PROGRAM

PRAIRIE DISCRETE MATHEMATICS WORKSHOP 2026

UNIVERSITY OF REGINA

MAY 7-8, 2026

University of Regina
Sci Faculty of Science
Pacific Institute for the Mathematical Sciences

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Pacific Institute for the Mathematical Sciences

Department of Mathematics and Statistics, University of Regina

Faculty of Science, University of Regina

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About

Prairie Discrete Mathematics Workshop

The 2026 Prairie Discrete Mathematics Workshop (PDMW) will take place at the University of Regina on May 7th and 8th 2026. The PDMW was first started at the University of Regina in 2003 by Brian Alspach and Shaun Fallat. It has since taken place annually at various locations in the prairies and in British Columbia. This will be the seventeenth edition of the PDMW and the first in-person edition since the pandemic. This year, we are excited to have Jane Breen (Ontario Tech University) and Melissa Huggan (Vancouver Island University) as our two invited speakers.

Organizing committee

Himanshu Gupta
Alice Lacaze-Masmonteil
Mitra (Roghayeh) Maleki
Karen Meagher
Samir Mondal
Alireza Talebpour

Timetable

CT: Contributed Talk PT: Plenary Talk.

Thursday, May 7

8:55–9:00	**Openning remarks**		
9:00–10:00	PT	**Melissa Huggan**	Vancouver IslandUniversity
10:00–10:30	**Coffee Break**		
10:30–11:00	CT	**Allen Herman**	University of Regina
11:00–11:30	CT	**Kaioke Begay**	University of British Columbia
11:30–12:00	IS	**Jaskaran S. Kaire**	University of Manitoba
12:00–12:10	**Group photo**		
12:10–13:30	**Lunch**		
13:30-14:00	CT	**Sarobidy Razafimahatratra**	Carleton University
14:00-14:30	CT	**Cody Solie**	University of Regina
14:30-15:00	CT	**Benjamin Moore**	University of Manitoba
15:00–15:30	**Coffee Break**		
15:30-16:00	CT	**Alice Lacaze-Masmonteil**	University of Regina
16:00–17:00	**Open problem session**		
17:00–19:00	**Social at The Study**		

Contributed talks should be 20 minutes long. Speakers will be given 5 minutes for questions.

Friday, May 8

8:55–9:00	**Openning remarks**		
9:00–10:00	PT	**Jane Breen**	Ontario TechUniversity
10:00–10:30	**Coffee Break**		
10:30–11:00	CT	**Nelson de Assis Junior**	University of Regina
11:00–11:30	CT	**Marshal Kaatz**	University of Manitoba
11:30–12:00	CT	**Alireza Talebpour**	University of Regina
12:00–13:30	**Lunch**		
13:30-14:00	CT	**Hermie Monterde**	University of Regina
14:00-14:30	CT	**Kirwin Hampshire**	University of Victoria
14:30-15:00	CT	**Samir Mondal**	University of Regina
15:00–15:30	**Coffee Break**		
15:30-16:00	CT	**Layne Burns**	University of Regina
16:00-16:30	CT	**Rick Brewster**	Thompson Rivers University
16:30–17:00	**Closing remarks**		

List of Participants

Shirin Alimirzaei	University of Lethbridge
Nelson de Assis Junior	University of Regina / Universidade Federal do Rio Grande do Sul (UFRGS)
Robert Bailey	Grenfell Campus, Memorial University
Kaioke Begay	University of British Columbia
Jane Breen	Ontario Tech University
Rick Brewster	Thompson Rivers University
Layne Burns	University of Regina
Peter Dukes	University of Victoria
Homer Franz De Vera	University of Manitoba
Karen Gunderson	University of Manitoba
Himanshu Gupta	University of Regina
Kirwin Hampshire	University of Victoria
Allen Herman	University of Regina
Marina Hildebrandt	University of Victoria
Melissa Huggan	Vancouver Island University
Marshall Kaatz	University of Manitoba
Jaskaran Kaire	University of Manitoba
Lord Kavi	Concordia University of Edmonton
Alice Lacaze-Masmonteil	University of Regina
Mitra (Roghayeh) Maleki	University of Regina
Karen Meagher	University of Regina
Abu Mohammad Hammad Ali	University of Regina
Samir Mondal	University of Regina
Hermie Monterde	University of Regina
Benjamin Moore	University of Manitoba
JD Nir	Oakland University
Johnna Parenteau	University of Regina
Trace Price	University of Regina
Sarobidy Razafimahatratra	Carleton University
Cody Solie	University of Regina
Alireza Talebpour	University of Regina

List of Abstracts – Talks

Thursday 7th

Controlling the Spread of a Virus with Self-disseminating Vaccines

Melissa Huggan, Vancouver Island University

PT

Live-attenuated vaccines contain the weakened form of a live virus. When an individual is inoculated with such a vaccine, the attenuated virus establishes a subdued infection resulting in resistance or immunity, but does not cause disease. In principle, it can then spread from individual-to-individual through close contact. The advantage is that the vaccine can be administered directly to a small portion of the population, but will spread 'for free' through the population. In this talk, we will introduce the containment problem, which is a deterministic, discrete-time model for the competing spread of a virus and self-disseminating vaccines on a graph. We will present results for the containment problem and several open problems.
This is joint work with Jessica Enright, Ethan Hunter-Frankland,Margaret-Ellen Messinger, and Dylan Pearson.

Systems of homogeneous polynomial equations with no zero-free solution

Allen Herman, University of Regina

CT

The problem of finding the minimum number of distinct eigenvalues $q(G)$ of a symmetric matrix supported by a distance-regular graph G leads one to look for zero-free solutions to certain systems of square-free homogeneous multivariate polynomial equations. Existence or nonexistence of zero-free solutions to such systems is a challenging computational algebraic geometry problem in general, but we have been able to find one situation where nonexistence can be established. I will give an overview of this situation, and how we apply it to determine $q(G)$ in some cases. This result appears in [arXiv:2411.0025] which is joint work with Shaun Fallat, Himanshu Gupta, and Johnna Parenteaux.

Circuit Axioms for Infinite Oriented Matroids

Kaioke Begay, University of British Columbia, Okanagan

CT

Oriented matroids are traditionally defined on finite ground sets. While standard matroids have been successfully generalized to the infinite setting without sacrificing matroid duality, the same generalization for oriented matroids proves challenging. In this talk, we discuss some of these challenges and propose a set of circuit axioms for oriented matroids to address them. By considering circuits to be conformally minimal dependencies, rather than support minimal dependencies, it may be possible to extend oriented matroids to the infinite setting in much the same way as non-oriented matroids.

Covering Number of 3-dimensional Cap Bodies

Jaskaran S. Kaire, University of Manitoba

CT

One of the major open problems in combinatorial geometry, the Hadwiger Covering conjecture, asserts that any convex body in n-dimensional Euclidean space can be covered by at most 2^n smaller positive homothetic copies of itself. Despite recent progress on the conjecture, it remains open in general, as well as for specific classes of bodies.

One such class of bodies are cap bodies – union of sets that are convex hulls of a unit ball (centered at origin) with an external point.

Bezdek, Ivanov, and Strachan showed that the conjecture holds for symmetric cap bodies in sufficiently high dimensions. Further, Ivanov and Strachan calculated the covering number for the class of 3-dimensional centrally symmetric cap bodies to be 6.

In this talk, I will show that even a broader class of all 3-dimensional cap bodies has the same covering number 6. Despite the geometric nature of the problem, the tools used to tackle it are rather general: discretization of the number of caps based on their size, probabilistic arguments (first moment methods), and integer linear programming.

This talk is based on joint work with A. Arman and A. Prymak.

On Ramanujan derangement graphs

Sarobidy Razafimahatratra, Carleton University

CT

Let X be a connected non-bipartite k-regular graph on n vertices with eigenvalues $\lambda_1 > \lambda_2 \geq \ldots \geq \lambda_n$, and let $\lambda(X) := \max\{|\lambda_2|, |\lambda_n|\}$. The graph X is called a Ramanujan graph if $\lambda(X) \leq 2\sqrt{k-1}$.

Given a finite transitive group $G \leq \mathrm{Sym}(\Omega)$, the derangement graph Γ_G is the graph whose vertex set is G, and two elements g and h of G are adjacent if hg^{-1} is a derangement, that is, a fixed-point-free permutation. In this talk, we will show that Γ_G is a Ramanujan graph for every subgroup $\mathrm{SL}_2(\mathbb{F}_q) \trianglelefteq G \leq \mathrm{GL}_2(\mathbb{F}_q)$ acting transitively on the non-zero vectors of $\mathbb{F}_q^2$.

This is based on joint work with Roghayeh Maleki.

Intersection Densities of Transitive Permutation Groups

Codie Solie, University of Regina

CT

The intersection density of a permutation group is the ratio of the size of a largest intersecting set in a permutation group compared to the size of the stabilizer of a point. Many families of groups have been shown to have intersection density equal to 1, and recent work has tried to find groups with intersection density greater than one. We present a dataset which catalogues intersection densities for small transitive permutation groups. This project has resolved the enumeration of intersection densities for transitive permutation groups on 18 points. We will discuss tools of algebraic graph theory useful for computing intersection densities and explore a handful of open problems resulting from this project.

Graph isomorphism and immersions

Benjamin Moore, University of Manitoba

CT

For every proper immersion-minor closed family M, there are non-isomorphic graphs G and H such that $\hom(K, H) = \hom(K, G)$ for all K in M, where $\hom(K, G)$ is the number of homomorphisms from K to G. This proves the immersion version of Robersons conjecture, and strongly disproves a conjecture of Neuen.

The game of Cops and Attacking Robbers

Alice Lacaze-Masmonteil, University of Regina

CT

The game of Cops and Robber played on graphs is a turn-based game between a set of $k \geqslant 1$ cops and a single robber. Cops and robber alike sit on the vertices of the graph with the cops first selecting their starting vertices. At the beginning of their turn, each cop may move to an adjacent vertex; likewise for the robber. The cops' objective is to capture the robber by having one of their number sit on the same vertex as the robber; the robber seek to avoid capture. Given a graph G, k cops have a winning strategy on G if they can guarantee the robber's capture within a finite number of turns. Of particular interest is the *cop number* of a graph G which is the minimum number of cops for which there exists a winning strategy on G. Since the introduction of the game of Cops and Robber, numerous variations of the game have been introduced. In this talk, I will focus on a variant of this game introduced by Bonato et al. (2013) known as the game of Cops and Attacking Robber. In this case, we follow the same rules as the original game except that the robber is now given the ability to attack an adjacent cop at the beginning of his turn, thereby removing this cop from play. I will discuss some result on open problems of Bonato et al. (2013) and Clow et al. (2025). This is joint work with Florian Brendle, Alex Clow, and Torsten Ueckerdt.

Friday 8th

Kemeny's constant for random walks on graphs: combinatorial expressions and interpretations

Jane Breen, Ontario Tech University

PT

Kemeny's constant is an interesting and useful quantifier of how well-connected the states of a Markov chain are. This is of particular interest when the Markov chain in question is a random walk on a graph, in which case Kemeny's constant is interpreted as a measure of how 'well-connected' the graph is.

This talk will provide an introduction to Markov chains, an overview of the history of Kemeny's constant, discussion of some applications, and a survey of recent results, with an emphasis on those where the value of Kemeny's constant is derived from the combinatorial structure of the graph, via counting spanning trees and forests. We focus in particular on the problem of interpreting and understanding these complex expressions and relating them to other graph metrics.

Structural properties of the A_α-spectrum of matrogenic graphs

Nelson de Assis Junior, University of Regina

CT

We investigate structural spectral properties of the matrix $A_\alpha(G)$ within the class of matrogenic graphs, introduced by Földes and Hammer and properly containing threshold graphs. The A_α-matrix, defined by Nikiforov as a convex combination of the adjacency and degree matrices, merges several well-known properties of the adjacency and signless Laplacian matrices. Exploiting the canonical decomposition of matrogenic graphs, we identify families of α-eigenvalues determined solely by the induced subgraph on a distinguished vertex set. For other subclasses, we derive explicit factorizations of the α-characteristic polynomial and describe how structural parameters govern the spectrum. As an application, we obtain new bounds for $\alpha_0(G)$, the smallest value of α for which $A_\alpha(G)$ is positive semidefinite.

Ramsey Theory for Acyclic Sets

Marshall Kaatz, University of Manitoba

CT

Ramsey numbers have gained notoriety over the last century for the difficulty of computing exact values or even improving known bounds, and have given rise to a large family of Ramsey-type problems. The classical theorem of Ramsey can be rephrased in terms of independent sets: in large enough graphs, either the graph or its complement will have a large independent set.

In this talk, I present a natural analogous problem to that of the classical Ramsey numbers. Observing that an independent set is a special case of an acyclic set in a graph — that is, a set of vertices which induces no cycles — we instead study how in large enough graphs, either the graph or its complement will have a large acyclic set. In addition to presenting key theorems and constructions, I will discuss small non-trivial exact values and best-known bounds.

The Clique Number of Some Normal Cayley Graphs

Alireza Talebpour, University of Regina

CT

In this talk we investigate the largest cliques and cocliques in some Cayley graphs $Cay(Sym(n), C)$, where $Sym(n)$ is the symmetric group on n elements and C is a specific conjugacy class or a union of conjugacy classes of $Sym(n)$. In addition to the clique and coclique number, we determine which maximum cliques of these Cayley graphs are also subgroups of $Sym(n)$. In fact, these types of problems are motivated by Erdos-Ko-Rado type problems.

We show that when C is the set of all involutions, the clique number of $Cay(Sym(n), C)$ equals $2^{\frac{n}{2}}$ and the maximum cliques are also subgroups of $Sym(n)$. Next, we study the case in which C is a conjugacy class of permutations which are the product of t disjoint transpositions, where $2 \leq t \leq \frac{n}{2}$. We prove that the clique number of of such Cayley graphs are bounded from below by the maximum of $\lfloor \frac{n-t}{t} \rfloor + 1$ and $|\mathcal{F}(2t)| + 1$, where $|\mathcal{F}(2t)|$ is the size of a maximum $[4^{\ell}]$-uniform 1-factorization of K_{2t}. Surprisingly, this bound holds with equality for $t = \frac{n}{2}$; in addition, the ratio bound for cliques holds with equality when n is a power of 2.

Local ε-uniform mixing in continuous quantum walks

Hermie Monterde, University of Regina

CT

A quantum walk describes the propagation of quantum states in a qubit network represented by a graph. We say that local uniform mixing occurs if the quantum walk achieves maximal entanglement of a quantum state evolved from a vertex state. In this talk, we gently introduce a generalization of local uniform mixing and discuss its relation to the combinatorial properties of the graph.

Edge Inversions in (P_k)-closed Groups

Kirwin Hampshire, University of Victoria

CT

This talk aims to explain the core observation that underpins the construction of a (P_2)-closed group acting on T_3 in which all edge inversions have infinite order, and the construction of a family of (P_2)-closed groups for which the smallest order of an edge inversion is an arbitrarily high finite number.

On Strongly Infinitely Divisible Matrices

Samir Mondal, University of Regina

CT

Strongly infinitely divisible matrices (SIDM) are invertible, entrywise nonnegative matrices whose matrix roots of all positive integer orders exist and remain nonnegative. Equivalently, a matrix A is SIDM if there exists an essentially nonnegative matrix B such that $A = eB$. These matrices are closely connected to continuous semigroups and the embedding problem for finite-state Markov chains. In this talk, we discuss SIDM matrices and their relationship with continuous semigroups. We explore their algebraic properties, spectra,and the nature of their roots. We also examine conditions under which a nonnegative pth root of a nonsingular stochastic matrix remains stochastic,highlighting connections with the embedding problem in probability theory. (This work is joint with K. C. Sivakumar and M. J. Tsatsomeros.)

1-capacitated graph burning

Layne Burns, University of Regina

CT

We introduce the 1-capacitated graph burning model, denoted $\hat{b}_1(G)$. In contrast to standard graph burning, where fire spreads to all neighbours simultaneously, the 1-capacitated model restricts a burning vertex to propagate to at most one unburned neighbour per discrete round. Consequently, high-degree vertices delay rather than accelerate the burning process.

We analyze this model by establishing a direct structural connection to zero forcing. The 1-capacitated propagation rule is mathematically equivalent to the zero forcing colour change rule, meaning every valid burning sequence forms a zero forcing set. In this talk, we outline this equivalence and demonstrate how the zero forcing number, $Z(G)$, alongside the concept of propagation delay, can be used to establish theoretical lower bounds for the 1-capacitated burning number.

Maneuver number for trees

Rick Brewster, Thompson Rivers University

CT

Eternal domination refers to the discrete-time process of constructing a sequence of dominating sets in a graph, subject to an infinite sequence of requests that a specific vertex be included in the next dominating set. Reconfiguring one dominating set to the next involves some vertices in the current dominating set being replaced by neighbours. At one extreme, only one vertex can be replaced by a neighbour per reconfiguration step, and at the other extreme all vertices can be replaced by neighbours. The minimum number of vertices that must be permitted to be replaced at each time step so that a dominating set of the minimum possible size can be maintained is called the *maneuver number* of the graph. We examine the maneuver number of trees, and provide a linear time algorithm.

Joint with Gary MacGillivray and Ethan Williams

Open Problem Session

Open Problems

- Edge switching to avoid triangles, **Karen Gunderson**
- Types of Problems in Erdős-Ko-Rado Combinatorics, **Karen Meagher**
- Homomorphism density of walk regular graphs, **Ben Moore**
- Are any graphs only eventually Hoffman-London? **JD Nir**

Useful Information

Venue

Location:

Talks will be held at the **RIC 119**. It is situated on the first floor of the the Research and Innovation Centre building (across the Protective Services main office).

Coffee breaks:

Coffee breaks will be offered right outside RIC 119. See the schedule for details on the time.

Food and beverages

Lunches:

There are multiple places to grab lunch in and around the University of Regina campus.

- **Ridell Centre Commons**: Liang's Kitchen, Chick'N'Tendees Express, Fresh Junction, and Ultimate Grab and Go, Ultimate Rotisserie Experience, Da India Curry House Xpress (vegetarian options).
- **College West**: Extreme Pita
- **Lab Commons**: Trifon's Pizza
- **Kramer Corner Mall (off-campus):** Triffon's pizza, Subway, McDonald's, Circle K.

Cafés:

- **Dr. John Archer Library**: Starbucks

- **Riddell Centre Commons**: Java Junction
- **Centre for Kinesiology, Health and Sport**: Gong Cha
- **Campion College**: Robin's Donuts/Mia Fresco
- **Luther College**: Luther Cafeteria
- **Innovation Place**: Momentum Café

How to get to the PDMW 2026?

The Prairie Discrete Mathematics Workshop 2026 will be held at the University of Regina's main campus. All Talks will be held at the **RIC 119**.

- **By air:** Regina is served by Regina International Airport (YQR), located approximately 10-15 minutes from the city centre and the University of Regina. More information about the airport can be found at: `https://www.yqr.ca/`. Upon arrival at YQR, travelers can reach the University of Regina and other city destinations by taxi, Uber, or public transit. Taxi and car rental services are available directly at the airport terminal.
- **By car:** It takes approximately 6 hours to get to Regina driving from Winnipeg and 3.5 hours driving from Brandon. From Alberta, it takes 7.5 hours driving from Calgary and 6 hours driving from Lethbridge. If you are comming from Saskatoon, it will only take 2.5 hours.

Research and innovation centre
(workshop venue)

College west building
(Department of Mathematics and
statistics)

Enter Here
(Ridell
Centre)

University of Regina Campus Map