNDr. Roman Soták, PhD. (roman.sotak@upjs.sk)

study form: full time

Annotation: To study edge colourings of graphs that are stronger than proper ones. A strong edge colouring requires that vertices of edges of each colour class induce a matching. It is known that $\Delta(G)+1$ colours are sufficient for a proper colouring of edges of a graph G . It is conjectured that the best upper bound of a sufficient number of colours for a strong colouring of a graph G is $1,25 \cdot \Delta(G) \cdot \Delta(G)$, but the currently known upper bound is only $1,772 \cdot \Delta(G) \cdot \Delta(G)$. In connection with that to try to improve the upper bound for the number of colours in a strong colouring for some classes of graphs (regular graphs, bipartite graphs, plane graphs etc.).

Structural properties of embedded graphs.

supervisor: doc. RNDr. Roman Soták, PhD. (roman.sotak@upjs.sk)

study form: full time

Annotation: To study local and global properties of embedded graphs. Analogies of some properties of plane graphs (e.g. existence of a vertex of degree at most 5 or of an edge with the sum of degrees of its vertices at most 13) can be proved for graphs embedded into various surfaces. To focus on structural properties of embedded graphs connected with simple graph invariants (minimum graph degree, girth of a graph etc.). To try to use obtained results in solving some problems of chromatic graph theory