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Registration

7:00 AM-8:30 AM

Room:Tivoli Student Union Turnhalle (TV 250) Atrium At 8:30 AM, registration will move to North Classroom 1130 Entry.

Opening Remarks

8:00 AM-8:15 AM

Room:Tivoli Student Union Turnhalle (TV 250)

Monday, June 4

IP1

Analytic Methods in Graph Theory

1

8:15 AM-9:00 AM

Room:Tivoli Student Union Turnhalle (TV 250)

Chair: To Be Determined

The theory of graph limits provides analytic tools to study large graphs. Such tools have found applications in various areas of computer science and mathematics; they are also closely linked to the flag algebra method, which changed the landscape of extremal combinatorics. We will present an introduction to this rapidly developing area of graph theory and survey some of the recent results obtained in the area.

Daniel Kral

University of Warwick, United Kingdom

Coffee Break

9:00 AM-9:30 AM



Room:Tivoli Student Union Turnhalle (TV 250) Atrium Monday, June 4 Registration 9:00 AM-4:00 PM

Room:North Classroom 1130 Entry

MS1 Combinatorics of Partially Ordered Sets - Part I of III

9:30 AM-12:00 PM

Room:North Classroom 1604

For Part 2 see MS6

Over the past 10 years there has been a resurgence of research into the combinatorics of partially ordered sets, including significant progress on old conjectures, applications of classical techniques to seemingly unrelated problems in other areas of mathematics, and novel connections between wellstudied areas. The goal of this minisymposium is to continue the growth of this area by bringing together senior and junior researchers working on the combinatorics of partially ordered sets.

Organizer: Mitchel T. Keller Washington and Lee University, USA

Organizer: Stephen J. Young Pacific Northwest National Laboratory, USA

9:30-9:55 Hereditary Semiorders and Enumeration of Semiorders by Dimension (Part I) 10 Mitchel T. Keller, Washington and Lee

University, USA; Stephen J. Young, Pacific Northwest National Laboratory, USA

10:00-10:25 Hereditary Semiorders and Enumeration of Semiorders by Dimension (Part II) 11

Mitchel T. Keller, Washington and Lee University, USA; *Stephen J. Young*, Pacific Northwest National Laboratory, USA

10:30-10:55 A Simple Proof Characterizing Interval Orders with Interval Lengths between 1 and k 10 Simona Boyadzhiyska, Freie Universitaet Berlin, Germany; Garth T. Isaak, Lehigh University, USA; Ann N. Trenk, Wellesley College, USA

11:00-11:25 A Note on the Size of *N*-free Families 11

Shanise Walker and Ryan R. Martin, Iowa State University, USA

Better Bounds for Poset Dimension and Boxicity <u>11</u>

David Wood, Monash University, Australia

MS2

Structural Graph Theory -Part I of III

9:30 AM-12:00 PM

Room:North Classroom 1130

For Part 2 see MS7

Structural theorems in graph theory seek to describe all the graphs with satisfying some desirable property by showing such graphs either fall into one of a number of basic classes or can be decomposed into smaller graphs. The methodology has shown to be extremely effective in proving both theoretical results as well as in the development of efficient algorithms.

Organizer: Paul Wollan

University of Rome La Sapienza, Italy

9:30-9:55 Large Independent Sets in Triangle-free Graphs Avoiding a Clique-minor 11

Zdenek Dvorak, Charles University, Czech Republic; Liana Yepremyan, University of Oxford, United Kingdom

10:00-10:25 Hereditary Families with Atypical Structure 12

Sergey Norin, McGill University, Canada; Yelena Yuditsky, Karlsruhe Institute of Technology, Germany

10:30-10:55 Polynomial-time Algorithm for Maximum Weight Independent Set on P6-free Graphs <u>11</u>

Andrzej Grzesik, University of Warwick, United Kingdom; *Tereza Klimosova*, Charles University, Czech Republic; Marcin Pilipczuk and Michal Pilipczuk, University of Warsaw, Poland

11:00-11:25 Erdös-Pósa Property of Chordless Cycles and its Applications

O-Joung Kwon, Incheon National University, Korea; Eun Jung Kim, Universite Paris Dauphine and CNRS, France 12

11:30-11:55 The Grid Theorem for Rank-Width $12 \end{tabular}$

Jim Geelen, University of Waterloo, Canada; O-Joung Kwon, Incheon National University, Korea; *Rose McCarty*, University of Waterloo, Canada; Paul Wollan, University of Rome La Sapienza, Italy Monday, June 4

MS3

Graph Coloring - Part I of II 9:30 AM-12:00 PM

7.00 /101-12.00 1 101

Room:North Classroom 1005

For Part 2 see MS8

Graph coloring is a central area of discrete mathematics, and it is widely studied. In this minisymposium we will hear about recent developments in the area.

Organizer: Daniel Cranston

Virginia Commonwealth University, USA 9:30-9:55 Acyclic Edge-coloring of

Planar Graphs: Delta Colors Suffice when Delta is Large $13\,$

Daniel Cranston, Virginia Commonwealth University, USA

10:00-10:25 Characterization of Cycle Obstruction Sets for Improper Coloring Planar Graphs 12

Ilkyoo Choi, Hankuk University of Foreign Studies, Korea

10:30-10:55 Distributed Coloring with Fewer Colors $12 \ 12$

Marthe Bonamy, LaBRI, Université de Bordeaux, and CNRS, France

11:00-11:25 Vector Coloring the Categorical Product of Graphs 13 Robert Šámal, Charles University, Czech

Republic 11:30-11:55 Vertex Partition with

Average Degree Constraint 13

Hehui Wu, Shanghai Center for Mathematical Sciences, China

Monday, June 4

MS4

Discrete Random Processes -Part I of II

9:30 AM-12:00 PM

Room:North Classroom 1003

For Part 2 see MS10

The analysis of discrete random processes is a central topic in the fields of probabilistic combinatorics and random graph theory, and has important applications to extremal combinatorics. In this minisymposium, researchers will share recent results in the area including dynamic concentration and the so-called "differential equations method" and its applications.

Organizer: Deepak Bal Montclair State University, USA

Organizer: Patrick Bennett Western Michigan University, USA

9:30-9:55 The Bipartite K_{2,2} -Free Process and Ramsey Numbers 13 Patrick Bennett, Western Michigan University, USA

10:00-10:25 A Probabilistic Approach Towards the Aharoni-Berger Conjecture on Rainbow Matchings 13

Pu Gao, Monash University, Australia

10:30-10:55 Domination in Random Regular Graphs and in Graphs with Large Girth 14

Carlos Hoppen and Giovane Mansan, Federal University of Rio Grande do Sul, Brazil

11:00-11:25 The Size of the GiantComponent in the D-Process13Laura Eslava, Georgia Institute of13

Technology, USA

11:30-11:55 Packing Edge-disjoint Spanning Trees in Random Geometric Graphs $$\underline{14}$$

Pu Gao, Monash University, Australia; Xavier Perez-Gimenez, University of Nebraska-Lincoln, USA; Cristiane M. Sato, University of Waterloo, Canada

MS5

Extremal Problems Involving Cycles and Trees - Part I of II

9:30 AM-11:30 AM

Room:North Classroom 1806

For Part 2 see MS11

Extremal combinatorics is the study of questions of the form "How large does a parameter of a graph G need to be to guarantee that G contains a certain substructure?" In addition to being interesting on their own right, problems in extremal combinatorics are important because they occur in many other branches of mathematics as well as computer science. Additionally, many useful methods, such as the probabilistic method and regularity, have arisen from the study of extremal combinatorics. The aim of this minisymposium is to bring together promising young researchers in extremal combinatorics. We will discuss recent progress on important conjectures, new methods developed to solve them, and interesting new problems in the area. We will particularly focus on extremal problems involving sparse structures such as cycles, trees and hypercubes. Such problems are usually much harder then ones involving dense structures. However, recently various new methods have been found for studying sparse structures e.g. the hypergraph container method. We hope that gathering researchers working on such problems will encourage the exchange of ideas, leading to further progress in the area.

Organizer: Shoham Letzter University of Cambridge, United Kingdom

Organizer: Alexey Pokrovskiy ETH Zürich, Switzerland

9:30-9:55 Rainbow Trees 14 Alexey Pokrovskiy, ETH Zürich, Switzerland

10:00-10:25 Three Colour Bipartite 14 Ramsey Number of Cycles and Paths *Matija Bucic*, Shoham Letzter, and Benjamin Sudakov, ETH Zürich, Switzerland

 10:30-10:55 A Stability Theorem for

 Small Cycle Covers
 14

 Frank Mousset, Tel Aviv University, Israel

11:00-11:25 Linear Cycles of Consecutive Lengths in Linear Hypergraphs 14 Liana Yepremyan, University of Oxford,

United Kingdom

Monday, June 4

CP1

Networks 9:30 AM-11:10 AM

Room:North Classroom 1606

Chair: To Be Determined

9:30-9:45 Algebraic Analysis of Spiking Neural Networks for Graph Partitioning

Kathleen Hamilton, Catherine Schuman, and Travis Humble, Oak Ridge National Laboratory, USA 2

9:50-10:05 Approximating Sparse Graphs: the Random Overlapping Communities Model 3

Samantha N. Petti and Santosh Vempala, Georgia Institute of Technology, USA

10:10-10:25 Robust Maximal Independent Sets

Kevin C. Halasz, Simon Fraser University, Canada; Arnaud Casteigts, Universite de Bordeaux I, France; Luis Goddyn, Simon Fraser University, Canada

2

10:30-10:45 Large Degree Asymptotics and the Reconstruction Threshold of Asymmetric Ising Model on Regular D-Ary Trees 2

Wenjian Liu, City University of New York, USA

10:50-11:05 Dynamical Stability Despite Time-Varying Network Structure 3

David Reber and Benjamin Webb, Brigham Young University, USA

Monday, June 4

CP2

Directed Graphs 9:30 AM-11:10 AM

Room:North Classroom 1607

Chair: To Be Determined

9:30-9:45 Proper Orientations of Planar Bipartite Graphs 3

Sebastian Gonzalez Hermosillo De La and Fiachra Knox, Simon Fraser University, Canada; Naoki Matsumoto, Seikei University, Japan; Bojan Mohar, Simon Fraser University, Canada; Claudia Linhares Sales, Federal University of Ceará, Brazil

9:50-10:05 Cyclic Triangle Factors in Regular Tournaments 4

Theodore Molla, University of South Florida, USA; Lina Li, University of Illinois at Urbana-Champaign, USA

10:10-10:25 A Matrix Approach to
p-Competition Graphs3

Taehee Hong, Suh-Ryung Kim, and Seung Chul Lee, Seoul National University, Korea

10:30-10:45 On 1-Factors with Prescribed Lengths in Tournaments 4

Dongyeap Kang, Korea Advanced Institute of Science and Technology, Korea; Jaehoon Kim, University of Birmingham, United Kingdom

10:50-11:05 Simple Transformation for Finding a Maximum Weighted Matching in General Digraphs

Choon Sung Lim, Bank of Korea, South Korea

Lunch Break

12:00 PM-1:30 PM

Attendees on their own

IP₂

Interpolation Polynomials, Operator Method, and **Theory of Enumeration**

1:30 PM-2:15 PM

Room:Tivoli Student Union Turnhalle (TV 250)

Chair: To Be Determined

Goncarov Polynomials are the basis of solutions of the classical Goncarov Interpolation Problem, which have been studied extensively by analysts due to their significance in the interpolation theory of smooth and analytic functions. These Polynomials also play an important role in combinatorics due to their close relations to parking functions. This is not just a coincidence. In this talk we will present the interpolation problems with delta-operators, develop the algebraic and analytic theory of delta-Goncarov polynomials, and apply these results to problems in binomial enumeration and order statistics.

Catherine Yan

Texas A&M University, USA

Coffee Break



Room: Tivoli Student Union Turnhalle (TV 250) Atrium

Monday, June 4

MS6

1

Combinatorics of Partially Ordered Sets - Part II of III

2:45 PM-5:15 PM

Room:North Classroom 1604

For Part 1 see MS1 For Part 3 see MS12

Over the past 10 years there has been a resurgence of research into the combinatorics of partially ordered sets, including significant progress on old conjectures, applications of classical techniques to seemingly unrelated problems in other areas of mathematics, and novel connections between wellstudied areas. The goal of this minisymposium is to continue the growth of this area by bringing together senior and junior researchers working on the combinatorics of partially ordered sets.

Organizer: Mitchel T. Keller Washington and Lee University, USA

Organizer: Stephen J. Young Pacific Northwest National Laboratory, USA

2:45-3:10 Local Dimension is **Unbounded for Planar Posets** 15

Bartlomiej Bosek, Jagiellonian University, Poland; Jaroslaw Grytczuk, Warsaw University of Technology, Poland; William T. Trotter, Georgia Institute of Technology, USA

3:15-3:40 Fractional Local Dimension

Fidel Barrera-Cruz, Thomas Prag, Heather C. Smith, and William T. Trotter, Georgia Institute of Technology, USA 15

3:45-4:10 Dimension and Subdivision of K₄ Free Posets 15

Adam Bamforth, University of Louisville, USA

4:15-4:40 Partially Ordered Sets and Finite Topologies 15

Emilie Purvine, Cliff Joslyn, and Brenda Praggastis, Pacific Northwest National Laboratory, USA; Michael Robinson, American University, USA

4:45-5:10 A Random Version of the r-fork-free Theorem 15

Kirsten Hogenson, Colorado College, USA

Monday, June 4

MS7

Structural Graph Theory -Part II of III

2:45 PM-4:45 PM

Room:North Classroom 1130

For Part 1 see MS2 For Part 3 see MS13

Structural theorems in graph theory seek to describe all the graphs with satisfying some desirable property by showing such graphs either fall into one of a number of basic classes or can be decomposed into smaller graphs. The methodology has shown to be extremely effective in proving both theoretical results as well as in the development of efficient algorithms.

Organizer: Paul Wollan

University of Rome La Sapienza, Italy

2:45-3:10 Scattered Classes of Graphs 16 O-Joung Kwon, Incheon National University, Korea; Sang-Il Oum, KAIST, Korea

3:15-3:40 On the Genus of the Complete 3-uniform Hypergraph 16

Bojan Mohar and Yifan Jing, Simon Fraser University, Canada

3:45-4:10 The Genus of a Random **Bipartite Graph** 16

Yifan Jing and Bojan Mohar, Simon Fraser University, Canada

4:15-4:40 Half-integral Linkages in Highly Connected Directed Graphs 16

Irene Muzi, University of Warsaw, Poland; Paul Wollan, University of Rome La Sapienza, Italy; Katherine Edwards, Nokia Bell Labs, USA

MS8

Graph Coloring - Part II of II 2:45 PM-5:15 PM

Room:North Classroom 1539

For Part 1 see MS3

Graph coloring is a central area of discrete mathematics, and it is widely studied. In this minisymposium we will hear about recent developments in the area.

Organizer: Daniel Cranston Virginia Commonwealth University, USA

2:45-3:10 Bounding the Chromatic Number by a Fraction of the Maximum Degree for Graphs with no Large Cliques 16

Thomas Kelly, University of Waterloo, Canada

3:15-3:40 Circular Flow and Circular Coloring of Graphs $$1\,7$$

Jiaao Li, West Virginia University, USA

3:45-4:10 4-coloring P₆-free Graphs 17 *Sophie Spirkl*, Princeton University, USA

4:15-4:40 Clustered Coloring, Hajos' Conjecture and Gerards-Seymour Conjecture 17

Chun-Hung Liu, Princeton University, USA

4:45-5:10 Coloring (2K₂, W₄)-Free Graphs 17

Aurélie Lagoutte, University Clermont-Auvergne, France

Monday, June 4

MS9

Secret Sharing at the Intersection of Cryptography and Coding Theory

2:45 PM-5:15 PM

Room:North Classroom 1606

Secret sharing is an important primitive in cryptography, allowing n parties to share a secret, x, so that "qualified" subsets of parties can recover the secret, but an "unqualified" subsets of parties learn nothing about the secret. There are rich connections between secret sharing and error correcting codes, and this mini-symposium will bring together researchers working at this intersection to discuss their work and share ideas. Secret sharing has found numerous applications in theoretical and realworld cryptographic constructions, and these cryptographic applications have motivated many variations and extensions of the basic definitions, including robust, verifiable, pseudorandom, and homomorphic secret sharing, among others. Ideas from coding theory have been a key tool in the approach of many of these problems, going all the way back to the Shamir secret sharing scheme, which is essentially a Reed-Solomon code. However, more recent advances have including connections throughout coding theory, in particular to locally decodable codes and coding for distributed storage. This minisymposium will highlight recent research on secret sharing across the fields of cryptography, theoretical computer science and electrical engineering, with the aim to strengthen the ties between these fields.

Organizer: Mary Wootters Stanford University, USA

Organizer: Brett Hemenway University of Pennsylvania, USA

2:45-3:10 Secure Distributed Storage and Its Connections to Communication-efficient Secret Sharing 18

Ankit Rawat, Massachusetts Institute of Technology, USA

3:15-3:40 Staircase Codes for Secret Sharing and Private Information Retrieval 17

Salim El Rouayheb, Rutgers University, USA

3:45-4:10 Homomorphic Secret Sharing, or: Locally Decodable Codes for Functions (Part 1) 17 Yuval Ishai, Technion, Israel

4:15-4:40 Homomorphic Secret Sharing, or: Locally Decodable Codes for Functions (Part 2) 17

Elette Boyle, Interdisciplinary Center Herzliya, Israel

4:45-5:10 Coding for Private Function Computation 18 Joerg Kliewer, New Jersey Institute of

Technology, USA

continued in next column

continued on next page

SIAM Conference on Discrete Mathematics

Monday, June 4

MS10

Discrete Random Processes - Part II of II

2:45 PM-4:45 PM

Room:North Classroom 1003

For Part 1 see MS4

The analysis of discrete random processes is a central topic in the fields of probabilistic combinatorics and random graph theory, and has important applications to extremal combinatorics. In this minisymposium, researchers will share recent results in the area including dynamic concentration and the so-called "differential equations method" and its applications.

Organizer: Deepak Bal Montclair State University, USA

Organizer: Patrick Bennett Western Michigan University, USA

2:45-3:10 Embedding the Uniform Random Graph into the Bipartite Regular Random Graph 19

Tereza Klimosova, Charles University, Czech Republic; Christian Reiher, University of Hamburg, Germany; Andrzej Rucinski, Adam Mickiewicz University, Poland, and Emory University, USA; *Matas Sileikis*, Czech Academy of Sciences, Czech Republic

3:15-3:40 Packing Nearly Optimal Ramsey R(3,t) Graphs 18

He Guo and Lutz Warnke, Georgia Institute of Technology, USA

3:45-4:10 Assessing Significance in a Markov Chain Without Mixing 18

Wes Pegden, Carnegie Mellon University, USA

4:15-4:40 Minimizing the Number of 5-cycles in Graphs with Given Edge-density 18

Andrzej Dudek, Western Michigan University, USA

Monday, June 4

MS11

Extremal Problems Involving Cycles and Trees -Part II of II

2:45 PM-4:45 PM

Room:North Classroom 1806

For Part 1 see MS5

Extremal combinatorics is the study of questions of the form "How large does a parameter of a graph G need to be to guarantee that G contains a certain substructure?" In addition to being interesting on their own right, problems in extremal combinatorics are important because they occur in many other branches of mathematics as well as computer science. Additionally, many useful methods, such as the probabilistic method and regularity, have arisen from the study of extremal combinatorics. The aim of this minisymposium is to bring together promising young researchers in extremal combinatorics. We will discuss recent progress on important conjectures, new methods developed to solve them, and interesting new problems in the area. We will particularly focus on extremal problems involving sparse structures such as cycles, trees and hypercubes. Such problems are usually much harder then ones involving dense structures. However, recently various new methods have been found for studying sparse structures e.g. the hypergraph container method. We hope that gathering researchers working on such problems will encourage the exchange of ideas, leading to further progress in the area.

Organizer: Shoham Letzter University of Cambridge, United Kingdom

Organizer: Alexey Pokrovskiy ETH Zürich, Switzerland

2:45-3:10 Path Partitions of Regular Graphs 19

Shoham Letzter, University of Cambridge, United Kingdom

3:15-3:40 Generalized Turan Problem for Trees 19

Clara Shikhelman, Tel Aviv University, Israel

3:45-4:10 Maximising the Number of Induced Cycles in a Graph 19

Natasha Morrison, University of Cambridge, United Kingdom

4:15-4:40 Incomplete Tilings 19

Vytautas Gruslys, University of Cambridge, United Kingdom

CP3

Algebraic Combinatorics/ Geometry

2:45 PM-5:15 PM

Room:North Classroom 1607

Chair: To Be Determined

2:45-3:00 Solving Tropical Linear Systems in Terms of the Shortest Path Problem 4

Yuki Nishida, Doshisha University, Japan; Sennosuke Watanabe, National Institute of Technology, Oyama College, Japan ; Yoshihide Watanabe, Doshisha University, Japan

3:05-3:20 Topology and Holomorphic Invariants Using the Application of Combinatorics 5

Abdulsalam G. Ya'u, Abubakar Tafawa Balewa University Bauchi, Nigeria; Mohammed Abdulhameed, Federal Polytechnic Bauchi, Nigeria

3:25-3:40 Many *k*-Neighborly Polytopes from Quivers 4

Daniel Mckenzie, University of Georgia, USA; Patricio Gallardo, Washington University, St. Louis, USA

3:45-4:00 On Generalized Quadrangles and Girth Eight Algebraically Defined Graphs 4

Brian Kronenthal, Kutztown University of Pennsylvania, USA; Felix Lazebnik, University of Delaware, USA; Jason Williford, University of Wyoming, USA

Welcome Reception



Room: Tivoli Brewing Company

Tuesday, June 5

Registration 7:30 AM-3:30 PM Room:North Classroom 1130 Entry

Announcements

8:10 AM-8:15 AM Room:North Classroom 1130

IP3

A Simply Exponential Upper Bound on the Maximum Number of Stable Matchings

8:15 AM-9:00 AM

Room:North Classroom 1130 Chair: To Be Determined

Anna R. Karlin University of Washington, USA

Coffee Break

9:00 AM-9:30 AM



1

Room:North Classroom 1130 Atrium

Tuesday, June 5

MS12

Combinatorics of Partially Ordered Sets - Part III of III

9:30 AM-11:30 AM

Room:North Classroom 1604

For Part 2 see MS6

Over the past 10 years there has been a resurgence of research into the combinatorics of partially ordered sets, including significant progress on old conjectures, applications of classical techniques to seemingly unrelated problems in other areas of mathematics, and novel connections between wellstudied areas. The goal of this minisymposium is to continue the growth of this area by bringing together senior and junior researchers working on the combinatorics of partially ordered sets.

Organizer: Mitchel T. Keller Washington and Lee University, USA

Organizer: Stephen J. Young Pacific Northwest National Laboratory, USA

9:30-9:55 On the Dimension of Random Posets 19

Csaba Biro, University of Louisville, USA; Peter Hamburger, Western Kentucky University, USA; H. A. Kierstead, Arizona State University, USA; Attila Por, Western Kentucky University, USA; William T. Trotter and Ruidong Wang, Georgia Institute of Technology, USA

10:00-10:25 The Width of Down Sets in Boolean Lattices $2\,0$

Dwight Duffus, Emory University, USA; David M. Howard, Colgate University, USA; Imre Leader, University of Cambridge, United Kingdom

10:30-10:55 Minimum Saturated Families of Sets $2\,0$

Tuan Tran, Matija Bucic, Shoham Letzter, and Benny Sudakov, ETH Zürich, Switzerland

11:00-11:25 Whitney Duals of Graded Posets 20

Joshua Hallam, Wake Forest University, USA

MS13

Structural Graph Theory -Part III of III

9:30 AM-12:00 PM

Room:North Classroom 1130

For Part 2 see MS7

Structural theorems in graph theory seek to describe all the graphs with satisfying some desirable property by showing such graphs either fall into one of a number of basic classes or can be decomposed into smaller graphs. The methodology has shown to be extremely effective in proving both theoretical results as well as in the development of efficient algorithms.

Organizer: Paul Wollan University of Rome La Sapienza, Italy

University of Rome La Sapienza, Italy

9:30-9:55 Coloring Graphs with No Clique Immersion 21

Paul Wollan and Tommaso d'Orsi, University of Rome La Sapienza, Italy

10:00-10:25 Caterpillars and the Strong Erdos-Hajnal Property 20

Anita Liebenau, Monash University, Australia; Marcin Pilipczuk, University of Warsaw, Poland; Paul Seymour and Sophie Spirkl, Princeton University, USA

10:30-10:55 Obstructions for Three-Coloring and List Three-Coloring H-Free Graphs $2\,1$

Maria Chudnovsky, Princeton University, USA; Jan Goedgebeur, Ghent University, Belgium; Oliver Schaudt, RWTH Aachen, Germany; *Mingxian Zhong*, Columbia University, USA

11:00-11:25 Unavoidable Minors in 2-connected Graphs of Large Pathwidth 20

Tony Huynh and Gwenael Joret, Université Libre de Bruxelles, Belgium; Piotr Micek, Jagiellonian University, Poland; David R. Wood, Monash University, Australia

11:30-11:55 Attacking Hadwiger's Conjecture via Chordal Partitions 21

David R. Wood, Monash University, Australia Tuesday, June 5

MS14

Graph Colouring - Part I of II 9:30 AM-12:00 PM

Room:North Classroom 1539

For Part 2 see MS17

In it's broadest definition, graph coloring involves assigning labels (which might be colors, numbers, lists) to each vertex or edge of a graph using stated restrictions, rules, and goals. Each type of graph coloring has its own uses and motivations. There are many forms of graph coloring. 'Proper' coloring, list coloring, path coloring, fractional coloring, distinguishing coloring are just a few of these. Graph theorists who study various graph colorings often find it useful to learn each others' motivations and methods. This session brings together researchers from a variety of types of graph colorings in order to encourage such sharing and productive cross fertilization.

Organizer: Debra L. Boutin Hamilton College, USA

Organizer: Gary MacGillivray University of Victoria, Canada

9:30-9:55 Acyclic Colouring of Graphs on Surfaces 22

Shayla Redlin and Luke Postle, University of Waterloo, Canada

10:00-10:25 The Distinguishing Cost of Graph Products \$21\$

Debra L. Boutin, Hamilton College, USA

10:30-10:55 On Uniquely *k*-List Colorable Graphs 21

Joan P. Hutchinson, Macalester College, USA; Ebad Mahmoodian, Sharif University of Technology, Iran

11:00-11:25 Distinguishing Numbers of Partially Ordered Sets 21

Karen Collins, Wesleyan University, USA; Ann N. Trenk, Wellesley College, USA

11:30-11:55 Arithmetic Progressions in Graphs 22

Michael Young, Iowa State University, USA

Tuesday, June 5

MS15

Computational Biology -Part I of II

9:30 AM-12:00 PM

Room:North Classroom 1003

For Part 2 see MS18

This minisymposium surveys a host of different topics where graph theory, combinatorics, and discrete mathematics more generally are making contributions to computational biology. Part I focuses on the analysis of biological networks. Part II looks at a range of topics from biological networks to sequence analysis, and circles back to new mathematical problems inspired by the biology.

Organizer: Lenore J. Cowen *Tufts University, USA*

9:30-9:55 Random Walk Methods and Their Application to Biological Networks 22

Lenore J. Cowen, Tufts University, USA

10:00-10:25 Synthesizing Signaling Pathways from Temporal Phosphoproteomic Data 22

Anthony Gitter, University of Wisconsin, Madison, USA

10:30-10:55 Integration and Dissection of Molecular Networks for Functional Analysis and Disease Modeling 23

Jian Peng, University of Illinois at Urbana-Champaign, USA

11:00-11:25 A Multi-Species Functional Embedding Integrating Sequence and Network Structure 23

Mark Leiserson, University of Maryland, College Park, USA

11:30-11:55 Denoising Large Scale Molecular Profiling Data Using Network Filters 22

Andrew J. Kavran and Aaron Clauset, University of Colorado Boulder, USA

MS16

New Trends in Enumerative Combinatorics - Part I of II

9:30 AM-12:00 PM

Room:North Classroom 1806

For Part 2 see MS19

The origin of algebraic combinatorics lies in the desire to bring coherence and unity to the discipline of combinatorics, in particular, enumeration, and to incorporate it into the mainstream of contemporary mathematics. Today Algebraic and Enumerative Combinatorics concerns itself with the study of combinatorial problems arising from other branches of mathematics and, on the other hand, with the application and use of techniques coming from other parts of mathematics to combinatorial problems. At the heart of the subject there is the development of algebraic theories for the solution to such problems. The implied interactions with other fields are mutually beneficial and concern particularly Algebra, Geometry, Topology, Computer Science, Probability Theory and Statistics. The development of combinatorics requires a familiarity of several mathematical branches for its researchers. This minisymposium is proposed to facilitate the contact between Enumerative and Algebraic Combinatorics and other fields in an effective way. It is aimed to bring together a strong group of active researchers in Algebraic Combinatorics with an emphasis on Enumeration, as well as other areas of mathematical sciences in which substantial enumerative questions with a strong algebraic or geometric foundation have arisen.

Organizer: Catherine Yan Texas A&M University, USA

Organizer: Yue Cai Texas A&M University, USA 9:30-9:55 Parking Distributions on Trees 24

Catherine Yan, Texas A&M University, USA

10:00-10:25 Barely Set-valued Tableaux and Nonintersecting Paths in Young Diagrams 23 Peter L. Guo, Nankai University, China

10:30-10:55 Mahonian-Stirling Statistics on Labeled Trees 24 Svetlana Poznanovikj and Amy Grady,

Clemson University, USA

11:00-11:25 Log-behavior of Partition Function $\ 24$

Xingwei Wang, Nankai University, China

11:30-11:55 Counting with Borel's Triangle 23

Yue Cai and Catherine Yan, Texas A&M University, USA Tuesday, June 5

CP4

Algorithms and Applications 9:30 AM-11:50 AM

Room:North Classroom 1606

Chair: To Be Determined

9:30-9:45 Polynomial Time Solution to the Domino Puzzle 5 *Ivan Avramovic*, George Mason University, USA

9:50-10:05 The Solution Attractor Theory of Local Search System: The Traveling Salesman Problem Case 6 *Weiqi Li*, University of Michigan-Flint, USA

10:10-10:25 Efficient Methods forEnforcing Contiguity in GeographicDistricting Problems5

Sheldon H. Jacobson, University of Illinois at Urbana-Champaign, USA; Douglas King, University of Illinois, USA; Edward Sewell, Southern Illinois University, Edwardsville, USA

10:30-10:45 Optimizing Order Picking Problem By a New Scalable Method

5

Arash Ghasemi, University of Tennessee, Chattanooga, SimCenter, USA

10:50-11:05 Leximax and Leximin Rank-Ordered Rules on the Power Set with Discrete Categories 6

Takashi Kurihara, Waseda University, Japan

11:10-11:25 Garden-of-Eden States and Fixed Points of Monotone Systems 8 *Ricky X. Chen*, Virginia Tech, USA; Christian Reidys and Henning Mortveit, Biocomplexity Institute, USA

11:30-11:45 The Fullerene Project 5 Elizabeth Hartung, Massachusetts College of Liberal Arts, USA; Jack Graver, Syracuse University, USA

Lunch Break

12:00 PM-1:30 PM

Attendees on their own

SP1

2018 Dénes König Prize Lecture: Pseudorandom Graphs and the Green-Tao Theorem

1:30 PM-2:15 PM

Room:North Classroom 1130

Chair: To Be Determined

The celebrated Green-Tao theorem states that there are arbitrarily long arithmetic progressions in the primes. I will explain some of the main ideas of the proof from a graph theoretic perspective, with a focus on the role of pseudorandomness in the proof. (Based on joint work with David Conlon and Jacob Fox)

Yufei Zhao Massachusetts Institute of Technology, USA

Coffee Break 2:15 PM-2:45 PM



Room:North Classroom 1130 Atrium

Tuesday, June 5

MS17

2.

Graph Colouring - Part II of II

2:45 PM-5:15 PM

Room:North Classroom 1539

For Part 1 see MS14

This 2-part minisymposium will showcase some of the many faces of graph colouring, arguably one of the most studied topics in graph theory. Part I features talks on distinguishing colourings where the colouring breaks the graph symmetry, list colourings where lists of colours are assigned to each vertex, and polychromatic colourings where given subgraphs must contain an element of each colour class. Part II features the following topics: a coloring game, colourings in which colour classes may induce cliques or independent sets, the chromatic number of subgraphs of a clustered graph, colouring with restrictions on the number of times each colour can appear in any neighborhood, and structures that forbid generalized colourings (i.e., homomorphisms) of graphs with two edge sets.

Organizer: Debra L. Boutin Hamilton College, USA

Organizer: Gary Macgillivray University of Victoria, Canada

2:45-3:10 The Slow-Coloring Game 25 Douglas B. West, Zhejiang Normal University, China and University of Illinois, USA

3:15-3:40 Fractional Cocolorings of Graphs 25

John Gimbel, University of Alaska, Fairbanks, USA; Andre Kundgen, California State University, San Marcos, USA

3:45-4:10 The Selective Coloring Problem 24

Tinaz Ekim, Bogazici University, Turkey

4:15-4:40 Homomorphism Duals for 2-Edge-Coloured Paths 24 Kyle Booker and *Richard Brewster*, Thompson Rivers University, Canada

4:45-5:10 Frugal Colourings and Homomorphisms 25

Gary MacGillivray, University of Victoria, Canada Tuesday, June 5

MS18

Computational Biology -Part II of II

2:45 PM-5:15 PM

Room:North Classroom 1003

For Part 1 see MS15

This minisymposium surveys a host of different topics where graph theory, combinatorics, and discrete mathematics more generally are making contributions to computational biology. Part I focuses on the analysis of biological networks. Part II looks at a range of topics from biological networks to sequence analysis, and circles back to new mathematical problems inspired by the biology.

Organizer: Lenore J. Cowen *Tufts University, USA*

Borislav Hristov, Princeton University, USA

3:15-3:40 New Directions in Deconvolving Genomic Mixtures of Copy Number Variation Data 26

Haoyun Lei, Theodore Roman, Jesse Eation, and Russell Schwartz, Carnegie Mellon University, USA

3:45-4:10 Two Problems on Tree-based Networks 26

Megan Owen, City University of New York, USA

4:15-4:40 The Language of RNA Base Pairings 25

Christine Heitsch, Georgia Institute of Technology, USA; Svetlana Poznanović, Clemson University, USA; Torin Greenwood, Georgia Institute of Technology, USA

4:45-5:10 Multi de Bruijn Sequences 26

Glenn Tesler, University of California, San Diego, USA

MS19

New Trends in Enumerative Combinatorics - Part II of II

2:45 PM-5:15 PM

Room:North Classroom 1806

For Part 1 see MS16

The origin of algebraic combinatorics lies in the desire to bring coherence and unity to the discipline of combinatorics, in particular, enumeration, and to incorporate it into the mainstream of contemporary mathematics. Today Algebraic and Enumerative Combinatorics concerns itself with the study of combinatorial problems arising from other branches of mathematics and, on the other hand, with the application and use of techniques coming from other parts of mathematics to combinatorial problems. At the heart of the subject there is the development of algebraic theories for the solution to such problems. The implied interactions with other fields are mutually beneficial and concern particularly Algebra, Geometry, Topology, Computer Science, Probability Theory and Statistics. The development of combinatorics requires a familiarity of several mathematical branches for its researchers. This minisymposium is proposed to facilitate the contact between Enumerative and Algebraic Combinatorics and other fields in an effective way. It is aimed to bring together a strong group of active researchers in Algebraic Combinatorics with an emphasis on Enumeration, as well as other areas of mathematical sciences in which substantial enumerative questions with a strong algebraic or geometric foundation have arisen.

Organizer: Catherine Yan Texas A&M University, USA

Organizer: Yue Cai Texas A&M University, USA

continued in next column

2:45-3:10 CLT for Descents in Matchings and Derangements 27

Gene Kim, University of South Carolina, USA

3:15-3:40 Two Types of Quasisymmetric Power Sums

Angela Hicks, Lehigh University, USA; Cristina Ballantine, College of the Holy Cross, USA; Zajj Daugherty, The City College of New York, USA; Sarah Mason, Wake Forest University, USA; Elizabeth Niese, Marshall University, USA

26

3:45-4:10 Enumeration on Rowincreasing Tableaux of Shape 2 x n 26

Ruoxia Du, East China Normal University, China

4:15-4:40 Detecting the Integer Decomposition Property and Ehrhart Unimodality in Reflexive Simplices Robert Davis, Michigan State University, USA

4:45-5:10 New Duals of MacMahon's Theorem on Plane Partitions 27 *Tri Lai*, University of Nebraska-Lincoln, USA Tuesday, June 5

MS20 Linear Algebra Methods in Combinatorics

2:45 PM-5:15 PM

Room:North Classroom 1005

Linear algebraic methods provide powerful tools for answering questions in combinatorics. Surprisingly, often the only solution for a purely combinatorial problem is found using linear algebra. Recent representative applications of these types of methods is the breakthrough upper bound on the maximum size of a 3-term AP free subset of $\mathbb{F}^{n_{1}}$ and the recent constructions of smaller counterexamples to Borsuk's conjecture. Our minisymposium will focus on linear algebra methods with a special emphasis on spectral graph theory. Often, spectral graph theory theorems can be used to strengthen those in classical extremal graph theory. Our session will bring together both junior and senior researchers, both domestic and international.

Organizer: Michael Tait Carnegie Mellon University, USA

Organizer: Sebastian Cioaba University of Delaware, USA

2:45-3:10 The Normalized Laplacian Matrix and Qualitative Properties of Graphs Including Random Walks 27

Steve Butler, Iowa State University, USA; Shaun Fallat, University of Regina, Canada; Kristin Heysse, Macalester College, USA; Stephen Kirkland, University of Manitoba, Canada

3:15-3:40 Forbidden Subgraphs and Equiangular Lines 27

Zilin Jiang, Technion Israel Institute of Technology, Israel

3:45-4:10 Rainbow Spanning Trees in General Graphs 28 Lauren M. Nelsen and Paul Horn, University

of Denver, USA

4:15-4:40 Graphs Whose Distance Matrices Have the Same Determinant Jephian C.-H. Lin, University of Victoria, Canada; Yen-Jen Cheng, National Chiao Tung University, Taiwan

4:45-5:10 Balanced Set Type Conditions 28 Jason Williford, University of Wyoming, USA

27

CP5

Hypergraphs, Ordered Sets, Extremal Combinatorics

2:45 PM-3:45 PM

Room:North Classroom 1604

Chair: To Be Determined

2:45-3:00 The Zarankiewicz Problem in 3-Partite Graphs 7

Craig Timmons, California State University, Sacramento, USA; Michael Tait, Carnegie Mellon University, USA

3:05-3:20 Decomposition of Random Hypergraphs 7

Xing Peng, Tainjin University, China

3:25-3:40 The Saturation Number, Extremal Number, Spectral Radius, and Family of k-Edge-Connected Graphs 6

Suil O, State University of New York, USA; Hui Lei and Yongtang Shi, Nankai University, China; Douglas B. West, Zhejiang Normal University, China and University of Illinois, USA; Xuding Zhu, Zhejiang Normal University, China Tuesday, June 5

CP6

Computational Geometry/ Words

2:45 PM-3:25 PM

Room:North Classroom 1606

Chair: To Be Determined

2:45-3:00 An Algorithm to Find Maximum Area Polygons Circumscribed About a Convex Polygon 7

Zsolt Langi, Budapest University of Technology and Economics, Hungary

3:05-3:20 Circular Repetition Thresholds for Small Alphabets

James D. Currie, *Lucas Mol*, and Narad Rampersad, The University of Winnipeg, Canada

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Wednesday, June 6

Registration

7:30 AM-3:30 PM Room:North Classroom 1130 Entry

Announcements

8:10 AM-8:15 AM Room:North Classroom 1130 1

Wednesday, June 6

IP4

Waiter-Client Games 8:15 AM-9:00 AM

Room:North Classroom 1130

Chair: To Be Determined

Waiter-Client games (also called Picker-Chooser games) is a type of positional games that gained popularity recently. When played on the edge set of a graph G (typically a complete graph K_n , or a random graph drawn from G(n,p)), the game goes as follows. For a positive integer q (the so called game bias), in each round Waiter offers to Client q+1 previously unoffered edges of G. Client chooses one of the edges offered, the rest go to Waiter. Waiter wins the game if by the time every edge of G has been claimed, Client's graph possesses a given graph theoretic property P, Client wins otherwise. We will present several recent results about Waiter-Client games played on complete and random graphs and discuss the role of the so called probabilistic intuition in their analysis. Based on joint works with M. Bednarska-Bzdega, D. Hefetz, T. Luczak, W. E. Tan, N. Trumer.

Michael Krivelevich

Tel Aviv University, Israel

Coffee Break

9:00 AM-9:30 AM



Room:North Classroom 1130 Atrium

Wednesday, June 6

MS21 Edge Colouring and Related

Notions - Part I of II 9:30 AM-11:30 AM

Room:North Classroom 1003

For Part 2 see MS28

Speakers will discuss problems related to edge colouring, including but not limited to: the classification problem, the Goldberg--Seymour conjecture, edge list colouring, matchings, and rainbow/ antirainbow subgraphs in edge-coloured graphs.

Organizer: Gregory J. Puleo Auburn University, USA

Organizer: Jessica McDonald Auburn University, USA

9:30-9:55 *t*-Cores for (△+*t*)-edgecolouring 28

Jessica McDonald and *Gregory J. Puleo*, Auburn University, USA

10:00-10:25 Star Edge-colorings of Subcubic Multigraphs 28 Zixia Song, University of Central Florida, USA

10:30-10:55 Delay Edge-colouring Bipartite Graphs 28

Katherine Edwards and William Kennedy, Nokia Bell Labs, USA

11:00-11:25 Recent Progress Toward Goldberg's Conjecture 28

Guantao Chen, Georgia State University, USA

Wednesday, June 6

MS22

Theoretical Computer Science as a New Discovery Engine of Discrete Mathematics

9:30 AM-12:00 PM

Room:North Classroom 1607

Theoretical Computer Science has a close relationship with discrete mathematics. The recent developments and breakthroughs in theoretical computer science can lead to surprising new progress of discrete mathematics. This session is a collection of some such amazing breakthroughs and connections.

Organizer: Rupei Xu University of Texas at Dallas, USA

Organizer: Andrea Lincoln Massachusetts Institute of Technology, USA

9:30-9:55 Fine-grained Complexity, Meta-algorithm and their Connections with Extremal Graph Theory 29

Rupei Xu and András Faragó, University of Texas at Dallas, USA

10:00-10:25 The 4/3 Additive Spanner Exponent Is Tight 29

Amir Abboud, IBM Research, USA; *Greg Bodwin*, Massachusetts Institute of Technology, USA

10:30-10:55 A Fast New Algorithm for Weak Graph Regularity 30

Jacob Fox, Stanford University, USA; László M. Lovász, University of California, Los Angeles, USA; *Yufei Zhao*, Massachusetts Institute of Technology, USA

11:00-11:25 Explicit Constructions of Ramsey Graphs via Randomness Extractors 29

Xin Li, Johns Hopkins University, USA

11:30-11:55 Duality, Flows, and Shortest Paths in Planar Graphs Jeff Erickson, University of Illinois at Urbana-Champaign, USA; *Kyle Fox*, University of Texas, Dallas, USA; Luvsandondov Lkhamsuren, Airbnb, USA

MS23

Reconfiguration Problems

9:30 AM-12:00 PM

Room:North Classroom 1604

Given two feasible solutions to a (combinatorial) problem, reconfiguration is the process of modifying the first into the second through a sequence of allowed steps while ensuring all intermediate configurations are feasible. A common framework for studying reconfiguration is to build a graph whose vertices are feasible solutions and adjacency indicates two solutions differ by a single reconfiguration step. Natural questions include studying the algorithmic complexity of finding reconfiguration sequences, conditions for the existence of reconfiguration sequences, and properties of reconfiguration graphs. Reconfiguration problems are interesting in their own right, They are also naturally applied to problems where one wishes to incrementally improve an existing solution while maintaining feasibility. Typically NP-hard problems lead to PSPACE-complete reconfiguration problems. A surprising example 3-colouring: it is NP-complete to determine if a graph admits a 3-colouring, but it is polynomial to determine if one colouring reconfigures to the another. This mini-symposium includes an introductory talk, and talks on reconfiguration of matroids, homomorphisms, matching, and dominating sets.

Organizer: Richard Brewster Thompson Rivers University, Canada 9:30-9:55 Invitation to Combinatorial Reconfiguration 30

Takehiro Ito, Tohoku University, Japan

10:00-10:25 Reconfiguring Graph Colourings and Homomorphisms 30 Richard Brewster, Thompson Rivers

University, Canada; Jae-Baek Lee, Kyungpook National University, Korea; Sean Mcguinness, Thompson Rivers University, Canada; Benjamin Moore, University of Waterloo, Canada; *Jonathan A. Noel*, University of Warwick, United Kingdom; Mark Siggers, Kyungpook National University, Korea

10:30-10:55 The Independent Domination Graph 31

Laura E. Teshima, University of Victoria, Canada; Richard Brewster, Thompson Rivers University, Canada; Kieka Mynhardt, University of Victoria, Canada

11:00-11:25 Hamilton Connectedness of Sdr Graphs $3\,0$

Stefan Bard, University of Victoria, Canada

11:30-11:55 Reconfiguration of Common Independent Sets of Matroids 30

Moritz Muehlenthaler, TU Dortmund, Germany

Wednesday, June 6

MS24

Analytic and Probabilistic Techniques in Combinatorics - Part I of II

9:30 AM-12:00 PM

Room:North Classroom 1005

For Part 2 see MS30

Contemporary combinatorics is an exciting and rapidly growing discipline on the frontier of mathematics and computer science. Many new techniques in combinatorics rely on applications of tools from other mathematical areas such as algebra, analysis and probability. In the last decade, various powerful novel methods have emerged. For example, recent works in the probabilistic method that culminated with the celebrated container method which answered many long-standing open Ramsey-type and extremal questions, new developments of algebraic techniques that were crucial in settling famous conjectures in design theory and number theory, and analytic approaches to Szemerédi's regularity lemma that served as the corner-stone of graph limits, which then spin-off to techniques for large networks and development of flag algebras. In this mini-symposium, we aim to bring mostly junior researchers in combinatorics in order to present further developments and applications of these methods, as well as talk about completely new approaches. We will discuss relevant open problems, exchange research ideas, and initiate new collaborations.

Organizer: Andrzej Grzesik University of Warwick, United Kingdom

Organizer: Jan Volec McGill University, Canada

9:30-9:55 Extremal Graph Theory and Finite Forcibility 31

Andrzej Grzesik and Daniel Kral, University of Warwick, United Kingdom; *Laszlo M. Lovasz*, University of California, Los Angeles, USA

continued on next page

10:00-10:25 Inducibility in Graphs 31

Florian Pfender, University of Colorado at Denver, USA; Bernard Lidicky, Iowa State University, USA

10:30-10:55 Large Multipartite Subgraphs of H-Free Graphs 31

Jan Volec, McGill University, Canada; Bernard Lidicky, Iowa State University, USA; Taisa Martins, University of Warwick, United Kingdom; Sergey Norin, McGill University, Canada; Ping Hu, University of Warwick, United Kingdom

11:00-11:25 Forcing Oriented Cycles

Roman Glebov, Hebrew University of 31 Jerusalem, Israel; *Andrzej Grzesik*, University of Warwick, United Kingdom; Jan Volec, McGill University, Canada

11:30-11:55 Step Sidorenko Property and Non-Norming Edge-Transitive Graphs 31

Daniel Kral, *Taisa Martins*, and Péter Pál Pach, University of Warwick, United Kingdom; Marcin Wrochna, University of Warsaw, Poland

Wednesday, June 6 MS25

Graph Pebbling - Part I of III

9:30 AM-12:00 PM

Room:North Classroom 1130

For Part 2 see MS31

The subject of graph pebbling encompasses a broad spectrum of concepts regarding the movement of pebbles through a graph, with many diverse applications to areas such as computational complexity, graph rigidity, large sparse matrix storage, and combinatorial number theory, among others. Modern graph pebbling also fits under the umbrella of network optimization, as a model for the transportation of limited and consumable resources. One of the main goals of this minisymposium is to attract new researchers to the field. Graph pebbling utilizes many techniques, including those from probabilistic combinatorics, linear optimization, discharging, domination, and more, making it naturally attractive to a wide audience. The topic has also supported a great amount of undergraduate research since the 1990s. Dozens of papers in this area have been written by participants in various REUs and such. We intend to introduce many new problems that are accessible to this population.

Organizer: John Asplund Dalton State College, USA

Organizer: Glenn Hurlbert Virginia Commonwealth University, USA

Organizer: Franklin Kenter United States Naval Academy, USA

Organizer: Carl Yerger Davidson College, USA

9:30-9:55 A Brief Introduction to Graph Pebbling 33

Franklin Kenter, United States Naval Academy, USA

10:00-10:25 Graph Pebbling Algorithms, Doppelgangers, and Lemke Graphs 32 Charles A. Cusack, Hope College, USA

continued in next column

10:30-10:55 Pebbling on Semi-2-Trees 32

Liliana Alcon and Marisa Gutierrez, Universidad Nacional de La Plata, Argentina; *Glenn Hurlbert*, VCU, Center for the Study of Biological Complexity, USA

11:00-11:25 Pebbling on Graph Products and More! 32

John Asplund, Dalton State College, USA; Franklin Kenter, United States Naval Academy, USA; Glenn Hurlbert, Virginia Commonwealth University, USA

11:30-11:55 Pebbling on Split Graphs 32

Liliana Alcon and *Marisa Gutierrez,* Universidad Nacional de La Plata, Argentina; Glenn Hurlbert, Virginia Commonwealth University, USA

MS26

Matroid Theory - Part I of II

9:30 AM-12:00 PM

Room:North Classroom 1806

For Part 2 see MS32

Matroid Theory is a vibrant and growing subject with connections across mathematics to graph theory, projective geometry, lattice theory, design theory, coding theory, combinatorial optimization etc. Groups of researchers in matroids and related objects tend to develop topic-specific language that obscures the interrelations. This minisymposium brings together researchers from different areas of matroid theory with the purpose of seeking commonalities and exploring connections between matroids and other areas of combinatorics.

Organizer: Sandra Kingan City University of New York, Brooklyn, USA

9:30-9:55 Graph and Matroid Designs Talmage J. Reid, University of Mississippi, USA 33

10:00-10:25 Delta-Matroids and Rigidity Matroids 33 Brigitte Servatius, Worcester Polytechnic Institute, USA

10:30-10:55 Interlacement and Activities in Delta-Matroids 33 Ada Morse, University of Vermont, USA

11:00-11:25 Algebraic Structures Related to Matroid Theory 33 *Ivan Martino*, Northeastern University, USA

11:30-11:55 Projective Planarity of3-Nets and Biased Graphs3 3Rigoberto Florez, The Citadel, USA

Wednesday, June 6

CP7 Structural Graph Theory

9:30 AM-11:30 AM

Room:North Classroom 1606

Chair: To Be Determined

9:30-9:45 A Bandwidth Theorem for Approximate Decompositions

Padraig Condon, Jaehoon Kim, Daniela Kühn, and Deryk Osthus, University of Birmingham, United Kingdom

9:50-10:05 Coloring Vertex-minor-free Graphs with No Short Cycles 7 James G. Davies, University of Warwick, United Kingdom

10:10-10:25 On the Excluded Minors for Represented Frame Matroids 8

Cynthia Rodriguez and Jim Geelen, University of Waterloo, Canada

10:30-10:45 Extending a Result of Corradi and Hajnal

Michael Santana, Grand Valley State University, USA

10:50-11:05 Extremal Collections of k-Uniform Vectors 7

Joseph G. Briggs and Wesley Pegden, Carnegie Mellon University, USA

11:10-11:25 On Group Divisible Designs with Two Associate Classes and Larger Second Index 8

Chariya Uiyyasathian, Chulalongkorn University, Thailand

Lunch Break

12:00 PM-1:30 PM

Attendees on their own

Wednesday, June 6



New Developments in Hypergraph Ramsey Theory

1

1:30 PM-2:15 PM

Room:North Classroom 1130

Chair: To Be Determined

The Ramsey number $r_k(s,n)$ is the minimum integer *N*, such that for any red/blue coloring of the k-tuples of {1,2,...,*N*}, there are s integers such that every *k*-tuple among them is red, or there are n integers such that every *k*-tuple among them is blue. In this talk, I will discuss new lower bounds for $r_k(s,n)$ which nearly settles a question of Erdos and Hajnal from 1972. I will also discuss a more general function introduced by Erdos and Hajnal, and several interesting open problems in the area. This is joint work with Dhruv Mubayi.

Andrew Suk University of California, San Diego, USA

Coffee Break 2:15 PM-2:45 PM



Room:North Classroom 1130 Atrium

MS27

Modification Problems to Discrete Structures -Part I of II

2:45 PM-5:15 PM

Room:North Classroom 1604

For Part 2 see MS34

A surprisingly high number of the interesting computational problems arising from theory and applications can be formulated as graph/matrix modification problems. In a graph modification problem, we are given as input a graph G, and the goal is to apply certain operations on G (such as vertex deletions, edge deletions, additions or contractions) in order to obtain a graph H with some particular property. A matrix modification problem is defined analogously. For an example the classical Vertex Cover problem can be formulated as trying to change G into an edgeless graph by deleting the minimum number of vertices. The treewidth problem is essentially a graph modification problem, where we add edges to make a graph chordal and having the minimum clique number, while the classic marix rigidity problems is nothing but a matrix modification problem. These problems have been studied quite extensively, and both algorithms for these problems and structural aspects have been thoroughly explored. We plan to bring together experts in algorithms and experts in graph classes and structural graph theory to join forces on graph modification problems.

Organizer: Yixin Cao Hong Kong Polytechnic University, China

Organizer: Saket Saurabh Institute of Mathematical Sciences, India

2:45-3:10 Modifications to Chodal Graphs $$3\,4$$

Saket Saurabh, Institute of Mathematical Sciences, India

3:15-3:40 Dynamic Parameterized Problems and Algorithms 33

Josh Alman, Massachusetts Institute of Technology, USA

3:45-4:10 Solving Feedback Vertex Set via Half-Integral Relaxation 33 *Yoichi Iwata*, National Institute of

Informatics, Japan

4:15-4:40 Delta Decomposition 34 Ross McConnell, Colorado State University Fort Collins, USA Wednesday, June 6

MS28 Edge Colouring and Related

Notions - Part II of II

2:45 PM-5:15 PM

Room:North Classroom 1003

For Part 1 see MS21

Speakers will discuss problems related to edge colouring, including but not limited to: the classification problem, the Goldberg--Seymour conjecture, edge list colouring, matchings, and rainbow/ antirainbow subgraphs in edge-coloured graphs.

Organizer: Gregory J. Puleo Auburn University, USA

Organizer: Jessica McDonald Auburn University, USA

2:45-3:10 Edge-Colouring Planar Graphs with Precoloured Edges 34 Joshua Harrelson, Jessica McDonald, and

Gregory J. Puleo, Auburn University, USA

3:15-3:40 Total List Coloring of Planar Graphs $\ 34$

Marthe Bonamy, LaBRI, Université de Bordeaux, and CNRS, France; *Théo Pierron* and Eric Sopena, Universite de Bordeaux I, France

3:45-4:10 Independence Number of Edge-chromatic Critical Graphs 35 Yan Cao, Guantao Chen, and Guanming Jing, Georgia State University, USA; *Songling*

Georgia State University, USA; Songling Shan, Vanderbilt University, USA

4:15-4:40 Polychromatic Colorings of Complete Graphs with Respect to 1-,2-factors and Hamiltonian Cycles Maria Axenovich, Karlsruhe Institute of Technology, Germany; John L. Goldwasser and Ryan Hansen, West Virginia University, USA; *Bernard Lidicky* and Ryan R. Martin, Iowa State University, USA; David Offner, Westminster College, USA; John Talbot, University College London, United Kingdom; Michael Young, Iowa State University, USA

4:45-5:10 Polychromatic Colorings of the Integers and Integers Mod N 34 John L. Goldwasser, West Virginia University, USA

MS29

Spatial Random Networks

2:45 PM-5:15 PM

Room:North Classroom 1606

The application of random graphs to the analysis of complex networks has led to many new mathematical models. Of special interest are spatial random graph models, where the vertices of the graphs are embedded in a metric space, and link formation depends on the distance of the vertices in the space. Spatial models are especially suited for the modelling of complex networks, such as social networks, biological networks, and Web-based networks such as Wikipedia. The underlying metric space represents the feature space, in which vertices are placed according to their defining properties. Vertices that are close together represent entities that are similar and so are more likely to be linked. This minisymposium aims to give an overview of the many different aspects of spatial random graphs. The simplest spatial graph model is the random geometric graph, where vertices are connected if and only if they are within a threshold distance of each other. The study of spatial random graphs is flourishing, and some of our speakers will give the latest results, including research on infinite random geometric graphs. A fundamental question addressed by some of our speakers is whether a large finite or infinite graph embodies the characteristics of the underlying metric space. Finally, some speakers will present state-of-the-art research using spatial random graphs to simulate the properties of real-life networks.

Organizer: Jeannette Janssen Dalhousie University, Canada

Organizer: Anthony Bonato Ryerson University, Canada

2:45-3:10 Infinite Random Geometric Graphs 35

Jeannette Janssen, Dalhousie University, Canada

3:15-3:40 Random Geometric Graphs in Normed Spaces $$3\,5$$

Karen Gunderson, University of Manitoba, Canada

3:45-4:10 Geometric Networks and Graph Limits 35

Mahya Ghandehari, University of Delaware, USA

4:15-4:40 On Geometric Embedding of Graphs and Random Graphs 35

Huda Chuangpishit, Ryerson University, Canada

4:45-5:10 Layout of Random Circulant Graphs 36

Israel S. Rocha, Czech Academy of Sciences, Czech Republic

Wednesday, June 6

MS30

Analytic and Probabilistic Techniques in Combinatorics - Part II of II

2:45 PM-5:15 PM

Room:North Classroom 1539

For Part 1 see MS24

Contemporary combinatorics is an exciting and rapidly growing discipline on the frontier of mathematics and computer science. Many new techniques in combinatorics rely on applications of tools from other mathematical areas such as algebra, analysis and probability. In the last decade, various powerful novel methods have emerged. For example, recent works in the probabilistic method that culminated with the celebrated container method which answered many long-standing open Ramsey-type and extremal questions, new developments of algebraic techniques that were crucial in settling famous conjectures in design theory and number theory, and analytic approaches to Szemerédi's regularity lemma that served as the corner-stone of graph limits, which then spin-off to techniques for large networks and development of flag algebras. In this mini-symposium, we aim to bring mostly junior researchers in combinatorics in order to present further developments and applications of these methods, as well as talk about completely new approaches. We will discuss relevant open problems, exchange research ideas, and initiate new collaborations.

Organizer: Andrzej Grzesik University of Warwick, United Kingdom

Organizer: Jan Volec *McGill University, Canada*

continued in next column

continued on next page

2:45-3:10 Induced Subgraphs of Ramsey Graphs $3\,6$

Matthew Kwan and Benjamin Sudakov, ETH Zürich, Switzerland

3:15-3:40 On the Turón Number of Ordered Forests 36

Daniel Korandi, École Polytechnique Fédérale de Lausanne, Switzerland; Gábor Tardos, Alfréd Rényi Institute of Mathematics, Budapest; Istvan Tomon, École Polytechnique Fédérale de Lausanne, Switzerland; Craig Weidert, Google, Inc., USA

3:45-4:10 Polynomial Time Smoothed Analysis for Local Max-Cut 36

Fan Wei, Stanford University, USA; Omer Angel, University of British Columbia, Canada; Yuval Peres and Sébastien Bubeck, Microsoft Research, USA

4:15-4:40 Counting Tree-Like Graphs in Locally Dense Graphs 36

Joonkyung Lee, University of Oxford, United Kingdom

4:45-5:10 The Erdos-Gallai Theorem for Berge-Cycles in Hypergraphs 36

Alexandr Kostochka and *Ruth Luo*, University of Illinois at Urbana-Champaign, USA

Wednesday, June 6

MS31 Graph Pebbling - Part II of III

2:45 PM-5:15 PM

Room:North Classroom 1130

For Part 1 see MS25 For Part 3 see MS37

The subject of graph pebbling encompasses a broad spectrum of concepts regarding the movement of pebbles through a graph, with many diverse applications to areas such as computational complexity, graph rigidity, large sparse matrix storage, and combinatorial number theory, among others. Modern graph pebbling also fits under the umbrella of network optimization, as a model for the transportation of limited and consumable resources. One of the main goals of this minisymposium is to attract new researchers to the field. Graph pebbling utilizes many techniques, including those from probabilistic combinatorics, linear optimization, discharging, domination, and more, making it naturally attractive to a wide audience. The topic has also supported a great amount of undergraduate research since the 1990s. Dozens of papers in this area have been written by participants in various REUs and such. We intend to introduce many new problems that are accessible to this population.

Organizer: John Asplund Dalton State College, USA

Organizer: Carl Yerger Davidson College, USA

Organizer: Glenn Hurlbert Virginia Commonwealth University, USA

Organizer: Franklin Kenter United States Naval Academy, USA

2:45-3:10 Thresholds for Random Pebbling $$3\,7$$

Neal Bushaw, Virginia Commonwealth University, USA

3:15-3:40 Optimal Pebbling Number of Graphs with Given Minimum Degree $-3.7\,$

Andrjez Czygrinow, Arizona State University, USA

3:45-4:10 The Weight Function Lemma and Its Applications 37

Glenn Hurlbert, Virginia Commonwealth University, USA

4:15-4:40 Distance Pebbling on Directed Cycle Graphs 37

Michael P. Knapp, Loyola University Maryland, USA

4:45-5:10 A Graph Pebbling Algorithm on Weighted Graphs $$3\,7$$

Nandor Sieben, Northern Arizona University, USA

MS32

Matroid Theory - Part II of II

2:45 PM-4:45 PM

Room:North Classroom 1806

For Part 1 see MS26

Matroid Theory is a vibrant and growing subject with connections across mathematics to graph theory, projective geometry, lattice theory, design theory, coding theory, combinatorial optimization etc. Groups of researchers in matroids and related objects tend to develop topic-specific language that obscures the interrelations. This minisymposium brings together researchers from different areas of matroid theory with the purpose of seeking commonalities and exploring connections between matroids and other areas of combinatorics.

Organizer: Sandra Kingan City University of New York, Brooklyn, USA

2:45-3:10 Deletion Sets in Binary 38 Matroids

Sandra Kingan, City University of New York, Brooklyn, USA

3:15-3:40 Efficient Enumeration of Binary Matroids Using a New **Canonical Form** 38

Ken Sugimori, University of Tokyo, Japan; Sonoko Moriyama, Nihon University, Japan; Kunihiko Sadakane, University of Tokyo, Japan

3:45-4:10 Beta Invariants of 3-Connected Matroids 38

Sooyeon Lee, University of Mississippi, USA

4:15-4:40 Triangle Roundedness in **Matroids** 3

Joao Paulo Costalonga, Federal University of Espirito Santo, Brazil

Wednesday, June 6

CP8

Enumeration 2:45 PM-4:05 PM

Room:North Classroom 1607

Chair: To Be Determined

2:45-3:00 Some Partitions Identities Between P(n,m) - P(n-1,m) and p(n,m-1)Q

Acadia B. Larsen, The University of Texas Rio Grande Valley, USA

3:05-3:20 Enumeration of Unsensed Orientable Maps on Surfaces of a **Given Genus** 9

Evgeniy Krasko and Alexander Omelchenko, St. Petersburg Academic University, Russia

3:25-3:40 Tools for Enumerating **Graphs with Prescribed Degree** Sequences 8

David Burstein, Swarthmore College, USA; Jonathan E. Rubin, University of Pittsburgh, USA

3:45-4:00 A Randomized Algorithm for Approximating Zonotopes

Paul Constantine, University of Colorado Boulder, USA; David F. Gleich, Purdue University, USA; Kerrek Stinson, Carnegie Mellon University, USA

Intermission

5:15 PM-5:30 PM

SIAG/DM Business Meeting

5:30 PM-6:30 PM



Complimentary refreshments will be served.

Thursday, June 7

Registration

7:30 AM-3:30 PM Room:North Classroom 1130 Entry

Announcements

8:10 AM-8:15 AM Room:North Classroom 1130

IP6 **Random Graph Processes**

1

8:15 AM-9:00 AM

Room:North Classroom 1130

Chair: To Be Determined

When dealing with random objects, it is often useful to reveal the randomness gradually, rather than all at once; that is, to turn a static random object into a random process. In this talk we will describe some classical proofs of this type, and a few more recent applications, for example to Ramsey numbers, and to determining sharp thresholds in G(n,p)and in random sets of integers. Various parts of the talk are based on joint work with Paul Balister, Béla Bollobás, Asaf Ferber, Gonzalo Fiz Pontiveros, Simon Griffiths, Oliver Riordan, Wojciech Samotij, and Paul Smith.

Robert Morris

Institute for Pure and Applied Mathematics -IMPA, Brazil

Coffee Break

9:00 AM-9:30 AM



Room:North Classroom 1130 Atrium

MS33

The Structure of Families of Finite Sets - Part I of II

9:30 AM-12:00 PM

Room:North Classroom 1539

For Part 2 see MS39

The theme of this minisymposium is the research on ordered sets in recent years, mainly on the structure of families of finite sets. In the last decade, more and more results on the problems related to finding the families of subsets avoiding a given pattern have been discovered and published. In the two sessions, we invite international researchers to give talks on the problems and results of determining the largest size of P-free families (avoiding the poset P as a subfamily) for general posets, for the specific posets, and for the induced subposets. In addition, we also invite the researchers to give talks addressing the results on antichains as well as the Ramseytype results in Boolean lattices. We expect this minisymposium will enhance the development of new theory of the structures of finite sets and draw attention to more people who may be interested in this type of problems.

Organizer: Wei-Tian Li

National Chung-Hsing University, Taiwan

9:30-9:55 An Improvement on the Intersecting Shadow Theorem 38 *Gyula Katona*, Renyi Institute, Hungary

10:00-10:25 Problems and Results Related to Maximal Antichains 38

Uwe Leck, Europa-Universitaet Flensburg, Germany

10:30-10:55 On Difference Graphs and the Local Dimension of Posets 39

Ryan R. Martin, Iowa State University, USA; Jinha Kim, Seoul National University, Korea; Tomas Masarik, Charles University, Czech Republic; Warren Shull, Emory University, USA; Heather C. Smith, Georgia Institute of Technology, USA; Andrew Uzzell, Grinnell College, USA; Zhiyu Wang, University of South Carolina, USA

11:00-11:25 Forbidden Induced Subposets

Istvan Tomon, École Polytechnique Fédérale de Lausanne, Switzerland 39

11:30-11:55 Ramsey-Type of Problems on Posets in the Boolean Lattices 39

Wei-Tian Li, National Chung-Hsing University, Taiwan

Thursday, June 7

MS34

Modification Problems to Discrete Structures -Part II of II

9:30 AM-12:00 PM

Room:North Classroom 1604

For Part 1 see MS27

A surprisingly high number of the interesting computational problems arising from theory and applications can be formulated as graph/matrix modification problems. In a graph modification problem, we are given as input a graph G, and the goal is to apply certain operations on G (such as vertex deletions, edge deletions, additions or contractions) in order to obtain a graph H with some particular property. A matrix modification problem is defined analogously. For an example the classical Vertex Cover problem can be formulated as trying to change G into an edgeless graph by deleting the minimum number of vertices. The treewidth problem is essentially a graph modification problem, where we add edges to make a graph chordal and having the minimum clique number, while the classic marix rigidity problems is nothing but a matrix modification problem. These problems have been studied quite extensively, and both algorithms for these problems and structural aspects have been thoroughly explored. We plan to bring together experts in algorithms and experts in graph classes and structural graph theory to join forces on graph modification problems.

Organizer: Yixin Cao Hong Kong Polytechnic University, China

Organizer: Saket Saurabh Institute of Mathematical Sciences, India

9:30-9:55 An $O(k^4)$ Kernel for Unit Interval Vertex Deletion 39

Yixin Cao, Hong Kong Polytechnic University, China

10:00-10:25 Complexity Dichotomies for H-free Edge Modification Problems $4\,0$

R B Sandeep, Indian Institute of Information Technology, India

10:30-10:55 Modification of Matroids and Matrices 4 ()

Meirav Zehavi, Ben-Gurion University, Israel

11:00-11:25 A Polynomial Kernel of Distance-Hereditary Vertex Deletion

39

Eun Jung Kim, Universite Paris Dauphine and CNRS, France; O-Joung Kwon, Incheon National University, Korea

11:30-11:55 Maximum Induced Matching Algorithms via Vertex Ordering Characterizations $4\ 0$

Lalla Mouatadid, University of Toronto, Canada

MS35 Modeling and Mining Network Data - Part I of II

9:30 AM-12:00 PM

Room:North Classroom 1003

For Part 2 see MS40

Discrete mathematics is at the heart of challenging data-driven problems. Many discrete datasets look like networks, a mathematical formalism for modeling complex systems by interactions between entities. This minisymposium highlights several recent advances in modeling and mining network data with an underlying theme of connecting theory and applications with real data. The theoretical tools are quite diverse and include extremal graph theory, numerical linear algebra, and algorithm design. The applications are equally diverse, drawing from marketing, machine learning, and social network analysis, using data from protein interactions, neural systems, email communications, transportation systems, and more. This minisymposium will showcase the exciting opportunities at the intersection of discrete mathematics and data science.

Organizer: Austin Benson Cornell University, USA

9:30-9:55 New Perspectives on Measuring Network Clustering $4\,1$

Austin Benson, Cornell University, USA; Hao Yin and Jure Leskovec, Stanford University, USA

10:00-10:25 Hypergraph Kronecker Models for Networks $4\,1$

David F. Gleich and Nicole Eikmeier, Purdue University, USA

10:30-10:55 Mitigating Overexposure in Viral Marketing $4\,0$

Rediet Abebe, Cornell University, USA; Lada Adamic, The University of Michigan, Ann Arbor, USA; Jon M. Kleinberg, Cornell University, USA

11:00-11:25 Modeling and Mining Dynamic Competition Networks 41

Anthony Bonato, Ryerson University, Canada

11:30-11:55 Tuning the Activity of Neural Networks at Criticality N/A Kathleen Finlinson, University of Colorado Boulder, USA

Thursday, June 7

MS36 Open Problems in Combinatorics on Words 9:30 AM-12:00 PM

Room:North Classroom 1806

Combinatorics on words is a rapidly growing field at the border of mathematics and computer science. Roughly speaking, it is the study of words (finite lists of symbols) and their combinatorial properties. Our minisymposium will center around the theme of open problems in combinatorics on words. We propose to have speakers discussing (1) the additive k'th power problem: does there exist an infinite word over a finite subset of Z avoiding k consecutive blocks of the same size and the same sum? Recently this problem was (positively) resolved for k = 3, but the problem for k = 2 is still open. (2) discrete tilings and their relationship to combinatorics on words. Here the principal open problem is Nivat's conjecture about two-dimensional periodicity. (3) automatic sequences (sequences generated by finite automata) and their generalizations. Here we propose to have speakers addressing generalizations of Cobham's theorem and p-adic properties.

Organizer: Jeffrey Shallit University of Waterloo, Canada

Organizer: Narad Rampersad The University of Winnipeg, Canada

Organizer: James D. Currie

The University of Winnipeg, Canada 9:30-9:55 Introduction to Combinatorics on Words 41

James D. Currie, The University of Winnipeg, Canada

10:00-10:25 Generalizations of Cobham's Theorem $\ \ 4\,1$

Jakub Byszewski, Jagiellonian University, Poland

10:30-10:55 The Additive K'th Power Problem and Generalizations 42 Matthieu Rosenfeld, LIMOS- UCA, France

11:00-11:25 Decidability and the Ostrowski Numeration System 41

Philipp Hieronymi, University of Illinois, Urbana-Champaign, USA

11:30-11:55 Automatic Sequences and p-adic Asymptotics 42 *Eric Rowland*, Hofstra University, USA Thursday, June 7

MS37 Graph Pebbling - Part III of III

9:30 AM-12:00 PM

Room:North Classroom 1130

For Part 2 see MS31

The subject of graph pebbling encompasses a broad spectrum of concepts regarding the movement of pebbles through a graph, with many diverse applications to areas such as computational complexity, graph rigidity, large sparse matrix storage, and combinatorial number theory, among others. Modern graph pebbling also fits under the umbrella of network optimization, as a model for the transportation of limited and consumable resources. One of the main goals of this minisymposium is to attract new researchers to the field. Graph pebbling utilizes many techniques, including those from probabilistic combinatorics, linear optimization, discharging, domination, and more, making it naturally attractive to a wide audience. The topic has also supported a great amount of undergraduate research since the 1990s. Dozens of papers in this area have been written by participants in various REUs and such. We intend to introduce many new problems that are accessible to this population.

Organizer: John Asplund Dalton State College, USA

Organizer: Carl Yerger Davidson College, USA

Organizer: Glenn Hurlbert Virginia Commonwealth University, USA

Organizer: Franklin Kenter United States Naval Academy, USA

continued on next page

9:30-9:55 Pebbling on Low Diameter Interval Graphs $4\,3$

Carl Yerger, Davidson College, USA; Xuchen Zhou, Columbia University, USA

10:00-10:25 Optimal Pebbling Number of Grids $4\,2$

Ervin Gyori, Renyi Institute, Hungary; Gyula Y. Katona and *Laszlo F. Papp*, Budapest University of Technology and Economics, Hungary; Casey Tompkins, Renyi Institute, Hungary

10:30-10:55 Variations on the Pebbling Game: Critical, Weighted, and Transport Pebbling $4\,2$

Josh Laison, Willamette University, USA

11:00-11:25 On Some Questions Regarding Class 0 Graphs 42 John Schmitt, Middlebury College, USA

11:30-11:55 Pebbling Bounds for Class 0 Graphs $4\,3$

Daniel Cranston, Virginia Commonwealth University, USA; Luke Postle, University of Waterloo, Canada; Carl Yerger, Davidson College, USA; *Chenxiao Xue*, Google, Inc., USA Thursday, June 7

CP9

Coloring 9:30 AM-10:30 AM

Room:North Classroom 1606

Chair: To Be Determined

9:30-9:45 A k-Partite Generalization of Chordal Bipartite Graphs 9

Terry McKee, Wright State University, USA

9:50-10:05 Properly Colored

Connections in Graphs 9 Wayne Goddard and Robert Melville, Clemson University, USA

10:10-10:25 An Asymptotic Bound for the Strong Chromatic Number $\ 9$

Allan Lo and *Nicolás Sanhueza-Matamala*, University of Birmingham, United Kingdom

Lunch Break

12:00 PM-1:30 PM Attendees on their own Thursday, June 7

IP7

Deciphering Cellular Networks: From Normal Functioning to Disease

1

1:30 PM-2:15 PM

Room:North Classroom 1130

Chair: To Be Determined

Each cell in our body accomplishes its functions via a complex network of molecular interactions. Analyses of these networks are thus key to understanding cellular functioning (and, in the case of disease, malfunctioning). I will overview what has been discovered about the basic structure and organization of cellular networks, and present frameworks and algorithms that leverage these properties in order to gain a better understanding of diseases such as cancer.

Mona Singh Princeton University, USA

Coffee Break 2:15 PM-2:45 PM



Room:North Classroom 1130 Atrium

MS38

Extremal Problems for Sparse Graphs and Hypergraphs - Part I of II

2:45 PM-5:15 PM

Room:North Classroom 1003

For Part 2 see MS43

Extremal theory for graphs and hypergraphs is a fast developing and important area within Combinatorics that typically studies extrema of parameters of graphs and hypergraphs with given properties. It has applications to areas such as combinatorial geometry, number theory, coding theory, computer science, and etc. In recent decades, extremal (hyper-)graph theory has experienced significant growth thanks to the development of some powerful methods such as the probabilistic method, the regularity method and the absorbing method. The latter two are especially effective on dense graphs. Relatively speaking, there has been a lack of general tools for tackling extremal problems for sparse graphs. However, there have been many interesting developments in this area and some promising methods have been introduced such as dependent random choice, delta system method, junta method and etc. The aim of this mini-symposium is to bring together a diverse group of active researchers working on sparse problems using different methods. The hope is that the interchanging of ideas from different angles will help forging the development of more universal tools for extremal problems in the sparse setting. We also hope that the broad range of the interesting results and methods covered by the talks will help generate more interests from the general discrete mathematics community in the extremal problems in the sparse setting.

Organizer: Tao Jiang Miami University, USA

Organizer: Liana Yepremyan University of Oxford, United Kingdom

continued in next column

2:45-3:10 Spanning Subgraphs of Randomly Perturbed Graphs 43

Julia Boettcher, London School of Economics, United Kingdom; Yury Person and Olaf Parczyk, University of Frankfurt, Germany; Richard Montgomery, University of Cambridge, United Kingdom

3:15-3:40 Proof of Komlos's Conjecture on Hamiltonian Subsets $4\,4$

Jaehoon Kim, University of Birmingham, United Kingdom; Hong Liu and Maryam Sharifzadeh, University of Warwick, United Kingdom; *Katherine L. Staden*, University of Oxford, United Kingdom

3:45-4:10 On Subgraphs of 2k-cycle-free Graphs and Some Generalised Turán Problems $4\,4$

Abhishek Methuku, Central European University, Hungary

4:15-4:40 The Junta Method in Extremal Hypergraph Theory and Chvátal's Conjecture 43

Nathan Keller and *Noam Lifshitz*, Bar-Ilan University, Israel

4:45-5:10 Isoperimetric Stability for the Cube $4\,3$

Peter Keevash and *Eoin Long*, University of Oxford, United Kingdom

Thursday, June 7

MS39

The Structure of Families of Finite Sets - Part II of II

2:45 PM-4:45 PM

Room:North Classroom 1539

For Part 1 see MS33

The theme of this minisymposium is the research on ordered sets in recent years, mainly on the structure of families of finite sets. In the last decade, more and more results on the problems related to finding the families of subsets avoiding a given pattern have been discovered and published. In the two sessions, we invite international researchers to give talks on the problems and results of determining the largest size of P-free families (avoiding the poset P as a subfamily) for general posets, for the specific posets, and for the induced subposets. In addition, we also invite the researchers to give talks addressing the results on antichains as well as the Ramsey-type results in Boolean lattices. We expect this minisymposium will enhance the development of new theory of the structures of finite sets and draw attention to more people who may be interested in this type of problems.

Organizer: Wei-Tian Li

National Chung-Hsing University, Taiwan

2:45-3:10 Sizes of Maximal Antichains in B_{N} $\quad 4\,4$

Jerry Griggs, University of South Carolina, USA; *Thomas Kalinowski*, University of New England, Armidale, Australia; Uwe Leck, Europa-Universitaet Flensburg, Germany; Ian Roberts, Charles Darwin University, Australia; Michael Schmitz, Europa-Universitaet Flensburg, Germany

3:15-3:40 An Algorithm Approach to Bounding Families of Subsets Avoiding a Subposet in Boolean Lattices 44

Hong-Bin Chen, Feng-Chia University, Taiwan

3:45-4:10 An Upper Bound on the Size of Diamond-Free Families of Sets 4.4 Dániel Grósz, Universita di Pisa, Italy; Abhishek Methuku, Central European University, Hungary; *Casey Tompkins*, Renyi Institute, Hungary

4:15-4:40 A Generalization of Sperner's Theorem for Convex Families N/A

Lili Mu, Liaoning Normal University, China

MS40 Modeling and Mining Network Data - Part II of II

2:45 PM-4:45 PM

Room:North Classroom 1604

For Part 1 see MS35

Discrete mathematics is at the heart of challenging data-driven problems. Many discrete datasets look like networks, a mathematical formalism for modeling complex systems by interactions between entities. This minisymposium highlights several recent advances in modeling and mining network data with an underlying theme of connecting theory and applications with real data. The theoretical tools are quite diverse and include extremal graph theory, numerical linear algebra, and algorithm design. The applications are equally diverse, drawing from marketing, machine learning, and social network analysis, using data from protein interactions, neural systems, email communications, transportation systems, and more. This minisymposium will showcase the exciting opportunities at the intersection of discrete mathematics and data science.

Organizer: Austin Benson

Cornell University, USA

2:45-3:10 Graph Matching Via Low Rank Factors $4\,5$

Huda Nassar, Purdue University, USA

3:15-3:40 Risk-Averse Matchings over Uncertain Graph Databases

Charalampos Tsourakakis, Boston University and Harvard University, USA

3:45-4:10 Detectability of Hierarchical Community Structure in Preprocessed Multilayer Networks $4\,5$

Dane Taylor, State University of New York, Buffalo, USA; Peter J. Mucha, University of North Carolina at Chapel Hill, USA

4:15-4:40 Evaluating Overfit and Underfit in Models of Network Community Structure 45

Amir Ghasemian, University of Colorado Boulder, USA; Homa Hosseinmardi, University of Southern California, USA; Aaron Clauset, University of Colorado Boulder, USA Thursday, June 7

MS41

Foundations of Data Science - Part I of II

2:45 PM-5:15 PM

Room:North Classroom 1130

For Part 2 see MS47

In support of the NSF initiative on Trandisciplinary Research in Principles of Data Science (TRIPODS) and tapping into the broader research interest and investment from research labs across the nation, this minisymposium will feature lectures on frontier research in foundational aspects of data science. A primary goal is to feature a diverse set of speakers from computing, engineering and statistics who will help identify algorithmic and mathematical challenges confronting the current state of this fast growing, exciting interdisciplinary field. Topics will include nonlinear optimization and high-dimensional statistics, statistical and large-scale machine learning, data-driven algorithm design, scalable learning algorithms, automation of data analysis, neural nets and deep learning, structured sparsity and compressed sensing, submodular optimization, and analysis of complex, high-dimensional data sets, large networks and computational phylogeny.

Organizer: Prasad Tetali Georgia Institute of Technology, USA

Organizer: Jennifer Chayes Microsoft Research, USA

Organizer: David Shmoys Cornell University, USA

2:45-3:10 Bayesian Optimization with Exotic Structure $\ 4\,6$

Peter I. Frazier, Saul Toscano Palmerin, Matthias Poloczek, and Andrew Wilson, Cornell University, USA; Jian Wu, Two Sigma, USA

3:15-3:40 Graphons: From Graph Limits to Non-Parametric Graph Models and Estimation $4\,6$

Christian Borgs, Microsoft Research, USA

3:45-4:10 Learning Determinantal Point Processes 46

Philippe Rigollet, Victor-Emmanuel Brunel, Ankur Moitra, and John Urschel, Massachusetts Institute of Technology, USA

4:15-4:40 Stochastic Combinatorial Optimization with Queries 46

Takanori Maehara, RIKEN Center for Advanced Intelligence Project, Japan; Yutaro Yamaguchi, Osaka University, Japan

4:45-5:10 Mathematical and Computational Grand Challenges in Estimating the Tree of Life $4\,6$

Tandy Warnow and Mike Nute, University of Illinois at Urbana-Champaign, USA; Sebastien Roch, University of Wisconsin, Madison, USA; Siavash Mirarab, University of California, San Diego, USA

MS42

Results from the Graduate Research Workshop in Combinatorics

2:45 PM-5:15 PM

Room:North Classroom 1606

Since the summer of 2014 the Graduate Research Workshop in Combinatorics (GRWC) has worked with over a hundred graduate students and postdocs by engaging them in original research in combinatorics. The research topics that have been explored cover a wide range including structural graph theory, graph coloring, extremal graph theory, and combinatorial linear algebra, resulting in over twenty papers (and counting). This minisymposium will bring together a few of the past participants to speak on some of the research which has come out of GRWC over the past few years. More information about GRWC is online at CombinatoricsWorkshop.org.

Organizer: Bernard Lidicky Iowa State University, USA

Organizer: Steve Butler Iowa State University, USA

2:45-3:10 The Zero Forcing Polynomial of a Graph $4\,7$

Kirk Boyer, University of Denver, USA; Boris Brimkov, Rice University, USA; Sean English, Western Michigan University, USA; Daniela Ferrero, Texas State University, San Marcos, USA; Ariel Keller, Emory University, USA; Rachel Kirsch, University of Nebraska, USA; Michael Phillips, University of Colorado, Denver, USA; Carolyn Reinhart, Iowa State University, USA

3:15-3:40 A Forest Building Process for Simple Graphs $4\,7$

Zhanar Berikkyzy and Steve Butler, Iowa State University, USA; Jay Cummings, Sacramento State University, USA; *Kristin Heysse*, Macalester College, USA; Paul Horn, University of Denver, USA; Ruth Luo, University of Illinois at Urbana-Champaign, USA; Brent Moran, Berlin Mathematical School, Germany

3:45-4:10 Graph Saturation Problems with Colored Edges $4\,7$

Michael Tait, Carnegie Mellon University, USA

Axel Brandt, Davidson College, USA;
Micheal Ferrarra, University of Colorado,
Denver, USA; Mohit Kumbhat, University of Nevada, Reno, USA; Sarah Loeb,
College of William & Mary, USA;
Derrick Stolee, Microsoft, USA; Matthew
Yancey, IDA/CCS, USA

4:45-5:10 Degree Conditions for Small Contagious Sets in Bootstrap Percolation 47

Andrew Uzzell, Grinnell College, USA

Thursday, June 7

CP10 General Graph Theory 2:45 PM-4:05 PM

Room:North Classroom 1607

Chair: To Be Determined

2:45-3:00 Limited Broadcast Domination and Multipacking 10 Frank Yang, University of Victoria, Canada

3:05-3:20 On Essentially 4-Edge-

Connected Cubic Bricks 10 Nishad Kothari, University of Vienna, Austria; Marcelo de Carvalho, Universidade Federal do Mato Grosso do Sul, Brazil; Charles Little, Massey University, New Zealand; Claudio Lucchesi, University of Campinas, Brazil

3:25-3:40 Vertex Disjoint Paths Covers of Rectangular Grids, Tori, and Hypertori 10

Wing Hong Tony Wong, Kutztown University of Pennsylvania, USA

3:45-4:00 A Local Chordalization Approach to the Hadwiger Conjecture and the Erdös-Faber-Lovász Conjecture 9

Soogang Eoh, Seoul National University, Korea; Jihoon Choi, Cheongju University, South Korea; Suh-Ryung Kim, Seoul National University, Korea

Intermission

5:15 PM-5:30 PM

SP2

2

Hot Topics Session

5:30 PM-6:30 PM

Room:North Classroom 1130

Chair: To Be Determined

Abstract Not Available At Time Of Publication.

Henry Cohn Microsoft Research New England, USA

2

Friday, June 8

Registration

7:30 AM-10:30 AM Room:North Classroom 1130 Entry

Closing Remarks

8:10 AM-8:15 AM Room:North Classroom 1130

IP8

Algorithms for the Asymmetric Traveling Salesman Problem

8:15 AM-9:00 AM

Room:North Classroom 1130

Chair: To Be Determined

The traveling salesman problem is one of the most fundamental optimization problems. Given n cities and pairwise distances, it is the problem of finding a tour of minimum distance that visits each city once. In spite of significant research efforts, current techniques seem insufficient for settling the approximability of the traveling salesman problem. The gap in our understanding is especially large in the general asymmetric setting where the distance from city i to j is *not* assumed to equal the distance from j to i. In this talk, we will give an overview of old and new approaches for settling this question. We shall, in particular, talk about our new approach that gives the first constantfactor approximation algorithm for the asymmetric traveling salesman problem. This is based on joint work with Jakub Tarnawski and László Végh.

Ola Svensson École Polytechnique Fédérale de Lausanne, Switzerland

Coffee Break *9:00 AM-9:30 AM*

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Room:North Classroom 1130 Atrium

Friday, June 8

MS43

Extremal Problems for Sparse Graphs and Hypergraphs -Part II of II

9:30 AM-12:00 PM

Room:North Classroom 1806

For Part 1 see MS38

Extremal theory for graphs and hypergraphs is a fast developing and important area within Combinatorics that typically studies extrema of parameters of graphs and hypergraphs with given properties. It has applications to areas such as combinatorial geometry, number theory, coding theory, Information theory, etc. In recent decades, extremal graph theory has experienced significant growth thanks to the development of some powerful methods such as the probabilistic method, the regularity method and the absorbing method. The latter two are especially effective on dense graphs. Relatively speaking, there has been a lack of general tools for tackling extremal problems for sparse graphs. However, there have been many interesting developments in this area and some promising methods have been introduced such as dependent random choice, delta system method, junta method, etc. The aim of this mini-symposium is to bring together a diverse group of active researchers working on sparse problems using different methods. The hope is that the interchanging of ideas from different angles will help forging the development of more universal tools for extremal problems in the sparse setting. We also hope that the broad range of the interesting results and methods covered by the talks will help generate more interests from the general discrete mathematics community in the extremal problems in the sparse setting.

Organizer: Tao Jiang Miami University, USA

Organizer: Liana Yepremyan University of Oxford, United Kingdom

continued in next column

9:30-9:55 Embedding Trees with Minimum and Maximum Degree Conditions $4\,9$

Maya Stein, Universidad de Chile, Chile

10:00-10:25 Extremal Problems for Multigraphs $4\,8$

Dhruv Mubayi, University of Illinois at Chicago, USA; Caroline Terry, University of Maryland, USA

10:30-10:55 Independent Sets in Sparse Hypergraphs 49

Jacques Verstraete, University of California, San Diego, USA; Jeroen Schillewaert, University of Auckland, New Zealand

11:00-11:25 Kissing Numbers in High Dimensions 48

Matthew Jenssen, University of Oxford, United Kingdom

11:30-11:55 Turan Exponents of Bipartite Graphs $4\,8$

Tao Jiang, Miami University, USA; Jie Ma, University of Science and Technology of China, China; Liana Yepremyan, University of Oxford, United Kingdom

SIAM Conference on Discrete Mathematics

Friday, June 8

MS44

Structured Families of Graphs and Posets

9:30 AM-12:00 PM

Room:North Classroom 3205

This minisymposium brings together researchers in the areas of structured families of graphs and posets, including basic graph properties, graph minors and interval orders. These structured families are utilized to organize and analyze data. Key goals include characterization; recognition and translation from one setting to another. Some families can be recognized in polynomial time and others not.

Organizer: Karen Collins Wesleyan University, USA

Organizer: Ann N. Trenk Wellesley College, USA

9:30-9:55 Structured Graphs and Posets Overview $\begin{array}{c} 4 \\ 9 \end{array}$

Karen Collins, Wesleyan University, USA

10:00-10:25 Hereditary Families and the Dominance Order 4 9 *Michael D. Barrus*, University of Rhode

Island, USA

10:30-10:55 Hamiltonian Path Variants in Structured Graph Families 49 Garth T. Isaak, Lehigh University, USA

11:00-11:25 Using Three-Sided Brambles to Bound Treewidth in Planar Graphs $5\,0$

Brett Smith, Yale University, USA

11:30-11:55 Non-monochromatic Triangles in 2-edge-coloured Graphs Jessica McDonald, Auburn University, USA Friday, June 8

MS45 Graph Curvature and Related Topics

9:30 AM-12:00 PM

Room:North Classroom 3207

There are rich connections between the spectral theory of the Laplace-Beltrami operator on Riemannian manifolds and the spectral theory of graph Laplacians. A recent effort of researchers has been to further develop analogies between Riemannian manifolds and graphs by developing notions of curvature and curvature lower bounds for graphs. These efforts involve a number of ideas from probability and geometry. Two major approaches developed recently are the use of curvature-dimension type inequalities, generalizing Bochner's formula, in a graph setting and using the Wasserstein distance between probability distributions to define a notion of graph curvature. Graph curvature notions have led to graph theoretical analogues of a number of results from Riemannian geometry, including eigenvalue bounds (such as Buser's inequality), and volume and diameter bounds. This mini-symposium brings together a number of active researchers in the area to discuss recent results in this direction, and further challenges on applying graph curvature as well as on related problems.

Organizer: Paul Horn University of Denver, USA

9:30-9:55 Curvature and the Geometry of Graphs 50 *Paul Horn*, University of Denver, USA

10:00-10:25 Volume Growth andBuser's Inequality in Graphs50Peter Ralli, Princeton University, USA

10:30-10:55 Gradient Flows of Wasserstein Spaces on Data Clouds and Their Continuum Limits $$\rm N/A$$

Nicolas Garcia Trillos, Brown University, USA

11:00-11:25 Large Scale Ricci Curvature on Graphs 50

Mark Kempton, Harvard University, USA; Gabor Lippner, Northeastern University, USA; Florentin Munch, University of Potsdam, Germany; Shing-Tung Yau, Harvard University, USA

11:30-11:55 Using Curvature to Bound Stretches in Eigenfunctions of Graphs Fan Chung, University of California, San Diego, USA; Shing-Tung Yau, Harvard University, USA

50

Friday, June 8

MS46 Computational Methods in Discrete Mathematics

9:30 AM-12:00 PM

Room:North Classroom 1207

Computational methods in discrete mathematics have become more widely used in recent years. Such approaches have had some stunning successes, such as the Four Color Theorem, the nonexistence of the projective plane of order 10, and the proof of the Kepler Conjecture, but these methods are now becoming part of the toolbox of the everyday working mathematician. This minisymposium will showcase recent results in the area.

Organizer: Stephen Hartke University of Colorado, USA

9:30-9:55 Chromatic Folkman Numbers and Some Related Computational Challenges 51

Xiaodong Xu, Guangxi Academy of Sciences, Guangxi, China; Meilian Liang, Guangxi University, China; *Stanislaw Radziszowski*, Rochester Institute of Technology, USA

10:00-10:25 Computational Bounds on Classical Ramsey Numbers $$\rm N/A$$

Brendan McKay, Australian National University, Australia

10:30-10:55 Generating New Patterns for Antique Lace 51

Veronika Irvine, University of Waterloo, Canada

11:00-11:25 On Small k-chromatic Graphs of Girth g 50 Geoffrey Exoo, Indiana State University, USA

11:30-11:55 Rotation Systems for Hamilton Cycles 51 Aaron Williams, Bard College at Simon's Rock, USA Friday, June 8

MS47 Foundations of Data Science - Part II of II

9:30 AM-12:00 PM

Room:North Classroom 1130

For Part 1 see MS41

In support of the NSF initiative on Trandisciplinary Research in Principles of Data Science (TRIPODS) and tapping into the broader research interest and investment from research labs across the nation, this minisymposium will feature lectures on frontier research in foundational aspects of data science. A primary goal is to feature a diverse set of speakers from computing, engineering and statistics who will help identify algorithmic and mathematical challenges confronting the current state of this fast growing, exciting interdisciplinary field. Topics will include nonlinear optimization and high-dimensional statistics, statistical and large-scale machine learning, data-driven algorithm design, scalable learning algorithms, automation of data analysis, neural nets and deep learning, structured sparsity and compressed sensing, submodular optimization, and analysis of complex, high-dimensional data sets, large networks and computational phylogeny.

Organizer: Prasad Tetali Georgia Institute of Technology, USA

Organizer: Jennifer Chayes Microsoft Research, USA

Organizer: David Shmoys Cornell University, USA

9:30-9:55 Robustness and Submodularity 52

Stefanie Jegelka and Matthew Staib, Massachusetts Institute of Technology, USA; Bryan Wilder, University of Southern California, USA

10:00-10:25 Statistical Estimation Under Group Actions: The Sample Complexity of Multi-Reference Alignment 51

Afonso Bandeira, Courant Institute of Mathematical Sciences, New York University, USA

10:30-10:55 Differential Privacy for Growing Databases 52

Rachel Cummings, Georgia Institute of Technology, USA; Sara Krehbiel, University of Richmond, USA; Kevin Lai and Uthaipon (Tao) Tantipongpipat, Georgia Institute of Technology, USA

11:00-11:25 Title Not Available At Time Of Publication $${\rm N}/{\rm A}$$

Hanie Sedghi, Google, Inc., USA

11:30-11:55 Catalyst, Generic Acceleration Scheme for Gradientbased Optimization 52

Zaid Harchaoui, University of Washington, USA; Hongzhou Lin, Massachusetts Institute of Technology, USA; Courtney Paquette, Lehigh University, USA; Julien Mairal, Inria, France; Dmitriy Drusvyatskiy, University of Washington, USA

SIAM Conference on Discrete Mathematics

Friday, June 8

MS48 Graph Polynomials

9:30 AM-12:00 PM

Room:North Classroom 3209

For a variety of combinatorial problems, such as network reliability and graph colourings, the models turn out to be graph polynomials. On the other hand, the investigation of various subgraph properties (such as independence and domination) leads one to explore the associated combinatorial sequences by formulating generating polynomials. In all cases, polynomials carry useful or even essential information about the underlying combinatorics, and the connections allow one to draw on classical areas of mathematics, such as analysis and algebra, in the investigations. Combinatorial properties such as unimodality and log-concavity of various graphical sequences can surprisingly be extracted from the location of the roots of such polynomials. Different graph properties can also lead to interesting analytical and algebraic properties of the polynomials as well, such as factorability, the distribution of roots in the complex plane, and even fractals appearing in their roots. We aim to draw on the research of people working on a variety of graph polynomials to share techniques and methods to help advance the study of each polynomial.

Organizer: Ben R. Cameron Dalhousie University, Canada

Organizer: Jason Brown Dalhousie University, Canada

9:30-9:55 The Theory of Network Reliability 53

Jason Brown, Dalhousie University, Canada

10:00-10:25 Counting Increasing
Spanning Forests in Graphs53Joshua Hallam, Wake Forest University, USA;

Jeremy Martin, University of Kansas, USA; Bruce Sagan, Michigan State University, USA

10:30-10:55 On the Stability of Independence Polynomials 53

Ben R. Cameron and Jason Brown, Dalhousie University, Canada

11:00-11:25 Chromatic Symmetric Functions and e-Positivity 53 Samantha Dahlberg, University of British Columbia, Canada

11:30-11:55 On the Roots of Wiener Polynomials of Graphs $\ 53$

Jason Brown, Dalhousie University, Canada; *Lucas Mol*, The University of Winnipeg, Canada; Ortrud R. Oellermann, The University of Winnipeg, Canada