Contributed Papers
Communications libres
(Org: **Martin Barlow** (UBC))

BHAGWAN AGGARWALA, University of Calgary
Entry Inhibitors of HIV

Entry Inhibitors of HIV (Fuzeon is an example) have been approved by FDA (Food and Drug Administration of the United States) only when taken in combination with other HIV medications and not otherwise. Using a Mathematical model for HIV propagation, we speculate on why this maybe a correct policy.

REZA AKHTAR, Miami University
Small-sum pairs in abelian groups

Let A and B be subsets of size k in a finite abelian group G. Answering a question of Bihani and Jin, we prove that if $A+B$ and $A+A$ both have size $2k-1$, then, under suitable technical hypotheses, A must be a translate of B. The main ingredient in the proof is Kemperman's structure theorem. This is joint work with Paul Larson.

MASHHOOR AL-REFAI, Princess Sumaya University for Technology
On Some Properties Defined Over Strongly Graded Rings and Graded Modules

Let G be a group with identity e. A ring R is said to be $G-$graded if there exists additive subgroups R_g of R such that $R = \bigoplus_{g\in G} R_g$ and $R_g R_h \subset R_{gh}$ for all $g, h \in G$. The $G-$graded ring R is denoted by (R, G). We denote by supp(R, G) the support of G which is defined as $\{g \in G : R_g \neq 0\}$. The elements of R_g are called homogeneous of degree g. For $x \in R$, x can be written uniquely as $\sum_{g\in G} x_g$ where x_g is the component of x in R_g. Also, we write $h(R) = \bigcup_{g\in G} R_g$.

Many studies in group graded rings assume R to be a strongly graded ring, i.e., $R_g R_h = R_{gh}$ for all $g, h \in G$. But this strong condition is hard to satisfy.

In 1995, we defined three successively stronger properties that a grading may have, and we investigated the relationship between these strong gradings and the stronger non-degenerate and faithful properties which are motivated by the work of Cohen and Rowen.

We will define new types of strongly graded rings and strongly graded modules and introduce some properties defined over strongly graded rings. A survey of my contribution to the field, will also be given.

A. BASS BAGAYOGO, University College of Saint-Boniface
Discrete Element Method for Granular Flow and Cracks Propagation

Granular Materials (GM) are everywhere in nature and are the second-most manipulated material in industry after water, but as once written by Pierre-Gilles de Gennes, their statistical physics is still in its infancy. In this talk, after a short overview of the mathematical challenges and the state of the art related to the diverse set of behaviors of GM, I will present some numerical simulations results, by using the contemporary Discrete Element Method (DEM) in order to simulate a wide variety of cases. I will also characterize the industrial relevance of the simulations, and the link with the cracks propagation.

ROSS CHURCHLEY, University of Victoria
Monopolar claw-free graphs

A graph is called *monopolar* if its vertices can be partitioned into an independent set and a disjoint union of cliques. Monopolar graphs, which include all bipartite and split graphs, form an important subclass of the so-called polar graphs. We present a structural characterization of monopolar claw-free graphs which suggests a simple $O(n^3)$ algorithm for their recognition. This contrasts with the NP-completeness of related recognition problems, including those for monopolar graphs in general and for polar claw-free graphs.

PINAR COLAK, Simon Fraser University
Two-sided chain conditions in Leavitt path algebras

Leavitt path algebras are a natural generalization of the Leavitt algebras, which are a class of algebras introduced by Leavitt in 1962. For a directed graph E, the Leavitt path algebra $L_K(E)$ of E with coefficients in K has received much recent attention both from algebraists and analysts over the last decade. So far, some of the algebraic properties of Leavitt path algebras have been investigated, including primitivity, simplicity and being Noetherian.

First, we explicitly describe the generators of two-sided ideals in Leavitt path algebras associated to arbitrary graphs. We show that any two-sided ideal I of a Leavitt path algebra associated to an arbitrary graph is generated by elements of the form $(v + \sum_{i=1}^{n} \lambda_i g^i)(v - \sum_{e \in S} ee^*)$, where g is a cycle based at vertex v, and S is a finite subset of $s^{-1}(v)$. Then, we use this result to describe the necessary and sufficient conditions on the arbitrary sized graph E, such that the Leavitt path algebra associated to E satisfies two-sided chain conditions. This is joint work with Dr. Gene Abrams, Dr. Jason P. Bell and Dr. Kulumani M. Rangaswamy.

LORRAINE DAME, University of Victoria
Student Readiness and Success in Entry Level Undergraduate Mathematics

Which elements of a student's preparation are predictors of success in entry level undergraduate math (ELUM) courses? This presentation describes recent research at the University of Victoria, which includes studies of the relationships between ELUM course outcomes, high school grades, and diagnostic test scores. It shows that higher grades in secondary school English and Math go together with a greater probability of success and higher grades in ELUM courses. The results of an in-house developed diagnostic test show that students identified as at-risk were significantly more likely to fail or drop an ELUM course.

DENNIS EPPLE, University of Victoria
Proper Circular Arc Graphs and Path Systems on Tori

Proper Circular Arc graphs are a generalization of proper interval graphs. In this talk, it will be shown how colourings of proper circular arc graphs, permutation groups and path systems on tori are intertwined and how these concepts can be used to derive an algebraic classification of maximal k-colourable proper circular arc graphs.

ROSS J. KANG, Durham University
Maximum bounded-density subgraphs of random graphs

For the Erdős-Rényi random graph, we give a precise asymptotic formula for the order of a largest vertex subset whose induced subgraph has average degree at most t, given that $p = p(n) \geq n^{-2/9}n^{\varepsilon}$ for some fixed $\varepsilon > 0$, p is bounded away from 1, and $t = t(n) = o(\log(np)/\log\log(np))$. For $t^2 = o(\log(np)/\log\log(np))$, we obtain two-point concentration. This generalises a theorem on the independence number of random graphs. For both the lower and upper bounds, our proofs rely on large deviations inequalities for the binomial distribution. We provide a comparison with a formula for the order of a largest vertex subset whose induced subgraph has maximum degree at most t, which was obtained instead by methods from analytic combinatorics. This is joint work with Nikolaos Fountoulakis and Colin McDiarmid.

HUILAN LI, TRUEMAN MACHENRY, Drexel University
The Convolution Ring of Arithmetic Functions and Symmetric Polynomials

Inspired by Rearick (1968), we introduce two new operators, LOG and EXP. The LOG operates on generalized Fibonacci polynomials giving generalized Lucas polynomials. The EXP is the inverse of LOG. In particular, LOG takes a convolution product of generalized Fibonacci polynomials to a sum of generalized Lucas polynomials and EXP takes the sum to the convolution product. We use this structure to produce a theory of logarithms and exponentials within arithmetic functions giving another proof of the fact that the group of multiplicative functions under convolution product is isomorphic to the group of additive functions under addition. The hyperbolic trigonometric functions are constructed from the EXP operator, again, in the usual way.

SHAHLA NASSERASR, University of Victoria
Complete Solution to the TP_2-Completion Problem

A matrix is called TP_2 if all 1-by-1 and 2-by-2 minors are positive. The TP_2-completion problem asks which partial matrices have a TP_2-completion. For each given pattern of the specified entries, an explicit finite list of polynomial inequalities in the specified entries is given that characterizes the TP_2-completability of any partial matrix with that pattern. The method uses a generalized form of the Bruhat order on permutations, some new partial orders on matrices and the logarithmic method to reduce to the TP_2-completion problem to determining the generators of a certain finitely generated, pointed cone. An algorithm that finds these polynomial (in fact monomial) inequalities for a given pattern is given.

JAMES NASTOS, UBCO
A novel branching strategy for parameterized graph modification problems

Many *fixed-parameter tractable* algorithms using a bounded search tree have been repeatedly improved by describing a larger number of branching rules involving an increasingly complex case analysis. We introduce a novel and general branching strategy that branches on the forbidden subgraphs of a relaxed class of graphs. By using the class of P_4-sparse graphs as the relaxed graph class, we obtain efficient bounded-search tree algorithms for several parameterized deletion problems. For the cograph edge-deletion problem and the trivially perfect edge-deletion problem, the branching strategy yields the first non-trivial bounded-search tree algorithms. For the cograph vertex deletion problem, the running time of our simple bounded search algorithm matches those previously designed with the help of complicated case distinctions and non-trivial running time analysis and computer-aided branching rules.

VARVARA SHEPELSKA, University of Manitoba
Slicely Countably Determined Banach Spaces

We introduce the class of slicely countably determined Banach spaces which contains in particular all spaces with the Radon-Nikodým property and all spaces without copies of ℓ_1. We present many examples and several properties of this class. We give some applications to Banach spaces with the Daugavet and the alternative Daugavet properties, lush spaces and Banach spaces with numerical index 1. In particular, we show that the dual of a real infinite-dimensional Banach space with the alternative Daugavet property contains ℓ_1 and that operators which do not fix copies of ℓ_1 on a space with the alternative Daugavet property satisfy the alternative Daugavet equation.

CHESTER JAY WEATHERBY, University of Delaware
On the transcendence of Fourier and other infinite series

We investigate the transcendental nature of the sums

$$\sum_{n\in\mathbb{Z}} \frac{f(n)A(n)}{B(n)} \quad \text{and} \quad \sum_{n\in\mathbb{Z}} \frac{A(n)}{B(n)}$$

where $A(x), B(x)$ are polynomials with algebraic coefficients with $\deg A < \deg B$, f is an algebraic valued periodic function, and the sum is over integers n which are not zeros of $B(x)$. By relating these sums to the Fourier series of some special

functions we are able to obtain transcendence results. In certain cases we relate these sums to a theorem of Nesterenko regarding the algebraic independence of π and $e^{\pi\sqrt{D}}$ for positive integer D.

YONGJUN XING, Mathematics and Statistics of University of Regina
Spread of some classes of normal matices

A spread of a matrix has extensive and practical applications in combinatorial optimization problems and cybernetics problems. The spread of a matrix is simply defined as the maximum absolute value of difference between any two eigenvalues of that matrix. There are many existing papers dealing with bounding the spread of a matrix in general. Of interest to us is the spread of n-by-n normal matrices with entries in closed set. In this paper, we are interested in the classes of real skew-symmetric matrices, complex Hermitian matrices and complex skew-Hermitian matrices, and we determine the structure of these matrices, in each class, when their spread attains the maximum value.