number of columns in an m-rowed simple matrix which has no configuration F. For this talk we consider forbidding a configuration $F(m)$, a configuration that grows with m. Some design theory questions arise.

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MS17

The Manickam-Miklós-Singhi Conjectures for Sets and Vector Spaces

More than twenty-five years ago, Manickam, Miklós, and Singhi conjectured that for positive integers n, k with $n \geq 4k$, every set of n real numbers with nonnegative sum has at least $\binom{n-1}{k-1}$ k-element subsets whose sum is also nonnegative. We verify this conjecture when $n \geq 8k^2$, which simultaneously improves and simplifies a bound of Alon, Huang, and Sudakov and also a bound of Pokrovskiy when $k < 10^{45}$. Moreover, our arguments resolve the vector space analogue of this conjecture.

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MS17

Maximizing the Number of Nonnegative Subsets

Given a set of n real numbers, if the sum of elements of every subset of size larger than k is negative, what is the maximum number of subsets of nonnegative sum? In this talk we will show that the answer is $\binom{n-1}{k-1} + ... + \binom{n-1}{0} + 1$ by establishing and applying a weighted version of Hall's Theorem. This settles a problem of Tsukerman. Joint work with Noga Alon.

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MS17

Turan Problem for Hypergraph Forests

The Turan number $ex_r(n, H)$ of an r-uniform hypergraph H is the largest size of an r-uniform hypergraph on n vertices that does not contain H as a subgraph. A hypergraph is a hypergraph forest if its edges can be ordered as $E_1, \ldots, E_m$ such that for any $i > 1$ there exists $a(i) < i$ such that $E_i \cap (\bigcup_{j<i} E_j) \subseteq E_{a(i)}$. A subgraph of a hypergraph forest is called a partial forest. Many results in extremal set theory are Turan results on very special hypergraph forests or partial forests. Here, we establish a general result: For all $r \geq q + 2 \geq 4$, if F is a partial forest of edge sizes at most q and H is obtained from F by enlarging its edges to r-sets using disjoint sets of new vertices then $ex_r(n, H) = (\sigma(H) - 1)\binom{n}{r-1} + O(n^{r-2})$, where $\sigma(H)$ is the smallest size of a set of vertices that meets each edge of H in exactly one vertex. We also determine the exact values of $ex_r(n, H)$ for all large n for certain so-called σ-critical H. Our results generalize many recent asymptotic or exact results on the topic. The work is joint with Z. Füredi. We also survey related results and pose some questions.

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MS17

Turán Numbers for Bipartite Graphs Plus Odd Cycles

In this talk, I will discuss a general approach to a class of extremal problems for bipartite graphs. Specifically, Erdős and Simonovits made three important conjectures concerning the asymptotic behavior of the extremal number for a bipartite graph containing a cycle. One of the conjectures states that if $\mathcal{C}_k$ is the set of odd cycles of length less than k, then for every bipartite graph F containing a cycle, the extremal $\mathcal{C}_k$-free F-free graphs should have asymptotically as many edges as an extremal F-free bipartite graph. We prove this conjecture for a wide class of graphs F, in addition exhibiting a "near-bipartite' structure of extremal graphs. The proof depends strongly on the existence of an exponent for a bipartite graph F, which constitutes another of the three conjectures of Erdős and Simonovits.

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MS18

Sudoku, Latin Squares, and Defining Sets in Graph Coloring

Over the last decade, Sudoku, a combinatorial number-placement puzzle, has become a favorite pastimes of many all around the world. In this puzzle, the task is to complete a partially filled 9 by 9 square with numbers 1 through 9, subject to the constraint that each number must appear once in each row, each column, and each of the nine 3 by 3 blocks. As it turns out, this is very similar to the notion of critical sets for Latin squares, or more generally, defining sets for graph colorings. In this talk, we discuss this connection and present a number of new results and open problems for Sudoku squares.

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MS18

Defining Sets in Graph Coloring

In a given graph G, a set of vertices S with an assignment of colors is called a defining set (of a k-coloring), if there exists a unique extension of the colors of S to a proper k-coloring of the vertices of G. The minimum cardinality between all defining sets is denoted by $d(G, k)$. Defining sets are defined and discussed for many concepts and parameters in graph theory and combinatorics. For example in Latin squares a critical set is a partial Latin square that has a unique completion to a Latin square of order n, the interest is to find the size of the smallest critical set. The following conjecture (1995), is still open: For any n, $d(K_n \times K_n, n) = \lfloor n^2/4 \rfloor$. Defining sets in graph coloring are closely related with the idea of "uniquely k-list colorable graphs". In this talk we mention these concepts in different areas and introduce some more open problems.

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MS18

Coloring Maps on Surfaces

Albertson conjectured every surface F^2 admits an integer $N(F^2)$ such that if $G \subset F^2$, then G admits some $S \subset V(G)$ with $|S| \leq N(F^2)$ such that $G - S$ is 4-colorable. In my talk, as a variation of it, we prove that every locally planar graph G on an orientable surface has a 5-coloring such that the cardinality of the smallest color class is bounded by $\varepsilon|V(G)|$. Moreover, we prove similar results for some classes of maps on orientable surfaces.

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MS18

Distinguishing Colorings of 3-regular Maps on Closed Surfaces

A k-coloring of a map on a closed surface is said to be *distinguishing* if there is no automorphism of the map other than the identity map which preserves the colors. In particular, if a map has a k-coloring which uses color k at most once, then it is said to be *nearly distinguishing* $(k-1)$-*colorable*. We shall show that any 3-regular map on a closed surface is nearly distinguishing 3-colorable unless it is one of three exceptions.

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MS18

Small Snarks and 6-chromatic Triangulations on the Klein Bottle

We take a dual approach to the embedding of snarks on the Klein bottle, and investigate edge-colorings of 6-chromatic triangulations of the Klein bottle. In the process, we discover the smallest snarks that embed polyhedrally on the Klein bottle. Additionally, we find that every triangulation containing certain 6-critical graphs on the Klein bottle must have a Grünbaum coloring and thus cannot admit a dual embedded snark.

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MS19

Properly Coloured Hamilton Cycles in Edge-coloured Complete Graphs

Let K_n^c be an edge-coloured complete graph on n vertices. Let $\Delta_{\mathrm{mon}}(K_n^c)$ denote the maximum number of edges of the same colour incident with a vertex of K_n^c. In 1976, Bollobás and Erdős conjectured that every K_n^c with $\Delta_{\mathrm{mon}}(K_n^c) < \lfloor n/2 \rfloor$ contains a properly coloured Hamilton cycle, that is, a spanning cycle in which adjacent edges have distinct colours. In this talk, we show that for any $\varepsilon > 0$ and for all $n \geq n_0(\varepsilon)$, $\Delta_{\mathrm{mon}}(K_n^c) < (1/2 - \varepsilon)n$ is sufficient. Hence the conjecture of Bollobás and Erdős is true asymptotically.

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MS19

Decomposition of Random Graphs into Complete Bipartite Graphs

For a graph G, the bipartition number $\tau(G)$ is the minimum number of complete bipartite subgraphs whose edge sets partition the edge set of G. In 1971, Graham and Pollak proved that $\tau(K_n) = n - 1$. For a graph G with n vertices, one can show $\tau(G) \leq n - \alpha(G)$ easily, where $\alpha(G)$ is the independence number of G. Erdős conjectured that almost all graphs G with n vertices satisfy $\tau(G) = n - \alpha(G)$. In this talk, we present upper and lower bounds for $\tau(G(n,p))$ which gives support to Erdős' conjecture.

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MS19

A Blow-up Lemma for Sparse Pseudorandom Graphs

We present a new blow-up lemma for spanning graphs with bounded maximum degree in sparse pseudorandom graphs and discuss its possible applications.

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MS19

The Typical Structure of Sparse H-free Graphs

Two central topics of study in combinatorics are the so-called evolution of random graphs, introduced by the seminal work of Erdős and Rényi, and the properties of H-free