The Canadian Undergraduate Mathematics Conference

2012

Congrès Canadien des Étudiants en Mathématiques

July 11-15 juillet 2012
The University of British Columbia's
Okanagan Campus
Kelowna, British Columbia

CUMC 12 CCÉM

Contents

Committee Notes

1.1 Welcome / Bienvenue

Welcome to the 19th annual Canadian Undergraduate Mathematics Conference! This year we are proud to present to you seven keynote speakers, in addition to the 86 student talks from over 25 different universities and colleges from across Canada and the USA.

UBC's Okanagan campus aims to be ecologically friendly by focusing on sustainability throughout our campus. One of the ways we accomplish this is by being bottled water free; please make use of the reusable water bottles we have provided for you and the water stations in various buildings. As well, please take note of the waste receptacles all around campus which are labelled for recyclable materials, returnable bottles, and other wastes. Please help keep our campus and environment clean and healthy. For more information on our sustainability programs see www.ubc.ca/okanagan/sustainability.

The CUMC is a unique opportunity for you to share ideas and make connections that could last you a lifetime. We know that you will be inspired by the talks you listen to and the people you meet this week. Enjoy your time here and welcome to beautiful Kelowna, BC!

Bienvenue

Bienvenue au 19e Concrès Canadien des Étudiants en Mathématiques! Cette année, nous sommes fiers de vous présenter sept conférences plénières, en plus des 86 présentations étudiantes de 25 universités et collèges de partout au Canada et aux États-Unis.

Le campus Okanagan de l'UBC a pour objectif d'être écologiquement responsable, en se concentrant sur la durabilité à travers tout le campus. L'une des façons d'accomplir cet objectif est de supprimer les bouteilles d'eau; nous vous prions donc de vous servir des bouteilles réutilisables que nous vous avons fournies, ainsi que des fontaines à eau disponibles dans plusieurs bâtiments. De plus, vous remarquerez que les poubelles sur le campus permettent le tri des matériaux recyclables, des bouteilles recyclables et des autres déchets. Nous vous serions gré de nous aider à garder notre

campus et notre environnement propres et sains. Pour plus d'informations sur notre programme de durabilité, vous pouvez visiter le www.ubc.ca/okanagan/sustainability.

Le CCÉM est une opportunité unique de partager vos idées et de créer des relations qui pourraient durer toute votre vie. Nous savons que vous serez inspirés par les présentations que vous écouterez et par les personnes que vous rencontrerez. Nous vous souhaitons un agréable séjour ici, et soyez les bienvenus au bel endroit qu'est Kelowna, en Colombie-Britannique!

1.2 Welcome From Studc / Un message de Studc

This year, the CUMC turns 19, the legal drinking age in British Columbia, and where better to celebrate than in the heart of the province in the beautiful Okanagan Valley famous for its wineries. Much like any 19-year-old, the CUMC constantly changes: each year, participants and organizers bring the conference its unique flavour - from the crisp, sophisticated notes of Ontario to the bright, expressive aromas of Quebec to the mellow, luscious bouquet of the West coast. Throughout all this change and throughout all these years, what keeps the CUMC going is the enthusiasm of everyone involved. As the overseeing body, the CMS Student Committee (Studc) shares the excitement and the passion of the organizers; we are happy to see the conference evolve - it supplies us with new ideas and influences our own projects. Studc not only ensures the continuation of the CUMC, it also supports regional events, publishes the semi-annual newsletter Notes from the Margin and holds students events at the Canadian Mathematical Society's winter and summer meetings. For more information on our past and present projects, check us out on the web at studc.cms.math.ca and don't hesitate to drop us a line at chair-studc@cms.math.caas we are constantly looking for feedback.

This year's dynamic CUMC organizing team has done an amazing job putting together a great event. But it is the participants that make the conference happen, so we strongly encourage you to partake in all of this year's numerous activities. Whether on the wine tour with Okanagan's best or at breakfast with some OJ, I invite you to raise the glass in celebration of CUMC 2012.

Un message de Studc

Cette annèe, le CCÉM a enfin atteint l'âge légal pour boire en Colombie-Britannique et quoi de mieux que de célébrer cet événement au coeur de cette province, dans la magnifique vallée de l'Okanagan qui est reconnue pour ses vignobles. Á l'image des jeunes de 19 ans, le CCÉM est bouillonnant de projets. Chaque année, les participants et les organisateurs apportent leurs saveurs particuliéres, en commençant par les notes mordantes et sophistiquées de l'Ontario, aux arômes

expressifs et éclatants du Québec en passant par la tranquilité teintée d'extravagance de la côte Ouest canadienne.

À travers le temps et les changements, ce qui tient en vie le CCÉM est certainement l'enthousiasme de toutes les personnes impliquées dans levènement. En tant qu'organisation chapeautant le congrès, le comité étudiant de la SMC (Studc) partage l'effervessence et la passion des organisateurs. Nous sommes heureux de constater que le congrès évolue, nous amenant de nouvelles idées et influenant nos projets. En plus d'assurer la continuité du CCÉM, le Studc supporte des événements régionaux, publie deux fois par année le bulletin "Notes from the Margin" et organise des activités étudiantes aux deux rencontres annuelles de la Société Mathématique du Canada. Pour plus d'informations sur nos projets passés et actuels, allez visiter notre site web studc.cms.math.ca et n'hésitez pas á nous écrire à chair-studc@cms.math.ca. Nous sommes toujours ouverts aux commentaires.

Le dynamique comité organisateur de cette année a mis beaucoup d'efforts dans l'organisation de ce congrès. Par contre, ce sont les participants qui font en sorte que le congrès est possible et c'est pourquoi nous vous encourageons fortement à participer aux nombreuses activités qui s'offrent à vous cette année. Que ce soit pendant la tournée des vignobles de la vallée de l'Okanagan ou en savourant un bon jus d'orange frais au déjeuner, vous êtes invités à lever votre verre pour célébrer le CCÉM 2012.

1.3 Committee Bios / Biographies des membres du comité

Figure 1.1: Committee from left to right: Crystal Parras, Jodie Foster, Spencer Hunt, Garrett Culos, Andrea Hyde, Rodney Earl and Faisal Rahman.

Crystal Parras - President

Crystal Parras is going into her fourth year of BSc Applied Math with Honours at UBC's Okanagan campus. Having first been a hairdresser for ten years, she took a turn into a completely different direction and now uses pencils and graph paper as her weapon of choice instead of scissors... though who's to say what would cause more damage! She is looking forward to delving into courses on financial math and statistics in the fall, and her goal is to continue this on into graduate studies. Crystal is also President of the Math and Stats Course Union, and when she's not studying, you can catch her snowboarding, dancing around to drum 'n' bass, cutting her friends' hair, and just being a general nuisance.

Crystal Parras débute sa quatrième anne d'étude au Baccalauréat en Mathématiques Appliquées à l'UBCO. Après avoir travaillé comme coiffeuse durant 10 ans, elle a emprunt une toute autre direction et a troqué ses ciseaux pour des crayons et du papier quadrillé. Dans les prochaines années elle envisage de s'orienter vers les statistiques et les mathématiques financières dans le but de poursuivre des études supérieures. Crystal est aussi Présidente du Math and Stats Course Union et lorsqu'elle n'étudie pas, elle aime faire de la planche à neige, danser au son du drum n bass et couper les cheveux de ses amis.

Andrea Hyde - VP Logistics

Andrea Hyde completed her BSc in Math with Honours at UBCO this year. Her undergraduate work was in Mathematical Biology under the supervision of Dr. Rebecca Tyson. She is excited to begin her MSc this fall in Number Theory with Dr. Blair Spearman at UBCO. Andrea is also the Internal Co-ordinator for the Math and Stats Course Union on campus. When not being a terrible nerd, Andrea loves biking, snowboarding, drinking beer with friends, and cuddling with her dogs. She highly recommends that you have the all you can eat waffles at the Jammery while you're here.

Andrea Hyde vient tout juste de compléter son baccalauréat en mathématiques à l'UBCO. Son projet d'étude a porté sur la biologie mathématique, sous la supervision de Rebecca Tyson. Elle est enthousiaste à l'idée de commencer sa maîtrise à àutomne dans le domaine de la théorie des nombres avec Blair Spearman à UBCO. En plus de son implication pour le CCÉM, Andrea est Coordinatrice Interne du Math and Stats Course Union. À part être une incroyable 'nerd', Andrea aime faire du vélo, de la planche à neige, boire de la bière avec des amis et jouer avec ses chiens. Selon elle, un déjeuner au crêpes-à-volonté du Jammery s'impose lors de votre passage à Kelowna.

Spencer Hunt - VP Finance

Spencer has grown up in the Okanagan in the small town of Okanagan Falls (there wasn't even a Tim Hortons!). Throughout his four years at UBC's Okanagan campus, Spencer has tried to be involved with the campus community. Working on campus as a residence advisor, teaching assistant, supplemental learning leader, and as the orientation coordinator, has fueled his passion for students and helping them succeed. Spencer was also a part of the President's non-academic misconduct committee, where the students would serve as an impartial body to students that have broken the campus conduct. Being a part of this committee has encouraged him to attend law school, and he will be taking the LSAT later this year. Spencer feels that his education in mathematics will provide him the objectivity and analytical skills to succeed on this career path.

Spencer Hunt a grandi dans le petit village d'Okanagan Falls (où il n'y a même pas de Tim Hortons!). Pendant ses quatres années sur le campus de UBCO, Spencer s'est impliqué de nombreuses faons. Il a travaillé à titre de responsable de résidences, d'auxiliaire d'enseignement et de conseiller en orientation, ce qui a alimenté sa passion pour la réussite des étudiants. Spencer a également fait partie du President non-academic misconduct committee, dans lequel les étudiants servent de corps impartial dans le jugement des étudiants ayant enfreint les lois du campus. Prendre part à ce comité l'a encouragé à s'inscrire à l'école de droit et il passera ses examens d'admission dans le courant de l'année. Spencer considre que ses études en mathématiques lui ont donné l'objectivité et les outils analytiques nécessaires pour réussir dans sa future carrière.

Rodney Earl - VP Logistics

Rodney Earl is going into his fifth year of his BSc with a double major, one in Computer Science and the other in Mathematics, with a concentration in Pure Math. Math has always been a hobby of Rodney's and became more of a passion as he continued his years of study. By the end of his second year, he knew that understanding how and why math works was very interesting to him, so he decided to take a concentration in the pure side of math. Outside of school, Rodney is a member of the Cadet Instructor Cadre, which is a sub component of the Canadian Forces, that specializes in the instruction, mentoring and development of youth in the Cadet Program. When not studying, working on projects or planning different activities for Cadets, Rodney enjoys reading and hanging out with his friends.

Rodney Earl débute sa cinquième année de baccalauréat avec majeure double en Informatique et en Mathématiques. Les mathématiques ont toujoursété un passe-temps pour Rodney et sont devenues une passion au cours de ses études. À la fin de sa deuxième année, il savait que la compéhension du fonctionnement des mathématiques était de première importance pour lui, ce qui l'a mené vers les mathématiques pures. En dehors du cadre scolaire, Rodney est un membre des Cadres Instructeurs des Cadets, une organisation affiliée aux Forces Canadiennes qui se spécialise dans la formation et le développement des jeunes Cadets. Dans ses temps libres, Rodney aime lire et passer du bon temps avec ses amis.

Jodie Foster - VP Fundraising

Jodie is entering her final year of a BSc in Mathematical Sciences with a minor in Physics. She is greatly looking forward to an awesome last year with her involvement as a teaching assistant in Math and Statistics as well as her position as the student coordinator for the Math and Science Tutor Centre. Next year she will be starting her MSc in Astrostatistics. In her spare time Jodie can be found travelling the world. She has spent time in both Sweden and Bolivia. Jodie also likes to spend her time in the Okanagan with friends and family. Fun fact: Jodie's obsessive love for Harry Potter and Star Wars (she owns 12 bobble heads of various characters) has provided her the attainment of badass status.

Jodie débute sa dernière année de baccalauréat en mathématiques avec mineure en physique. Elle envisage une superbe année compte tenu de son implication comme auxiliaire d'enseignement et comme coordonnatrice étudiante du centre de tutorat. Par la suite, elle compte faire une maîtrise en Astrophysiques. Dans ses temps libres, Jodie aime passer du temps dans la vallée de l'Okanagan avec sa famille et ses amis. Fait cocasse: L'obsession de Jodie pour Harry Potter et Star Wars

(elle possède 12 bobble heads de diffrents personnages) est la seule chose qui l'empêche d'obtenir le statut de "badass".

Faisal Rahman - Web Coordinator

Faisal Rahman started his academic career with an obsession for Machine Learning and Artificial Intelligence, but slowly his passion grew for Mathematics. He feels blessed to be able to see the beauty of Mathematics behind equations. While he has his weakness for theoretical mathematics, he also allows himself to explore his affection for other branches of arts and science. His career dream is to aid the study of human behavior with mathematics, and possibly extend the research to Artificial Intelligence. He enjoys dancing, sports, and looking at paintings. He gets inspired by the success of others, and always inspires others to reach their potential. His true inspiration is Salman Khan, who in his graduation speech said, "It is no exaggeration to say that we will change the world", and later formed the Khan Academy, which helps educate millions of people.

Faisal Rahman a dèbuté sa carrière académique avec une obsession pour l'intelligence artifielle et l'apprentissage automatique, puis sa passion pour les mathématiques s'est graduellement développée. Il se considère chanceux de saisir la beauté des mathématiques au-delà des équations. Même si les mathématiques théoriques le captivent, il aime explorer d'autres branches des arts et des sciences. Dans sa future carrière, il voudrait étudier le comportement humain grâce aux mathématiques et peut-être même poursuivre ses recherches dans le domaine de l'intelligence artificielle. Il aime la danse, les sports et les peintures. Il est inspiré par le succès de ses collègues et inspire les autres à atteindre leur plein potentiel. Il puise son inspiration dans Salman Khan, qui a dit dans son discours de graduation que "ce n'est pas de l'exagération de dire que l'on va changer le monde" et qui a fondéla Khan Academy, qui aide à éduquer des millions de personnes.

Garrett Culos - VP Fundraising

Garrett Culos is going into his fifth and final year at UBC's Okanagan, where he is studying applied math and physics. He will be ending his undergraduate degree by undertaking two honours projects specializing in mathematical biology and theoretical physics. When Garrett is not studying, he enjoys going to the gym where he picks things up and puts them down. Garrett is a tall man, who finds pleasure in playing video games such as Starcraft, Diablo, and Fallout 3. Garrett also enjoys long walks on the beach, going to the park to do acrobatic yoga, and talking in the third person. If there's one thing that Garrett stresses most about Kelowna is to bask in the glory that is the Wood Fire Bakery and enjoy their succulent chicken cordon bleu.

Garrett Culos amorce sa cinquième et dernière annèe á l'UBCO où il étudie les mathématiques et la physique appliquées. Il terminera ses études de premier cycle avec deux projets d'envergure

en biologie mathématique et en physique théorique. Mis à part l'école, Garrett aime s'entraîner au gym où il lève de la fonte. Garrett aime aussi jouer à des jeux tels que Starcraft, Diablo et Fallout 3. Il aime aussi les longues marches sur la plage, aller au parc faire du yoga acrobatique et parler à la troisième personne. S'il pouvait insister sur une chose à faire à Kelowna, ce serait de profiter du temps au Wood Fire Bakery en savourant leur poulet cordon bleu.

1.4 Attendee Policy / Politique de participation

The Canadian Undergraduate Mathematics Conference 2012 is dedicated to providing a harassment-free conference experience for everyone, regardless of gender, sexual orientation, disability, physical appearance, body size, race, religion, language, or mathematical preference. We do not tolerate harassment of conference participants in any form. Sexual language and imagery is not appropriate for any conference venue, including talks. Conference participants violating these rules may be sanctioned or expelled from the conference without a refund at the discretion of the conference organizers.

Harassment includes: offensive verbal comments related to gender, sexual orientation, disability, physical appearance, body size, race, or religion; sexual images in public spaces; following, stalking, deliberate intimidation, unwelcome photography or recording; sustained disruption of talks or other events; and inappropriate physical contact, or unwelcome sexual attention. Participants asked to stop any harassing behavior are expected to comply immediately.

If a participant engages in harassing behavior, the conference organizers may take any action they deem appropriate, including issuing a warning or removing the offender from the conference with no refund. If you are being harassed, notice that someone else is being harassed, or have any other concerns, please contact a member of conference staff immediately. Conference staff can be identified by coloured Organizer and Volunteer t-shirts.

Conference staff will be happy to help participants contact campus security or local law enforcement, or otherwise assist those experiencing harassment to feel safe for the duration of the conference. Campus security can provide escorts if desired. We value your attendance.

If you have any questions regarding the policy or its enforcement, please don't hesitate to contact us at the email below.

CUMC 2012 Organizing Committee E-mail: cumc.2012@ubc.ca

Campus Security (Emergency): 250-807-8111

Campus Security (Non-Emergency): 250-807-9236

On-Campus Accommodation: 250-807-8050

Police/Fire/Ambulance (Emergency): 911

RCMP (Non-Emergency): 250-726-3300

Taxi: 250-861-1111 or 250-212-1212

Kelowna Crisis Line: 1-888-353-2273

Okanagan College Security (Non-Emergency): 250-317-2435

Politique de participation

Le Congrès Canadien des Étudiants en Mathématiques 2012 s'engage à fournir une expérience de congrès exempte de harcèlement pour tous, quels que soient le genre, l'orientation sexuelle, les invalidités, l'apparence physique, la taille, la race, la religion, la langue ou les préférences mathématiques de la personne. Nous ne tolérerons le harcèlement de participants au congrès d'aucune forme. Le langage et les images à caractère sexuel ne sont appropriées ni lors des conférences ni lors des présentations. Les participants aux conférences contrevenant á ces règles pourront être sanctionnés ou expulsés des conférences sans remboursement, à la discrétion des organisateurs.

Le harcèlement inclut : les commentaires verbaux offensifs liés au genre, à l'orientation sexuelle, aux invalidités, à l'apparence physique, à la taille, à la race, à la religion, à la langue ou aux préférences mathématiques; l'affichage d'images sexuels dans les espaces publics; le harcèlement criminel, la traque, l'intimidation délibérée, les photographies ou enregistrements déplacés; des interruptions soutenues de présentations ou d'autres événements et des contacts physiques inappropriés ou une attention sexuelle importune. Les participants à qui l'on demandera d'arrêter tout comportement d'harcèlement devront se conformer aux demandes immédiatement.

Si un participant se livre à un comportement de harcèlement, les organisateurs des conférences pourront prendre toutes les mesures qu'ils jugeront appropriées, y compris émettre un avertissement ou retirer le délinquant du congrès sans remboursement. Si vous êtes harcelés, remarquez que quelqu'un est harcelé, ou avez connaissance de tout autre renseignement pertinent, nous vous serions gré de contacter un membre du personnel (organisateurs ou bénévoles) immédiatement. Ils peuvent être repérés grâces aux t-shirts colorés.

Les membres du personnel seront heureux dider les participants à contacter la sécurité du campus, ou le bureau de loi local, ou dider ceux qui subissent le harcèlement à se sentir en sécurité pour toute la durée du congrès. La sécurité du campus peut aussi fournir des escortes si nécessaire. Nous tenons à votre présence et à votre sécurité.

Pour toute question concernant la politique ou son application, n'hésitez pas à nous contacterà l'adresse de courriel électronique ci-dessous.

Comité d'organisation du CCÉM: cumc.2012@ubc.ca
Sécurité du Campus (Urgences): 250-807-8111
Sécurité du Campus : 250-807-9236
Hébergment sur le Campus: 250-807-8050
Police/Pompiers/Ambulance (Urgences): 911
GRC (Sans urgence): 250-726-3300
Taxi: 250-861-1111 or 250-212-1212
Ligne de crise de Kelowna: 1-888-353-2273
Sècurité du College Okanagan (Sans urgence): 250-317-2435

Schedule of Events

2.1 Basic Schedule / Horaire de base

Wednesday July 11, 2012 - Mercredi 11 juillet	
13:00	Check in / Enregistrement
15:30	Refreshments / Pause café
16:00	Opening Remarks / Discours d'ouverture
17:00	Keynote Speaker / Conférence plénière - *Tim Swartz*
18:30	Opening Banquet / Banquet d'ouverture

Thursday July 12, 2012 - Jeudi 12 juillet	
9:00	Student Talks / Conférences étudiantes
11:00	Coffee Break / Pause café
11:30	Keynote Speaker / Conférence plénière - *Heinz Bauschke*
12:30	Lunch / Dîner
14:00	Student Talks / Conférence étudiantes
15:00	Coffee Break / Pause café
15:30	Keynote Speaker / Conférence plénière - *Donovan Hare*
17:00	Wine Tour (Optional Activity) / Tournée vinicole (Activité facultative) (section 2.3)
20:00	Movie Night (Optional Activity) / Soirée cinéma (Activité facultative) (section 2.3)

Friday July 13, 2012 - Vendredi 13 juillet	
7:45	Buses to Okanagan College / Transport vers Okanagan College (see section 4.2)
8:50	Opening Remarks from Okanagan College / Discours d'ouverture du Okanagan College
9:00	Student Talks / Conférence étudiantes
11:00	Coffee Break / Pause café
11:30	Keynote Speaker / Conférence plénière - *Jennifer Hyndman*

12:30	Lunch / Dîner
14:00	Student Talks / Conférence étudiantes
16:00	Coffee Break / Pause café
16:30	Keynote Speaker / Conférence plénière - *Catherine Beauchemin*
17:30	CUMC 2013 Host Bids / Enchères pour accueillir le CCÉM 2013 (section 4.6)
18:30	Women in Math and Science Dinner (Optional Activity) / Souper pour les Femmes en Maths et Sciences (Activité facultative)(see section 2.3)
18:30	Scandia (Optional Activity)/(Activité facultative)(see section 2.3).

Saturday July 14, 2012 - Samedi 14 juillet	
9:00	Student Talks / Conférence étudiantes
11:00	Coffee Break / Pause café
11:30	Keynote Speaker / Conférence plénière - *Dominikus Noll*
12:30	Lunch / Dîner
14:00	Student Talks / Conférence étudiantes
15:00	Coffee Break / Pause café
15:30	Keynote Speaker / Conférence plénière - *Gerda de Vries*
17:30	Closing Banquet / Banquet final
19:45	Announcement of CUMC 2013 Host University / L'annonce de l'université d'accueil CCÉM 2013

Sunday July 15, 2012 - Dimanche 15 Juillet
Free day to tour Kelowna/ Journée libre pour visiter Kelowna

2.2 Comprehensive Schedule / Horaire de compléter

Wednesday July 11, 2012 - Mercredi 11 juillet		
Time - Heure	Description	Room - Local
13:00 - 15:30	Check in / Enregistrement	Fipke Foyer
15:30 - 16:00	Refreshments / Pause café	Fipke Foyer
16:00 - 16:20	Opening Remarks / Discours d'ouverture	Fip 204
16:20 - 17:00	**Carolyn Labun** - How to Make Your Conference Presentation Count	Fip 204
17:00 - 18:00	**Keynote Speaker / Conférence plénière : Tim Swartz** - Statistical Excursions in Sport	Fip 204
18:30 - 20:30	Opening Banquet / Banquet d'ouverture	The Commons (behind the UNC)

Thursday July 12, 2012 - Jeudi le 12 juillet		
Time - Heure	Description	Room - Local
9:00 - 10:00	Ruth, William - *Introduction to Estimation*	Fipke 124
	Simard, Nicolas - *Euclid's Elements and Pythagoras' Theorem*	Fipke 138
	Baker, Michael - *Special Functions and Orthoganal Polynomials*	Fipke 121
	Tawfik, Selim - *Parallel Parking with Lie Algebras*	Fipke 140
	Raymond-Beizile, Léo - *Causal inference and Bayesian propensity score adjustment methods*	Fipke 250
	Marceau, Jean-François - *Introduction to Additive Frieze Patterns*	Fipke 129
10:00 - 10:30	Hyde, Andrea - *An Individual Based Model for Bear Movement*	Fipke 124
	Poelstra, Andrew - *On the Existence of Double Arithmetic Progressions*	Fipke 138
	Beckett, Mathew - *Scaling Arguments on the Space of Connections*	Fipke 121
	Mehta, Arthur - *The Story of Srinivasa Ramanujan*	Fipke 140
	Godin, Jonathan - *Analysis Around Fractals*	Fipke 250
	Luther, Robert - *Combinatorial Designs and Block-Intersection Graphs*	Fipke 129

10:30 - 11:00	Banero, Graham - *Abelian and Additive Complexity: Analyzing Structure in Infinite Words*	Fipke 124
	Foster, Jodie - *Supplemental Learning: A New Way to Learn Mathematics!*	Fipke 138
	Richards, Larissa - *Pattern Subgroups of GLn(F)*	Fipke 121
	Ryan, Philip - *As Easy as A, B, C*	Fipke 140
	Deschênes, Andréa - *Connexions et Calcul Rigourex*	Fipke 250
	Recoskie, Jeremy - *Critical Issues in Statistical and Biological Interperetation*	Fipke 129
11:00 - 11:30	Coffee Break / Pause café	Fipke Foyer
11:30 - 12:30	**Keynote Speaker / Conférence plénière: Heinz Bauschke** - An invitation to projection methods	Fip 204
12:30 - 13:30	Lunch / Dîner	Fipke Foyer
14:00 - 15:00	Pynn-Coates, Nigel - *VC Dimension and Density: Connections between Computational Learning Theory and Model Theory*	Fipke 124
	Hsu, Chieh-Ting (Jimmy) - *The Convergence Criterias of the Bayesian Monte Carlo Simulation on the Quantification of the Number of Fluorophores in a Cell*	Fipke 138
	Charlesworth, Ian - *DFAs, Automatic Numbers, and Transcendence*	Fipke 121
	Tarzwell, Caleb - *Modelling Techniques of Genetic Information Flow: Past and Future*	Fipke 140
	Snarski, Michael - *Representations of Harmonic Donuts*	Fipke 250
	Asad, Reza - *Steiner Symmetrizations: Convergence and Rate of Convergence*	Fipke 129
15:00 - 15:30	Coffee Break / Pause café	Fipke Foyer
15:30 - 16:30	**Keynote Speaker / Conférence plénière: Donovan Hare** - To All the Graphs I've Loved Before	Fip 204
17 :00 - 20:30	Wine Tour (Optional Activity) / Tournée vinicole (Activité facultative) (section 2.3)	Meet at UBC-O bus loop
20 :00 - 22:00	Movie Night (Optional Activity) / Soirée cinéma (Activité facultative) (section 2.3)	UNC movie theatre

Friday July 13, 2012 - Vendredi 13 juillet		
Time - Heure	Description	Room - Local
8:50-9:00	Opening Remarks from Okanagan College / Discours d'ouverture du Okanagan College	Centre for Learning Atrium
9:00 - 10:00	Papst, Irena - *From Differential Equations to Diphtheria: The Mathematics of Infectious Disease Spread*	E202
	Candales, Manuel - *Cyclotomic Polynomials and Elementary Number Theory*	E207
	Charron, Philippe - *Temperley Lieb Algebras*	E103
	Pelletier, Laurent - *Probability and Measure*	E208
	Szatmari, Simon - *Lie Group Methods for Moving Mesh Algorithms*	E212
	Klusowski, Jason - *Flows, Branching Numbers, and Percolation on Trees*	E213
10:00 - 10:30	Parras, Crystal - *A Brief History of Women in Mathematics*	E202
	Reimer, Sarah - *Lost in Inversion: Conditioning of Spectral Collocation Methods*	E207
	Horan, Joseph - *Qualitative Analysis of Chemical Reaction Networks*	E103
	Wu, Steven - *A Winning Strategy*	E208
	Tavakoli, Arman - *Introducing Uniformly Distributed sequences*	E213
10:30 - 11:00	Leylan, Richard - *The Roots of Flow and Chromatic Polynomials*	E202
	Hunt, Spencer - *Derivative Free Optimization Techniques on a series of test functions*	E207
	Hunt, Sean - *Cooking Howard's Curry With The Agda Programming Language*	E103
	Maheux, Dominique - *Introduction aux Méthodes de Schwarz*	E208
	Dranovski, Anne - *Rate of Convergence of Random Polarizations*	E213
11:00 - 11:30	Coffee Break / Pause café	Centre for Learning Atrium

11:30 - 12:30	**Keynote Speaker / Conférence plénière: Jennifer Hyndman** - Finite Bases of Quasi-equations of Unary Algebras: How Few Rules Can We Get Away With?	Centre for Learning Atrium
12:30 - 14:00	Lunch / Dîner	Centre for Learning Atrium
14:00 - 14:30	Lévesque, Jean-Sébastien - *Brain, Dynamical Systems and Fun!*	E202
	Street, Colin - *Intuition and Probability*	E207
	Bouchard, Nicolas - *Calcul formel et programmation / Programming computer algebra*	E103
	Gerbelli-Gauthier, Mathilde - *Introduction to Modular Forms*	E208
	Zung, Jonathan - *How Topologically Inclined Thieves Split Their Spoils*	E212
	Tufts, Julia - *Domination Polynomials of Graphs and Their Roots*	E213
14:30 - 15:00	Jackett, Neal - *An Introduction to Topology*	E202
	Funk, Jacob - *Stabilization Time for a Type of Evolution on Binary Strings*	E207
	Gervais, Kevin - *Introduction à l'Homologie Singuliére*	E103
	Klassen, Jamie - *Representations and Duality with a View Towards Number Theory*	E208
	Petrie, Tara - *Math and Art: the Math Behind the Beauty*	E212
	Josh Holt, Richard Hudson, Bryan Zintel - *Exponential Model of the Eiffel Tower*	E213
15:00 - 15:30	Culos, Garrett - *Predicting the Spatial Distribution of an Orchard Insect Pest*	E202
	Beg, Nikolina - *Principal Component Analysis and its Application to High Dimensional Data Sets*	E207
	Kabir, Ifaz - *A Simple proof of the Jordan Curve Theorem*	E103
	Sequeira, Nigel - *Continuous Model Theory and Von Neumann Algebras*	E208
	Provost, Alex - *A Topological Proof of the Infinitude of Primes*	E212
	Al-Shaghay, Abdullah - *An Irreducibility Criterion of A. Cohn*	E213

15:30 - 16:00	Bidart, Rene - *What is Understanding?*	E202
	Crosbie, Kimberly - *Finite State Automata and an Intrusion Detection System*	E207
	Mack, Richard - *Fundamental Theorem of Calculus for Lebesgue Integration*	E103
	Mather, Kevin - *Dirichlet Series and Arithmetic Functions*	E208
	Mandryk, Isaiah - *Structure of Neural Networks*	E212
16:00 - 16:30	Coffee Break / Pause café	Centre for Learning Atrium
16:30 - 17:30	**Keynote Speaker / Conférence plénière: Catherine Beauchemin** - Virologie in Silico: Cultiver des Infections en Ordinateur (In Silico Virology: Growing Infections in a Computer)	Centre for Learning Atrium
17 :30 - 18:30	CUMC 2013 Host Bids / Enchères pour accueillir le CCÉM 2013 (section 4.6)	Centre for Learning Atrium
18:30 - 20:30	Women in Math and Science Dinner (Optional Activity) / Souper pour les Femmes en Maths et Sciences (Activité facultative)(see section 2.3) or Scandia (Optional Activity)/(Activité facultative)(see section 2.3)	

Saturday July 14, 2012 - Samedi 14 juillet		
Time - Heure	Description	Room - Local
9:00 - 10:00	Tyson, Rebecca - *Opportunities in Mathematical Biology for Grad Studies*	Fipke 124
	Peterson, David - *Investigating Orthogonal Latin Squares Using Universal Algebra*	Fipke 138
	Dosseva, Annamaria - *Galois Theory and the Insolvability of the Quintic*	Fipke 121
	Butson, Dylan - *Introduction to Stochastic Calculus*	Fipke 140
	Arbour, Jean-François - *An Overview of Some Elements of Spectral Geometry.*	Fipke 250
	Park, Hongyoul (Mike) - *Diophantine Approximations*	Fipke 129
	Wiebe, Toban - *Game Theory and Evolution*	Fipke 133

10:00 - 10:30	Yeremi, Miayan - *Statistical refinement of astrophysical numerical simulations*	Fipke 124
	Kovesi, Michelle - *An Introduction to Machine Learning for Text Classification*	Fipke 138
	Weng, Gwen Yun - *The Shortest Introduction to Semidefinite Programming*	Fipke 121
	Martieau, Joanie - *Weyls Theorem*	Fipke 140
	Reid, Samuel - *Simplicial k-Combinatorial and Packings: Touching $(k+1)$-tuples of Congruent Balls in 3-space*	Fipke 129
10:30 - 11:00	Davis, Chad - *Exploiting Known Structures to Approximate Normal Cones*	Fipke 124
	Lyon, Keenan - *Using Symmetry Groups to Solve Partial Differential Equations*	Fipke 138
	Dhawan, Andrew - *The Tumor Control Probability and Cancer Stem Cells*	Fipke 121
	Allan, Kara - *A Model of the Spread of MRSA in a Hospital*	Fipke 140
	Sokolowsky, Benjmain - *Achieving all Radio Numbers*	Fipke 129
11:00 - 11:30	Coffee Break / Pause café	Fipke Foyer
11:30 - 12:30	**Keynote Speaker / Conférence plénière: Dominikus Noll** - On Active and Passive Control	Fip 204
12:30 - 14:00	Lunch / Dîner	Fipke Foyer
14:00 - 15:00	Lagacé, Jean - *Proof of Brouwer Fixed Point Theorm, using Sperner's Lemma*	Fipke 124
	Da Silva, Patrick - *Factorial Function : Theorems and Generalization*	Fipke 138
	Chen, Li - *A Taste of Homopy Groups and Classification of Principal Bundels Over S^n*	Fipke 121
	Haris, Asad - *Introduction to Markov Chain Monte Carlo and their Applications to ODE Models*	Fipke 140
	Huntemann, Svenja - *On MDS Codes, the Main Conjecture, and the Partition Weight Enumerator*	Fipke 250
	Wanless, Michael - *Knapsack-Based Cryptography*	Fipke 129
15:00 - 15:30	Coffee Break / Pause café	Fipke Foyer

15:30 - 16:30	**Keynote Speaker / Conférence plénière: Gerda de Vries** - The Language of Life: When Mathematics Speaks to Biology	Fip 204
17:30	Closing Banquet Opens / Banquet final	Ramada Hotel
18:30-18:45	Closing Remarks / Discours final	Ramada Hotel
18:45-19:45	Dinner / Souper	Ramada Hotel
19:45-20:00	Announcement of CUMC 2013 Host University / L'annonce de l'université d'accueil - Dessert	Ramada Hotel
20:00-1:00	DANCE DANCE!	Ramada Hotel

Sunday July 15, 2012 - Dimanche 15 juillet		
Time - Heure $\forall$ t	Description $\exists x$	Room - Local $x \in Kelowna$

2.3 Activities / Activités

Thursday, July 12 - Jeudi le 12 juillet

Ex Nihilo Winery Tour - Tour de cave à vin Ex Nihilo

For those of you who have registered for the Ex Nihilo Winery Tour, your bus will be departing from the UBC Okanagan bus loop at 5pm. Ex Nihilo will be giving us a private tour of their wine making facilities, art gallery, and tasting room. This is a pre-registered event and we will not be taking registration for the event during the conference.

Pour ceux d'entre vous qui se sont inscrits au tour de cave à vin Ex Nihilo, l'autobus partira de du terminus d'autobus de l'Université de Colombie-Britannique Okanagan à 17h. La compagnie Ex Nihilo nous fera faire un tour privé de ses installations de fabrication du vin, de sa galerie d'art et de sa salle de dégustation. Pour participer à cet événement, vous devez déjà être inscrit. Les inscriptions se seront pas possibles durant le congrés.

Movie Night - Soirée de films

For those of you who aren't feeling adventurous today, we have booked the UBC Students' Union Theatre for you to come, relax, and eat some popcorn (yes there will be popcorn!). The theatre is located in the University Centre (UNC) building. The show starts at 8pm. We will be showing "A Dangerous Method".

Pour ceux qui n'ont pas trop le goût d'aventure aujourd'hui, nous avons réservé le UBC Students' Union Theatre pour que vous puissiez relaxer en mangeant du pop-corn (oui, il y aura du pop-corn!). Ce cinéma se situe au University Centre (UNC). La projection débutera à 20h et le anglais film présenté sera "A Dangerous Method".

Friday, July 13 - Vendredi le 13 juillet

Women in Math and Science (WIMS) Dinner - Souper pour les Femmes en Maths et Sciences

The CUMC 2012 is pleased to continue the tradition of offering a Women in Math and Science (WIMS) Dinner. The theme of this year dinner is "Breaking Down Barriers: Challenges Facing Female Mathematicians." The evening will begin with a round table discussion, held in the Centre for Dialogue in the newly renovated Library at Okanagan College, where panelists from both industry and academia will have the chance to share their experiences and discuss a range of topics.

Participants will have ample opportunity to join the conversation with their own questions as well. Afterwards, dinner with be served outside in the Courtyard in the beautiful Kelowna sunshine. During dinner, the participants and panelists will be encouraged to mingle and to continue their conversations.

This year's organizing committee has decided to make the dinner for women and woman-identified participants only. We thank you in advance for respecting our plans.

Le CCÉM de 2012 est heureux de poursuivre la tradition d'offrir le souper Femmes en Maths et en Sciences. Cette année, le thème du souper est "Briser les barrières : Les Défis Rencontrés par les Femmes Mathématiciennes." La soirée commencera par une discussion au "Centre for Dialogue" dans la partie renovée de la bibliothèque de l'Okanagan College. Les panlistes de l'industrie et de l'académie auront alors la chance de partager leurs expériences et d'aborder plusieurs sujets. Les participantes sont invitées à participer à la discussion en posant leurs propres questions. Ensuite, le souper sera servi dans la Cour sous le superbe soleil couchant de Kelowna. Pendant le souper, les participantes et panélistes seront encourages à se mélanger et poursuivre leurs conversations.

Le comité organisateur de cette année a décidé de mettre en place ce souper pour les participantes seulement. Nous vous remercions à lvance de respecter nos plans.

Scandia

After our day at Okanagan College the 2012 organizing committee has arranged a fun evening at our local mini-golf and games centre, Scandia (www.scandiagolfandgames.com). There are retro-style arcade games, bumper cars, batting cages, and loads of mini-golf fun! Mini-golf starts around $10/game and arcade games at 1 token/game. Buses will be leaving Okanagan College at 6:30pm and 7:10pm to head to Scandia (enroute to UBC Okanagan) for an evening of fun. To get back to the university take the #97 - UBC Okanagan Express from the bus stop across the highway.

Après la journée prévue à l'Okanagan College, le comité organisateur 2012 a prévu une soirée pour se relaxer au centre de jeux et de mini-golf local, Scandia (www.scandiagolfandgames.com). On y retrouve des jeux d'arcade de style rétro, des autos-tamponneuses, des cages de baseball et du mini-golf à volonté! Le prix du mini-golf commence à environ 10$ par partie et les jeux d'arcade coûtent un minimum d'un jeton par partie. Des autobus partiront de l'Okanagan College à 18h30 et à 19h10 pour rejoindre Scandia, qui se trouve sur le chemin vers l'Université de Colombie-Britannique Okanagan, pour une soirée de plaisir. Pour retourner à lniversité, il suffit de prendre l'autobus #97 - UBC's Okanagan Express à partir de lrrêt d'autobus de lutre côté de l'autoroute.

Abstracts / Résumés

3.1 Keynote Abstracts / Résumés plénière

Statistical Excursions in Sport

Dr. Tim Swartz

This talk explores some work that I have done and some topics that you may find interesting with respect to statistics in sport. Time permitting, some of the questions that I may cover include:

When should you pull your goalie in hockey?

Was the draft in the Indian Premier League (cricket) sensible?

Do competitive Highland dancers perform in a fair order?

Is there an age effect in minor hockey?

When should you gamble in sports?

An Invitation to Projection Methods

Dr. Heinz H. Bauschke

Feasibility problems, i.e., finding a solution satisfying certain constraints, are common in mathematics and the natural sciences. If the constraints have simple projectors (nearest point mappings), then one approach is to use these projectors in some algorithmic fashion to approximate a solution.

In this talk, I will survey three methods (alternating projections, Dykstra, and Douglas- Rachford), and comment on recent advances and remaining challenges.

To All the Graphs I've Loved Before

Dr. Donovan Hare

What inspires me? Love inspires me. And me loves the graphs.

I will show you some graphs I especially love and the problems they come from. Be warned: I'm not talking about graphing functions. No, I'm talking about the structure of love - relationships - and what can be dished about them.

Sound crazy? It is. But then so is love.

Finite Bases of Quasi-equations of Unary Algebras: How Few Rules Can We Get Away With

Dr. Jennifer Hyndman

The associative, distributive, commutative, negation and identity laws (equations) for the integers are fundamental to our understanding of the integers. From childhood we "know" that everything follows from these laws. When we move to another algebraic structure a natural question is to ask what are the equations that hold and from which equations does everything else follow?

When we allow for implications as well as equality we are considering expressions called quasi-equations. Sometimes when working with small algebraic structures with, say, 4 or 5 elements, our natural instinct that a few quasi-equations are sufficient to imply all quasi-equations is true. In other instances we require initely many quasi-equations to generate all quasi-equations. In this talk we see the variety of results that can arise in the seemingly simple situation of quasi-equations of small algebraic structures with only unary operations.

Virologie in silico: cultiver des infections en ordinateur (In silico virology: growing infections in a computer)

Dr. Catherine A.A. Beauchemin

French talk with English slides

L'expérimentation in vitro ou in vivo a longtemps éeté la seule et unique fa con d'étudier les infections virales. Cette méthode d'apprentissage est essentiellement fondée sur des postulats rarement contestés, du fait qu'il est diffcile detudier séparément une des composantes de ces systémes complexes sans en affecter une autre. Heureusement, les modéles mathématiques et informatiques

nous permettent de déconstruire le système expérimental a d'identir ses composantes principales et de déterminer de quelle facon elles doivent être recombinées a de recréer la dynamique observée en laboratoire.

Dans cet exposé, je présenterai des exemples de modèles mathématiques qui remettent en question la validité de certaines expériences d'infections in vitro et des exemples d'expériences in vitro qui nous forcent à revoir nos expressions mathématiques préférées.

Experimentation in vitro and in vivo has traditionally been the only way to study viral infections. This approach for deriving knowledge often relies on "common-sense" assumptions that go unchallenged due to the difficulties involved in controlling components of these complex systems without affecting others. Mathematical and computer models, however, make it possible to deconstruct an experimental system into individual components and determine how the pieces come together to recreate the observed behaviour.

In this talk, I will give examples of math models that challenge the validity of certain in vitro infection experiments, and of experiments that force us to consider more difficult math.

On Active and Passive Control

Dr. Dominikus Noll

We will discuss passive control, also known as optimal control, and active control, also referred to as feedback control. We ask when these techniques are applied, what they have in common, in which sense they are complementary, and we discuss the mathematical techniques used to characterize and compute these control laws.

The Language of Life: When Mathematics Speaks to Biology

Dr. Gerda de Vries

Mathematics often is described as the language of science, particularly suited to speak to problems in physics, chemistry, engineering, and so on. Is mathematics also the language of life, suited to speak to problems in biology? Indeed, mathematics has a long and rich history in biology, and the reality is that today biology depends increasingly on data, algorithms, and models; mathematics plays an extremely important role in biology. In this talk, I will highlight some particularly noteworthy historical contributions of mathematics in biology, dating back to the late 1600, make connections to contemporary research in mathematical biology, and discuss how this research impacts our lives.

3.2 Student Abstracts / Résumés des étudiants

The student talks are arranged in alphabetical order by the speaker's last name. The presentation will be in the language of the abstract, except if a note says otherwise.

Les présentations étudiantes sont classées en ordre alphabétique selon le nom de famille de l'orateur. Elles seront présentées dans la même langue que le résumé, sauf si une note indique le contraire.

An Irreducibility Criterion of A. Cohn

Abdullah Al-Shaghay

This talk explores an interesting irreducibility criterion, which is attributed to Arthur Cohn, for a particular subset of polynomials belonging to the ring $\mathbb{Z}[x]$. I hope to discuss the significance of the theorem, examples of applying the theorem, and a conjecture which is closely related to the theorem.

A Model Of The Spread of MRSA In A Hospital

Kara Allan

MRSA is a serious problem in most hospitals throughout the world. It is spread primarily by health care workers. This talk focuses on the model that I have been building since last summer to represent the spread of this disease. I use a stochastic SIS model with the population divided into patients and healthcare workers. The patients are further divided by rooms. I assume that there is no contact between patients, so that the healthcare worker is acting as the vector for transmission between patients. I will be studying the distribution of the time to extinction to understand the effects of intervention by healthcare workers.

An overview of the some elements of spectral geometry

Jean-François Arbour

There are a lot of approaches to study a geometric object. Probably the most important idea for this has been the introduction of coordinates to view our geometric object as the solution of an equation of some sort, linking the geometry with algebra or calculus. In this talk, I will describe another approach: that of spectral geometry. Say you want to tell two random geometric objects apart. Well, a spectral geometer may be inclined to throw rocks at them and decide they are not the same if they don't make the same noise! Another spectral geometer may put them on fire, put

one hand on each objects, and decide they are not the same if he burns his left hand first! Put it briefly, I will describe to you some of the finest technological tools we have to do geometry.

Required background: First year undergraduate mathematics.

Steiner Symmetriations: Convergence and Rate of Convergence

Reza Asad

Steiner symmetrization was invented in the 19 century as a tool for proving the isoperimetric inequality. The isoperimetric problem in the plane says that among all closed and simple curves of fixed length, the circle and only the circle encloses the most area. In the 1970, rearrangements like Steiner symmetrization gained new interest, because they proved to be useful for less obvious minimization problems in functional analysis.

Steiner Symmetrization manipulates the shape of a body (or a function) without changing its size (norm). It is a classical fact that given an arbitrary convex body, there exists an appropriate sequence of Steiner symmetrizations that transforms it to a Euclidean ball. How well is full radial symmetrization approximated by sequences of such rearrangements? How fast do these sequences converge? These questions are subtle, because Steiner symmetrizations are neither linear, nor spatially localized and typically do not commute.

In this talk, I will discuss works of a former U of T Master student Marc Fortier regarding Steiner symmetrizations applied to continuous functions with compact support. I will also state an open problem regarding the rate of convergence of such sequences of Steiner symmetrizations. Lastly, I will introduce ideas on how to approach the open problem.

Required Background: Basic Analysis and Algebra

Special Functions and Orthoganal Polynomials

Micheal Baker

I will give a lucid exposition of the theory of special functions and orthogonal polynomials (spherical harmonics, in particular, will be emphasized). The talk will be historically motivated by classical problems from mathematical physics. Some modest complex analysis will inevitably be a prerequisite.

Abelian and Additive Complexity: Analyzing Structure in Infinite Words

Graham Banero

Motivated by the problem of avoidability of abelian and additive squares, notions of the abelian and additive complexity of an infinite word w over a finite alphabet have been introduced as follows. The *abelian complexity* $\rho^{ab}(w, n)$ counts the maximum number of factors of w having length n, such that no two are permutations of each other; the *additive complexity* $\rho^{\Sigma}(w, n)$ counts the number of distinct sums of factors of w with length n. We give an overview of some main results on these relatively new concepts, paying attention in particular to the rich similarities and surprising differences between the two.

Scaling Arguments on the Space of Connections

Matthew Beckett

The intent of this talk is to introduce Derrick scaling arguments. I will begin by giving give a (very) brief introduction to connections and deing the curvature form so that we are able to introduce the Yang-Mills action.We will work with the speci example of the Yang-Mills action, deed on the space of connections, to show how by rescaling the base space and then observing how this effects the action we can learn interesting information about critical points. Some prior knowledge of differential forms will be helpful, but not necessary.

Principal Component Analysis and its Application to High Dimensional data Sets

Nikolina Beg

Data sets are getting bigger and bigger, with more and more variables. What can you do when your data set is so large you can analyze it efficiently? Principal Component Analysis (PCA) is a well known multivariate technique that can lead to effective dimension reduction, allowing statisticians to analyze their data set efficiently without losing information from the data. The concepts behind Principal Component Analysis will be introduced and its mathematical background explored, as well as how visualization techniques can be used to generate a better understanding of results. Then, the problem of dimension reduction on high dimensional data sets, specifically where $p \gg N$, will be explored. Variations of PCA, such as Supervised Principal Components, will be investigated

in order to understand how a sub-sampling approach to a large problem can produce usable results and information.

What is Understanding?

Rene Bidart

What does it mean when someone says they understand something? Is it the same for everyone or do people understand in different ways? why do some people excel when presented with rigorous proofs, which others simply could not grasp? this presentation will discuss the way in which people learn or understand "abstract" math, such as group theory, and more elementary topics in mathematics, such as basic arithmetic. It will consider the concept that understanding is visualization, along with the other possible ideas of what learning is.

Calcul formel et programmation / Programming Computer Algebra

Nicolas Bouchard

Aujourd'hui, personne ne peut se passer d'ordinateurs, pas même les mathématiciens. Les logiciels, tels que Mathematica ou Maple, sont de plus en plus sophistiqués et permettent de faire des choses inouïes. Ils permettent de dériver des expressions complexes, ils peuvent jongler avec des groupes et même calculer des séries de Taylor. Mais comment? Ce n'est pas de la magie, c'est de la programmation!

Nowadays, everybody uses a computer, even mathematicians. Softwares like Mathematica and Maple are getting more and more sophisticated and can do things quite unexpected. For instance, they can differentiate most expressions of any degree of complexity, they can use group theory, and even compute Taylor expansion. How? It is not magical, it is programming!

Introduction to Stochastic Calculus

Dylan Butson

In the deterministic setting of real analysis one may dee the Riemann Stieltjes integral, which integrates one function with respect to another. In analogy with this, one can dee the integral of one stochastic process with respect to another, which is itself a new random process. Such integrals can be used to give meaning to stochastic di?erential equations and in many ways these ob jects

behave similarly to their deterministic counterparts. I introduce these concepts and motivate the key basic results of the sub ject. Topics include: Necessary background in the theory of stochastic processes; the Riemann-Stieltjes integral; the Ito integral; properties of the integral process; the Ito formula; examples throughout.

Required Background: Only a knowledge of basic probability is assumed, but background in real analysis and stochastic processes will be useful.

Cyclotomic Polynomials and Elementary Number Theory

Manuel Candales

The n-th cyclotomic polynomial $\Phi_n(x)$, (n a positive integer) is the monic polynomial $\Phi_n(x) = \prod(x-\zeta)$ where ζ runs over all the n-th primitive roots of unity. It is an integer polynomial, and it is irreducible in $\mathbb{Z}[x]$. The polynomial x^n-1 factors in $\mathbb{Z}[x]$ in the following way: $x^n-1 = \prod_{d|n} \Phi_d(x)$.

Historically, the cyclotomic polynomials (and cyclotomic number fields) have played a very important role in mathematics, because of their connection to fundamental problems, such as the constructibility of regular polygons and Fermat's Last Theorem.

In this talk we will discuss the applications of cyclotomic polynomials to solve problems in elementary number theory. We will introduce them and present some of their elementary properties. We will then use them to give elementary proofs of problems such as the infinitude of primes congruent to 1 modulo n (which is a special case of Dirichlet's theorem on arithmetic progressions).

Required Background: If you have some familiarity with elementary number theory and understood the first paragraph, then you are in good shape.

DFAs, Automatic Numbers, and Transcendence

Ian Charlesworth

A common object within the theory of computing is the *Deterministic Finite Automaton* (DFA); roughly and informally, a DFA is like a computer with a finite (and often small) amount of memory available. These give rise to the definition of an *automatic sequence* as one which can be generated by a DFA, and an *automatic real number in base-b* as one whose base-b expansion is automatic. After introducing these concepts more rigorously, we will demonstrate a recent result of Boris Adamczewski and Yann Bugeaud from 2007: that any automatic number is either rational or transcendental.

Required background: Prior exposure to automatic numbers or sequences is not expected; experience with DFAs will add to the talk, but the talk should still be accessible without it and they will be covered briefly at the start of the talk.

Temperley Lieb Algebras

Philippe Charron

What happens when you take a vector space and embed it with some kind of vector multiplication? You get an algebra, which is a well-studied algebraeic object (no pun intended). I will introduce the Temperley-Lieb algebras, a family of algebras that were introduced to modelize certain phase transitions and ice phenomenons in physics. Also, despite being ugly looking they admit a very natural visual presentation, which I will investigate in greater detail.

A Taste of Homopy Groups and Classifications of Principal Bundels over S^n

Li Chen

It seems so that mathematicians pursued after their agenda of pure abstractions while the physicists had less interest in the mathematical generalizations. The great divorce of mathematics and physics might have just occurred after their first rendez-vous in ancient Babylon. But when Einstein made his theory of general relativity, it seems that physics and mathematics came together once more as laws of nature are written by strokes of differential geometry. More than that, but the story that we are going to tell is one that is even more profound. It is what physicists call gauge fields. In this short talk, however, we will only venture to speak of the two basic concepts: homotopy groups and principal bundles. In particular, we will classify principal bundles over S^n. If time permits, we will introduce connections on principal bundle, Yang-Mill functional, and matter fields.

Finite State Automata and an Intrusion Detection System

Kimberly Crosbie

An Intrusion Detection System (IDS) is used to help protect computer networks from attacks and intrusions. One specific type of IDS is called signature-based network IDS. This kind of IDS monitors network traffic in search of malicious activity as specified in attack descriptions (referred to

as signatures). It has been discovered that several of these signatures can be triggered by the same set of packets, a situation which has been referred to as overlapping signatures. It has been shown that attacks on networks can occur by exploiting overlapping signatures. After a brief introduction to basic finite state automata theory, this talk will look at overlapping signatures in a commonly used IDS called Snort. By using set theory and finite state automata theory we will see how it is possible to quantify this overlapping signature problem.

Predicting the Spatial Distribution of an Orchard Insect Pest

Garrett Culos

Codling moth is a pest which has plagued agriculturalists for the better part of the last century. Attempts in controlling this pest were successful until early 2000's when of some mysterious reason the wild population began to increase. In an attempt to better understand this invasive pest a model was used to predict the percent of codling moths at arbitrary distance from there release point. This model is a deterministic diffusion-based partial differential equation which allows switching between two different movement modes. We used the experimental data to validate this model. Using the negative log-likelihood function and a recursive cubical division of parameter space to fit the data we obtained some extraordinary insight into the codling moth behaviour.

Factorial Function : Theorems and Generalization

Patrick Da Silva

As it stands today, mathematicians in general know very few things of the factorial function outsidethe fact that it appears in the denominator of the terms in the Taylor expansion of an analytic function, the binomial coefficients and counting interpretations. In his paper, Manjul Bhargava wrote a paper which is generalizing the factorial function and exploring not-so-well-known theorems involving the factorial function. We will see that his generalization of the factorial function is quite natural from a number-theoretic point of view, and many questions arise from his paper. I will try to explain the theorems and the reasons behind the deitions of Manjul Bhargava. His paper can be found online by typing "ManjulBhargava Factorial" on Google.

Exploiting Known Structures to Approximated Normal Cones

Chad Davis

The normal cone to a constraint set plays a key role in optimization theory. We consider the question of how to approximate the normal cone to a set under the assumption that the set is provided through an oracle function or collection of oracle functions, but contains some exploitable structure. We provide a new simplex gradient based approximation technique that works for sets of the form

$$S = \{x \big| g_i(x) \leq 0, i = 1, \ldots, N\}$$

where each $g_i : R^n \to R$ is unknown and provided by an oracle. We further present novel results showing that, under a non-degeneracy condition, approximating normal cones to intersections of sets is possible by taking sums of approximations. Finally, we provide numerical results that exemplify the accuracy of the simplex gradient approximation when it is applicable, and the failure of this technique when a linear independence constraint qualification is not met.

Connexions et calcul rigourex

Andréa Deschênes

Le calcul des solutions d'équations différentielles représente souvent un défi pour les scientifiques. En effet, les méthodes permettant de trouver ces solutions analytiquement s'appliquent rarement. Mais que faire lorsque la théorie ne nous permet pas d'aller plus loin? On doit alors mélanger les mathématiques numériques à l'analyse! Dans cet exposé, nous montrerons comment utiliser le calcul rigoureux pour trouver une connexion, un type particulier de solution d'une équation différentielle ordinaire. Pour ce faire, nous introduirons la notion de connexions homoclines et hétéroclines. Puis, les grandes étapes d'une méthode de calcul rigoureux seront présentées. Cette méthode permet de prouver, grâce à l'ordinateur et à l'analyse, l'existence d'une vraie connexion dans un voisinage autour de celle trouvée de manière numérique. Posséder quelques connaissances de base sur les équations différentielles représentera un atout pour comprendre cette présentation.

The Tumor Control Probability and Cancer Stem Cells

Andrew Dhawan

This talk will provide an introduction to the mathematics underlying the tumor control probability (TCP), as well as the relevant cancer biology, as they are used within the planning and modeling of radiotherapeutic treatments for cancer. The TCP is a formalism derived to compare

various treatment regimens of radiation therapy, and gives the probability that a prescribed dose of radiation eradicates, or controls, a tumor. The focus of this talk will be the development of a novel TCP model to account for the presence of cancer stem cells - a critically important subpopulation of cells found within the tumor mass. Such cancer stem cells are thought to drive the proliferation of the tumor, as they possess an unlimited replicative potential. Moreover, by analyzing tumor control through the control of stem cells, this talk will cover how this formulation of the TCP can be used in practice as a measurable quantity, as opposed to a theoretical one, via the results of immunohistochemical assays.

Galois Theory and the Insolvability of the Quintic

Annamaria Dosseva

Methods for solving some quadratic equations were known since Babylonian times, around 300 B.C., though the quadratic formula as we know it today was not discovered until around the ninth century, by the Persian mathematician al-Khowârizmî. The solution is outlined in his *Algebra* using the Greek method of geometry – our modern complete the square method. Over the next several hundred years, other mathematicians searched for a cubic formula that could be used to solve cubic equations, similar to the quadratic formula for quadratic equations. The solutions to the cubic and quartic were found during the 1500s through a combined effort of mathematicians at the Italian Mathematical School at Bologna.

For nearly 300 years after that, algebraists searched for a general equation of the fifth degree. Paolo Ruffini (1765-1822) first proved that there is no general solution; Niels Henrik Abel (1802-1829) proved it as well, using a more rigorous argument than Ruffini's; finally, Évariste Galois (1811-1832) showed the precise conditions for when a quintic – and, in general, for when an algebraic equation of any degree – could be expressed as a finite number of additions, subtractions, multiplications, divisions, and a finite extraction of roots.

Before discussing the problem, we will briefly review some of the language and theory of Abstract Algebra, namely the theories of Groups, Rings, Fields, Vector Spaces, and some Galois Theory. However, "Galois Theory is like garlic in that there is no such thing as a little of it. One must make a substantial study of it to appreciate the reasoning" (Carl B. Boyer).

Required Background: A previous exposure to Groups, Rings, Fields and Vector Spaces will be useful, although not necessary as they will be covered briefly.

Rate of Convergence of Random Polarizations

Anne Dranovski

His talk will give a description of simple rearrangements known as polarizations, or two-point symmetrizations, and an outline of a convergence problem which is the topic of a summer research project.

Required Background: basic analysis and probability.

Supplemental Learning: A New Way to Learn Mathematics!

Jodie Foster

Supplemental Learning (SL) is a peer lead program that targets historically difficult courses in order to help students improve their understanding of course material. In particular, it allows students to get together to discuss important concepts and develop strategies for studying the subject. Supplemental Learning Leaders are exceptional students who have taken the course previously and are prepared to share what they have learned over the years when studying that particular topic. SL applies techniques such as: turning questions, student teaching, and the Boardwork Model. SL is not limited to only mathematics, but also in an assortment of subjects such as applied science, art history, biology, chemistry, geography, human kinetics, physics and psychology. Who are we if not professional learners? It is up to us to lend ourselves and our undergraduate experiences to those just beginning to immerse themselves into the world of mathematics.

Stabilization Time for a Type of Evolution on Binary Strings

Jacob Funk

We consider a type of evolution on $\{0,1\}^n$ inspired by an elementary question about a line of soldiers, each of whom are attempting to find the right direction to face. Mathematically, we consider a string consisting of n binary bits, and engage in a process of simultaneously replacing every instance of "01" in this string with "10". By doing so, new instances of "01" are created (for instance "0101" $\mapsto$ "1010", with a new instance of "01" appearing in the middle). Thus the same operation as above can be performed on the new string that was obtained, and so on. It is elementary to show that this process of recursively creating new strings stabilizes after at most $n-1$ iterations, with the final string being of the form $11\cdots1100\cdots00$. The time of stabilization for a random string in $\{0,1\}^n$ is thus a random variable with values in $\{0,1,\ldots,n-1\}$. My talk will

present results describing the asymptotic behaviour of this random variable for $n \to \infty$. The tools used in the arguments are a natural interpretation of strings in $\{0,1\}^n$ as Young diagrams, and a connection with the known distribution for the maximal height of a Brownian path on $[0,1]$. This is a joint project with Mihai Nica and Michael Noyes, and is part of my current NSERC USRA term in the Pure Mathematics Department at Waterloo.

Introduction to Modular Forms

Mathilde Gerbelli-Gauthier

The aim of this talk will be to give an intuitive introduction to a class of highly symmetric complex functions: Modular Forms. In order to do this, we will study the group of automorphisms of the complex upper half-plane and its discrete subgroups. This will allow us to dee modular forms, to derive some of their properties, and to get a glimpse of their relation to number theory. Drawings included!

Required background: complex numbers, familiarity with groups.

Introduction à l'Homologie Singuliére

Kevin Gervais

En topologie, il peut être très difficile de déterminer si deux espaces donnés sont différents l'un de l'autre. Une technique très efficace qui nous permet de diffé rencier les espaces topologiques consiste à associer aux espaces une structure algébrique. Les groupes d'homologie en sont un bel exemple. Non seulement permettent-ils de différencier (à homotopie près) les espaces topologiques, ils permettent ègalement d'offrir des preuves très élégantes pour de nombreux théorèmes, tels que : le théorème du point e de Brouwer, le théorème de Jordan et l'invariance de la dimension. Je propose donc de vous introduire aux groupes d'homologie et de présenter certaines de leurs propriétés.

Analysis around Fractals

Jonathan Godin - *Engish talk with French slides*

How can we create a fractal? This presentation will introduce some useful analysis tools such as metric spaces, Hausdorff distance, and iterated function system (IFS) so that we can create some interesting sets in $\mathbb{R}^2$. Basic real analysis knowledge such as convergence of a sequence and continuity are necessary for a better understanding of the concepts.

Introduction to Markov Chain Monte Carlo and their application to ODE models

Asad Haris

Markov Chain Monte Carlo (MCMC) methods have long been used to simulate samples from a given target distribution. In the past few decades numerous MCMC algorithms have been developed and improvements have been made to the existing algorithms. This talk will begin with a short introduction to Bayesian statistics, the theory of Markov Chains and a brief description of certain basic MCMC algorithms. In Bayesian Statistics, on many occasions, we obtain only partial knowledge about the distribution of a random variable. The first part of the talk will focus on such circumstances and hence lead to the discussion on the motivation of sampling techniques and MCMC methods.

In the second part of the talk I will demonstrate the use of Bayesian computational tools to estimate parameters in an Ordinary Differential Equation (ODE) Model. ODE models can are used in many sciences to model numerous systems and in many cases have many parameters associated with the model. Due to multiple parameters, the usual sampling techniques prove to be inefficient and hence advanced MCMC methods are used. This talk will review and compare some of the recent advancements to MCMC algorithms. The model under consideration will be the Fitz-Hugh Nagumo Model which aptly demonstrates the usual computational problems associated with such problems of parameter estimation.

Finally, I will discuss my current research and possible ideas for future research. This talk will assume only a basic knowledge of probability and is open to all interested in applied computational statistics.

Exponential Model of the Eiffel Tower

Josh Holt, Richard Hudson, Bryan Zintel

Equations modeling the shape of the Eiffel Tower are investigated. We have developed an exponential model based on the equilibrium of moments and embodied wind load on the tower. The result yields an exponential profile of the tower. We analyze the actual Eiffel Tower Profile to show that this profile may be closely approximated by two piecewise exponential curves with different growth rates.

Qualitative Analysis of Chemical Reaction Networks

Joseph Horan

We are often interested in investigating non-linear dynamical systems, which are nigh impossible to solve explicitly for the most part; however, there exist numerous methods of qualitative analysis we can use to determine if there are equilibrium points or periodic orbits, on which subspaces do solutions reside, and how stable limit points/sets are, amongst other things. One particular class of non-linear systems which is interesting is that of chemical reaction networks; this is the subject of my summer research. Here, I briefly review the notation for such systems, and in a survey style, present a pseudo-graph-theoretic approach developed by Vol'pert, as well as the row/column diagonal dominance Lyapunov method developed by many, all illustrated by the same simple example, that of the enzyme model. A method for finding conservation relations, by Schuster and Höfer, is also discussed. I posit questions for the future, due to the open nature of the field.

The convergence criterias of the bayesian Monte Carlo Simulation on the quantification of the number of fluorophores in a cell

Chieh-Ting(Jimmy) Hsu

Photobleaching of fluorophores in a cell e.g. Green Fluorescent Protein(GFP) is a stochastic process, which is similar to radioactive decay. Though it leads to an exponential decay on average, the fluctuations away from the average exponential decay are not white noise, so traditional least-squares fits of the decay are not appropriate. Since the fluctuations are due to the photobleach events, we can use them to quantify the number of fluorophores in a cell. To extract the fluctuations we need the average decay, however real photobleach data of bacteria expressing GFP shows stochastic exponential decay in each cell, though with a variety of timescales that prevent us from simply averaging different cells together.

What if we have only a single cell? I will present our Monte Carlo Maximum Likelihood with Bayesian statistics approach that allows us to extract information (or "fit") a photobleach decay for an individual cell and find out the number of initial GFP that we have while focussing on the convergence criterias needed during the simulation in order to explore enough parameter space to reach convergence.

Note: Even though the abstract involves biology terminology, the talk only involves mathematics and statistics with abosolutely no biology background required.

Cooking Howard's Curry With The Agda Programming Language

Sean Hunt

This talk will be an introduction to the Curry-Howard correspondance between proofs in formal logic systems and type checking in programming languages. This remarkable observation allows for veriation of proofs by way of checking that a computer program compiles. This is exploited by computer systems such as Coq and Agda to allow for formal veriation of proofs.

The talk will include a brief explanation of the correspondance, but the main focus will be on taking advantage of the correspondance with the Agda programming language in order to make non-trivial proof. The limitations of this environment, both in terms of the limitations of what can be proved, as well as requirements for human interaction. The speaker hopes to, time permitting, be able demonstrate a proof of an interesting but relatively simple elementary theorem of mathematics.

Required Background: none

Derivative Free Optimization: An Investigation of Algorithms on Sample Functions

Spencer Hunt

From the dawn of time, it has been known that extremely powerful data can be found in the derivatives of any function one wishes to optimize. Many "standard" definitions of local minima, given by first-order necessary conditions, are in fact, for continuously differentiable functions, that the first-order derivatives are indeed zero. In a fantastical world, all functions would have easily attainable derivatives. But this is the Real World–seven strangers, picked to live in a house–and not all functions provide reliable derivatives. Is is because of this, that the branch of derivative-free optimization was born. I will be discussing three basic derivative-free optimization techniques and applying them to a number of sample functions. These functions are made to test the robustness of the algorithms. As well, they will highlight some of the problems that many mathematicians face in derivative-free optimization. Please join me in our exploration into derivative-free optimization, a world of mystery and wonder.

On MDS Codes, the Main Conjecture, and the Partition Weight Enumerator

Svenja Huntemann

Maximum Distance Separable (MDS) codes are those error-correction codes that have the largest possible minimum distance, which means that they can correct more errors than any other type of code. MDS codes have many applications in the industry and every-day life.

One important area of research concerning this type of codes is finding an upper bound on the length n of the codewords given the alphabet size q and the dimension k. This long-standing problem is also important for combinatorial and experimental designs and in finite geometry.

For linear MDS codes there has recently been a great advance towards solving this problem and proving the main conjecture to be true. The main conjecture states that the upper bound on n is $q+1$, except for $k=3$ or $k=q-1$ and q even, where it is $q+2$.

For general, not necessarily linear, MDS codes very little is known about the upper bound. A summary of known upper bounds with an emphasis on bounds related to the main conjecture will be presented.

A new technique for proving these upper bounds in the general case uses the partition weight enumerator (PWE). The PWE for linear MDS codes has been introduced by El-Khamy and McEliece (2005), and their proof can be easily adjusted for general MDS codes. Several examples deriving upper bounds using the PWE together with other combinatorial techniques will be given.

An Individual Based Model for Bear Movement

Andrea Hyde

The International Bear Association lists 6 of the 8 bear species world wide as endangered or threatened. Neither the American Black Bear or the Brown Bear are currently listed. However, with the expansion of tourism, and industry into the back country, the increased rate of human bear interactions may change that. This project aims to understand the effect that different Human-Bear Management strategies have on the movement patterns and rates of human bear interactions in Communities. I will present a novel individual-based model for bear movement in which the displacement of a bear from one habitat patch to another follows a probability function. It is not known exactly what this function should depend upon, and so our mathematical approach is helping to elucidate the motivating factors for bear movement, their relative importance, and the dispersal patterns that result.

Preliminary investigations show that including the location of food sources and of Human-Bear Interactions (HBI) is sufficient to create realistic movement patterns for an individual bear.

An Introduction to Topology

Neal Jackett

Topology is the study of how properties of the domain and range affect the behaviour of a continuous mapping. We will explore the concept of topological spaces and subspaces and the continuity inherent in them. We will also discuss connectivity and compactness of topological spaces and look at familiar examples.

A Simple Proof of the Jordan Curve Theorem

Ifaz Kabir

The Jordan Curve Theorem states an obvious, but hard to prove fact: that a simple closed curve divides the plane into two components, one bounded and one unbounded. In this talk I will attempt to give a simple proof of the Jordan Curve Theorem assuming some easy to prove 'hammers' such as the Brouwer Fixed Point Theorem.

Representations and Duality with a View towards Number Theory

Jamie Klassen

I will provide a quick, flashy and results-oriented approach to representation theory (focusing on finite groups and providing analogies to linear algebraic groups when necessary) and discuss some elementary results concerning Kronecker coefficients and Schur-Weyl duality as well as some indications of their broader consequences in the realm of automorphic forms and modern number theory. Students will need some familiarity with the concepts of linear algebra and basic abstract algebra. As an example, you should understand what GL_n means and what $\mathfrak{S}_d$ the symmetric group is, ideally as well as the significance of such topics as number fields and Galois theory.

Flows, Branching Numbers, and Percolation on Trees

Jason Klusowski

Let T be a locally finite tree and fix $p \in [0, 1]$. For each vertex v of T, randomly declare v to be open with probability p. Otherwise v will be closed with probability $1 - p$. Make the choice of the state of each vertex independent of the state of every other vertex of T. A path P in T is open if all the vertices of P are open in T.

A natural question to ask is if there exists a critical probability in which such open paths exist in T with positive probability, and if so, how it might relate to Galton-Watson branching processes conditioned on survival? I will answer this question by introducing the concepts of a flow and a branching number along with some of their elementary properties and a couple of examples.

An Introduction to Machine Learning for Text Classification

Michelle Kovesi

How can a computer be programmed to classify inputs into various categories? The answer, often, is to use machine learning. Machine learning is a branch of artificial intelligence that is concerned with making computers evolve in response to input. This talk will give a basic introduction to the topic of machine learning for text classification. It will include information on how to prepare text documents for classification, as well as how the classification algorithms actually work. As an example, we will look at a basic classification algorithm called the Perceptron. Finally, I will present a new multi-lingual classifier that I implemented last summer.

Required Knowledge: none

Proof of Brouwer Fixed Point Theorem, using Sperner's Lemma

Jean Lagacé

Brouwer Fixed Point Theorem states that any continuous mapping from a compact convex subset of an Euclidean space into itself has a ed point, i.e. a point such that $f(x) = x$. While this theorem is considered to be one of the key theorems concerning the topology of Euclidian spaces, it has applications in many mathematical lds, ranging from differential equations to game theory. As such, a variety of proofs arise with arguments coming from a wide range of lds. Here, a graph theory result, Sperner Lemma, will be used to prove that the Brouwer Fixed Point Theorem is true for any simplex in R^n , and, since the ed point property is conserved by homeomorphisms, true for any compact convex subset of R^n .

Brain, Dynamical Systems and Fun!

Jean-Sébastien Lévesque

Dans plusieurs régisons du cerveau, les neurones s'organisent en petits groupes capables de produire des oscillations. Ces oscillateurs neuronaux interagissent entre eux par de faibles connexions et peuvent précenter divers phénomènes de synchronisation. Dans cet exposé, il sera question d'oscillateurs faiblement couplés et principalement de différentes dynamiques (comportement péiodique, quasi-péiodique, synchronisation) observables sur un tore, l'espace de phase naturellement associé à un système de deux oscillateurs couplés.

Required Background: At least one eye, to see great pictures and cool videos!

The Roots of Flow and Chromatic Polynomials

Richard Leyland

Using graph flows one can model many different phenomena such as electricity or networks. So it is important to know if a graph has a k-flow. The flow polynomial $\Phi_G(x)$ tells us the number of such flows. It turns out the flow polynomial is related to the chromatic polynomial of the planar dual $\chi_{G^*}(x)$, which tells us the number of k colorings. In a paper by Sokal, he shows that the roots of chromatic polynomials are dense in the complex plane. I will discuss this result and what we results we hope to obtain with flow polynomials, along with some conjecture regarding the roots of flow polynomials.

Combinatorial Designs and Block-Intersections Graphs

Robert Luther

A combinatorial design $\mathcal{D}$ is a pair $(V, \mathcal{B})$ where V is a set of distinct points and $\mathcal{B}$ is a set of subsets of V called blocks.

A *pairwise balanced design* $PBD(v, K, \lambda)$ is a design $\mathcal{D} = (V, \mathcal{B})$ where $v = |V|$ and each pair of points of V occurs in exactly λ blocks of $\mathcal{B}$. In addition, the cardinality of each block of $\mathcal{B}$ must be an element of K. If K should consist of a single element, say $K = \{k\}$, then the design is called a *balanced incomplete block design* $BIBD(v, k, \lambda)$. In addition to the constant block size in a $BIBD$, there is a fifth parameter r called the replication number which is the number of times any one point of V occurs in the blocks of $\mathcal{B}$.

The block-intersection graph of a design $\mathcal{D} = (V, \mathcal{B})$ is the graph $G_{\mathcal{D}}$ having the block set $\mathcal{B}$ as its vertex set and such that two vertices B_1 and B_2 are adjacent if and only if $(B_1 \cap B_2) \neq \emptyset$.

A cycle in a graph G is a closed path in G such that no vertex is repeated more than once. A cycle that contains every vertex in a graph is called a *Hamilton* cycle and if a graph G has a Hamilton cycle, then G is called *Hamiltonian*. A graph G is called *pancyclic* if G has a cycle of every possible length, from a 3-cycle to a Hamilton cycle.

We discuss some known results about cycles in block-intersection graphs of $BIBD$s and of PBDs as well as some open questions regarding cycles in these block-intersection graphs.

Using Symmetry Groups to Solve Partial Differential Equations

Keenan Lyon

Many of the useful properties of symmetry groups on partial differential equations (PDEs) arise from the fact that they are Lie groups, which are differentiable manifolds endowed with a group structure. The smooth manifold part of the Lie group allows one to continuously vary the elements in the Lie group. The idea of using group theory to solve ODEs first originated at the turn of the century by Sophus Lie. Although he did not finish his work, the applications of his Lie groups and Lie algebras are ever present in many fields of math, and the technique of using symmetry groups to find PDE solutions is still a matter of much research.

PDEs model systems that depend on several variables. For example, the schrodinger equation is a PDE where the solutions depend on both the position of a particle and the time of the system; it is the fundamental of non-relativistic quantum mechanics. The heat equation is another example, and it models the distribution of heat over time given some initial condition, and it can also be used to model particle diffusion. These two examples show the various applications that PDEs have in describing natural processes.

The spirit of finding symmetry groups of PDEs is that one solution, via some group element of the symmetry group, can be transformed into another solution. Since the groups are Lie groups, this implies a family of infinite solutions which can be created from just one solution. The motivation behind this talk is to outline the basic algorithm first created by Lie to find solutions. On the way to applying the algorithm, and extensive look into Lie groups, vector fields, group actions and topology will be aided by examples.

Fundamental Theorem of Calculus for Lebesgue Integration

Richard Mack

The Fundamental Theorem of Calculus is one of the core results in analysis. However, in its standard form taught in beginning calculus/analysis courses, it applies only when the function has continuous derivatives, which is a very small class of functions. In my talk, I will be discussing a generalization of the Fundamental Theorem of Calculus to the Lebesgue integral, and the proof in the context of measure theory, based on Lebesgue-Radon-Nicodym theorem and absolute continuity. This talk will be aimed toward an audience with some exposure to measure theory.

Introduction aux méthodes de Schwarz

Dominique Maheux

Plusieurs méthodes de résolution matricelle sont à notre disposition. D'une part, on connaît la méthode de la matrice inverse ou la décomposition LU, qui sont des méthodes directes. D'autre part, il existe aussi certaines méthodes itératives qui permettent d'approximer la solution désirée. Toutefois, les méthodes directes sont souvent trop coûteuses et les méthodes itératives ne sont pas toujours très robustes. Nous allons proposer un compromis entre ces deux types de méthodes, soit la décomposition de domaine. Nous présenterons quelques méthodes de Schwarz en expliquant les avantages et les inconvénients de ces méthodes.

Il s'agit d'une présentation très simple qui ne nécessite que quelques notions de base i.e. savoir ce qu'est une équation et une dérivée!

Structure of Neural Networks

Isaiah Mandryk

Artificial neural networks are computational models inspired by the way neurons pass information via synapses in the brain. They are effective for modelling complex nonlinear relationships between an input and output set of data vectors where there is little or no a priori information about the relationships, and are also very helpful for discovering patterns in data. The connectivity between nodes in the network is often represented by a graph, with neurons as nodes and synapses as edges. The structure of this graph can have enormous implications on the performance of the neural network. This talk focuses on the different types of structures typically used in neural network implementations and the effects the different architectures have on the network. These include differences in the capability of the network to generalize the learned information to apply

to new data, the number of mathematical operations (and thus the amount of time) required to train the network, and the capacity for the network to approximate arbitrary functions.

Introduction to Additive Frieze Patterns

Jean-François Marceau

Additive Frieze Patterns are pure combinatorial objects that were developed by G.C. Shephard in 1976. Even if they are now 36 years old, just few mathematicians studied them so they are not well known. In this talk, I will present the results I got from my research on the subject during summer 2011 (see arXiv 1205.5213).

Weyl's Theorem

Joanie Martineau

Weyl's theorem is the first interesting result found in spectral geometry. This theorem gives us an asymptotic expression for the number of eigenvalues of the Laplacian operator for bounded domains in Euclidean space. This talk will introduce the basic concepts of spectral geometry and prove intuitively Weyl's theorem.

Dirichlet Series and Arithmetic Functions

Kevin Mather

We will discuss basic detions and convergence of Dirichlet Series, construction of Dirichlet Series by Arithmetic Functions, factorization of Dirichlet Series, and the similarities of Dirichlet Series to power series

The Story of Srinivasa Ramanujan

Arthur Mehta

The talk will be split into segments. The first segment will consist of a brief telling of the one of the most romantic stories in the history of mathematics: the story of Srinivasa Ramanujan. Ramanujan was a self-taught Indian mathematician who was born into poverty. After years of obscurity his talent was finally recognized by G.H Hardy, a prominent mathematician at Trinity

College, Cambridge. The discovery of Ramanjuan eventually resulted with him traveling to England to work alongside Hardy. This led to one of the most productive mathematical partnerships of the 20th century, and resulted in works contributing to a wide variety of areas, including Number theory, Analytic Combinatorics, Infinite Fractions and Infinite Series. This segment will be followed by a segment devoted to examining a select set of works completed by Ramanujan. These works will include a look at Ramanujan work on Highly Composite Numbers: his contribution to determining the number of partitions of a given number. Lastly we will examine a host of intriguing identities, infinite series and infinite fractions produced by Ramanujan.

Required background: none

From Differential Equations to Diphtheria: the Mathematics of Infectiouse Disease Spread

Irena Papst - *English talk with Bilingual slides*

In recent years, mathematical modeling has become an important tool in epidemiology. Mathematicians are able to create models of infectious disease spread which can be used predict the outcome of an outbreak in different populations, as well as the effectiveness of various control strategies, all without risking the public's safety. This tool enables public health agencies to make well-founded decisions in high-risk situations.

In this talk, we will introduce the concept of mathematical modeling and discuss what makes a good model. We will focus on the application to epidemiology and consider one of the simplest epidemiological models, the SIR model, in order to draw important conclusions from it. However, models are not perfect; they must be set up, adjusted, and interpreted carefully, while bring mindful of observed data. We will analyze the simple SIR model in the context of childhood diseases such as measles, mumps, and rubella, and adjust it accordingly to make other important conclusions about the dynamics of these infectious diseases.

Recommended background: First year calculus, some experience with ordinary differential equations.

Diophantine Approximations

Hongyoul (Mike) Park

The field of Diophantine approximations is the study of the approximation of real numbers by rational numbers.

First, we need to make sure that the problem of rational approximation is well formulated. Let α be some real number which we would like to approximate by rational numbers. We know that rational numbers Q form a dense set on the real line R; this means that we can always find a rational number arbitrarily close to α. Moreover, for any $\varepsilon > 0$, there are infinitely many rationals $a/b \in Q$ satisfying $|\alpha - a/b| < \varepsilon$. Thus, we need to adjust the problem.

One possible approach is to make ε depend on denominators of rational approximations. Specifically, let $\varepsilon(b) = 1/b^k$ where k is some positive integer. Are there rational numbers which satisfy $|\alpha - a/b| < \varepsilon(b)$? How many rationals (finitely many or infinitely many) satisfy this inequality? As it turns out, the answers to these questions depend not only on the value of k, but also on the intrinsic properties of the number we seek to approximate! For instance, there are famous theorems by Liouville and Roth which assert that algebraic numbers cannot be approximated "too well" by rationals.

In my talk, I will discuss how algebraic numbers behave with respect to Diophantine approximations. I will construct examples of numbers which have very good rational approximations and, therefore, cannot be algebraic. I will also explain how to find good rational approximations using the theory of continued fractions.

A Brief History of Women in Mathematics

Crystal Parras

This presentation was inspired by my first encounter reading about a female mathematician, Sophie Germain. The lengths at which she went to study mathematics against her parents' wishes fascinated me. This lead me to explore further stories of other women in mathematics: the contribution they made, the people they interacted with, the lives they lived. This presentation will give a brief overview of the lives of some female mathematicians, whose stories have caught my eye.

Probability and Measure

Laurent Pelletier

In this talk, we will try to motivate and introduce the concepts of measure theory by probabilistic means. The concept of a measure is fundamental in probability theory. On the other hand,

probabilities give an interesting meaning to the usual objects of measure theory. Subsets become events, σ-algebras talk about independence....

Required Background: You don't need to know about measure theory, a basic probability course will be enough.

Investigating Orthogonal Latin Squares Using Universal Algebra

David Peterson

Latin squares are simple mathematical objects that are familiar to anyone who has solved a Sudoku puzzle – a special type of Latin square. Basically a Latin square is a square matrix of entries from some set S such that every element of S occurs in every column and every row. We will be investigating pairs of orthogonal Latin squares; that is, a pair of Latin squares A, B with entries from some set S such that for every $(a, b) \in S^2$ there is a unique pair of row i and column j such that $(a_{ij}, b_{ij}) = (a, b)$. We will explore these structures by converting them to algebraic structures, thereby allowing us to take advantage algebraic techniques (as well as providing a good excuse to do some neat algebra). In particular, we will refute a conjecture by Euler stating that it is impossible to find a pair of orthogonal Latin squares if $|S| \equiv 2 \pmod 4$.

Required Background: Some familiarity with basic abstract algebra, especially group theory, is helpful but not strictly necessary as this talk aims to be reasonably self contained. Everyone is welcome and should get something out of the talk.

Math and Art: the math behind the beauty

Tara Petrie

Many people are skeptical when they hear that math and art are interwoven throughout history and that in some universities you can get a math degree through the faculty of arts; but the truth is that although they seem like very different subjects, math and art have influenced and grown from each other since their creation. My talk focuses on the influence of mathematics in art and architecture, particularly concerning the golden ratio and certain geometric shapes and patterns. I was very fortunate to spend two weeks of May studying in Italy; the vast art and architecture in that area inspired me to learn more about the math behind the beauty.

Because the connections between math and art are so numerous, I have decided to concentrate mainly on Ancient times and the Renaissance as well as some modern mathematical art, with my

presentation set up as a timeline. I start by explaining the Golden Ratio, geometric shapes designed according to the Golden Ratio, and its influence on the Great Pyramids and the Parthenon. I then discuss ancient artist and mathematician Polykleitos and his Canon. Next I move to the Renaissance, focusing on the development of perspective including Piero della Francesca logical art in his De Prospectiva Pingendi as well as the various mathematical influences within Leonardo da Vinci work. Lastly, I give a quick discussion on more modern mathematical art from M.C. Escher, John Robinson, and various others.

I believe this is a good topic because no matter at which level an undergraduate student stands, he or she will be able to understand and find value in this discussion. With particular emphasis on geometry and perspective and using specific examples of art and architecture throughout history, I hope to ignite in my audience the same fascination I have with two interconnected subjects that are commonly viewed as polar opposites.

On the Existence of Double Arithmetic Progressions

Andrew Poelstra

Van der Waerden's Theorem states that for any number of colors r, and any length k, every r-coloring of the natural numbers must contain a monochromatic k-term arithmetic progression (a sequence $x_1, x_2, \ldots, x_k$ with constant gap between consecutive entries.)

We extend this idea to *double* k-term arithmetic progressions: sets $x_{i_1}, x_{i_2}, \ldots, x_{i_k}$ which have constant gap between consecutive entries, and constant gap between consecutive indices.

We ask whether every r-coloring of the natural numbers must contain a k-term arithmetic progression, present computational evidence to suggest that the answer is (in general) no, and show that this question is equivalent to one about infinite words on finite alphabets.

A Topological Proof of the Infinitude of Primes

Alex Provost

It is well-known that there is an infinite number of primes; Euclid offered the first known proof of that statement circa 300 BC.

In this talk I will give a beautiful proof of the infinitude of primes using elementary notions of point-set topology. This modern proof was discovered in 1955 by mathematician Furstenberg. No anterior knowledge of topology is assumed; the basic concepts (topological space, closed and open sets, base) will be explained along the way.

VC Dimension and Density: Connections between Computational Learning Theory and Model Theory

Nigel Pynn-Coates

In this talk we will introduce the notions of Vapnik-Chervonenkis dimension and density developed in computational learning theory. These notions are important because they determine whether a concept is uniformly learnable, a key question in computational learning theory. Along the way, we will also consider some standard mathematical examples to help clarify these ideas.

Model theory is a branch of mathematical logic seemingly unconnected to computational learning theory. In fact, there is an interesting connection and we will see how a model-theoretic perspective leads to new results about VC theory. In particular, it is used to prove uniform bounds on VC density in different structures. Finally, we will consider a theorem from computational learning theory (translated into probability theory) and discuss how we can use the theorem to guess at the VC dimension or density of families of sets.

Recommended background knowledge: some elementary logic would be helpful (e.g. formulas, realisations) but is not required to understand most of the talk.

Causal Inference and Bayesian Propensity Score Adjustment Methods

Léo Raymond-Belzile

Often times, in the context of policy analysis or medical research, one is interested in establishing causal relationship between variables, for example the effect of legislation on individual's behaviour or the impact of a drug on survival. The purpose of the talk is to introduce the Rubin Causal Model framework along with the various challenges faced in the area of causal inference. I will introduce some basic statistical notions, as well as confounding, propensity score adjustment (PSA) and ways to adjust for uncertainty in the context of missing data problem. The incapacity of the PSA method to incorporate uncertainty arising from the evaluation of the propensity score model justifies some recent literature on Bayesian PSA which will be discussed. A first course in statistics is assumed.

Critical Issues in Statistical and Biological Interpretation

Jeremy Recoskie

Within the field of medicine, there is a constant written dialogue through various medical journals, papers, and reports. Professionals within the academic disciplines of medicine, health, biology, statistics, and mathematics are primary contributors to these texts. Due to the complexity involving many disciplines, authors, and re- searchers, there is a clear need for a common language of dissemination so that the results of these texts may be more easily interpreted across multiple disciplines.

In a recent survey of the 2009 H1N1 pandemic literature, there were several in- stances where semantic and statistical misinterpretation or miscommunication arose. These examples could be of use to interdisciplinary groups or researchers in the field of medicine.

The focus of this talk is on the mathematical and statistical issues realized through the literature reviewed, however some semantic issues will also be mentioned. Included will be examples of how improper use of hypothesis testing, density fitting, citations and terminology contribute to a decreased quality of research texts. Discussion of all aspects is key to the goal of a more precise understanding of the many texts that comprise medical research.

Simplicial k-Complexes and Packings: Touching $(k+1)$-tuples of Congruent Balls in 3-space

Samuel Reid

By generalizing the problem in combinatorial geometry of determining the maximum number of touching unit balls in a packing of n unit balls, we define a class of problems captured by the Δ-function, $\Delta_d^k(n)$, which determines the maximum number of touching $(k+1)$-tuples of unit d-balls in a packing of n unit balls in E^d. The case of $k = 1$ was studied by Heiko Harborth in E^2 (1974) and Károly Bezdek in E^3 (2010), where Harborth proved the precise result of $\Delta_2^1(n) = \lfloor 3n - \sqrt{12n-3} \rfloor$ and Bezdek gave an upper bound of $\Delta_3^1(n) < 6n - 0.695n^{2/3}$, provided $n \geq 2$. By applying Bezdek's upper bound on $\Delta_3^1(n)$ to the case of pairwise touching 4-tuples (quadruplets) of spheres in E^3, and using a simple combinatorial argument, we prove an initial bound of $\Delta_3^3(n) < 4n - 0.463n^{2/3}$. To improve this upper bound independent of the bounds for $k = 1$, we construct an approach to finding upper bounds on $\Delta_d^k(n)$, where $k \geq 2$, by observing that $\Delta_d^k(n)$ equivalently describes the maximum cardinality of a simplicial k-complex $\mathcal{K}$ in E^d determined by an n-element point set in E^d, where the minimum distance between points is of twice the radius of the unit d-ball. By proving two key lemmas, that (1) at most four tetrahedra can share an edge in $\mathcal{K}$, and (2) at most twelve tetrahedra can share a vertex in $\mathcal{K}$, we prove that $\Delta_3^3(n) \leq 12n/4 = 3n$. We propose a

research program to determine the behaviour of the Δ-function in non-Euclidean geometries, such as spherical and hyperbolic geometry, as well as in higher dimensions.

Lost in Intervention: Conditioning of Spectral Collocation Methods

Sarah Reimer

Spectral collocation methods are used to solve boundary value problems for ordinary differential equations with narrow boundary layers. The numerical results are very accurate, despite the sometimes severe ill-conditioning of the system matrices arising. Equations with zero boundary conditions do not amplify perturbations, but equations with nonzero boundary conditions do. By solving an equation with inhomogeneous boundary conditions in two steps we maintain accuracy and increase the robustness of our method.

Pattern Subgroups of GLn(F)

Larissa Richards

This talk assumes knowledge from an Introductory Course in Abstract Algebra/Group Theory and is built from a chapter of G.D. James' Representations of General Linear Groups with the help of Professor Fernando Szchetman. The theory of representation of the symmetric groups is extremely elegant and can be used in several ways to find representations of other groups. In addition, their theory has applications in fields such as quantum mechanics and polynomial identity algebras. There is a close connection between the representations of the symmetric groups over a field F and the representations of GLn(F) over the same field. The finite general linear group is associated to a finite subset of a real vector space with certain combinatorial properties known as its root system. The classification of GLn(F) reduces to the classification of root systems and the structure of any of these groups can be obtained from properties of its root system. We will introduce the pattern (root) subgroups of GLn(F) and prove an easy result which is of fundamental importance in the representations of GLn(F). This will lead us to two interesting open problems.

Introduction to Estimation

William Ruth

Making predictions is one of the most fascinating problems in statistics. It allows for everything from engineering buildings to deciding the risk of heart attacks in cardiac patients. I this talk, I will introduce a popular framework for predictions and 2 models that have been proposed to handle it.

The framework being discussed is called regression, in which a response variable (dependent variable) is predicted based on knowledge of some set of predictor variables (independent variables). The first model, known as linear regression, s the more well known of the two models and will share the first 1/3 of the talk with setting up the framework. This model consists of expressing the response variable as a linear combinations of the predictor variables and choosing the 'best' such linear combination. The second model is called a regression tree and is only usually taught i graduate courses on data mining. This model will also receive about 1/3 of the talk and consists of partitioning the data then estimating each part ion separately. The final third of the talk will be split between a few topics related to the two models. This will included a discussion of how to evaluate a model, a comparison of the strengths and weaknesses of each of the models discussed, and a brief introduction to a few procedures that extend the basic regression tree structure.

This will be an elementary presentation that assumes almost no background in statistics (if you know what a mean is then you're good). As such, it will be more of an overview of a few areas than in in-depth analysis of one topic. In conclusion, this talk is a good opportunity to get an introduction to a fascinating and widely applicable area in statistics.

As Easy as A, B, C

Philip Ryan

This talk introduces the ABC Conjecture in number theory, also known as the Oesterle-Masser Conjecture. If A, B, and C are natural numbers with no common factors, with $A + B = C$, when is it possible that C is larger than the product of the prime factors of ABC (that is, the largest square-free factor of ABC)? The conjecture claims "very rarely," and if true, it provides an incredibly powerful tool which can be applied to a deep well of number theory, including Fermat's Last Theorem and the Erdos-Mullin-Walsh conjecture on triplets of powerful numbers, as well as a host of other results and conjectures. I will explain the conjecture in full and work through an example of its use.

Required background: Basic arithmetic

Continuous Model Theory and von Neumann Algebras

Nigel Sequeira

In my talk, I will introduce the topic of my summer research project: von Neumann algebras and some modern model theoretic approaches to their study. Basics ideas from operator theory and, more specifically, from the theory of von Neumann algebras, will be discussed. In particular, we will look at the operator-theoretic methods and constructions necessary to discuss aspects of the classification of type II factors; emphasis will be put on the type III factors, or tracial von Neumann algebras with trivial centres. Additionally, I will talk about some applications of continuous first-order logic in the context of von Neumann algebras, which will allow us to examine some of the current research and results from the intersection of operator theory and model theory.

Assumed knowledge: A good course in linear algebra, basic logic and analysis. Basic topology and more analysis is a plus, but not required. The required operator theory and model theory will be introduced as needed.

Euclid's Elements and Pythagoras' Theorem

Nicolas Simard

This talk is divided into two parts. In the first part, I will present some important facts (that all mathematicians should know) about Euclid's elements and Pythagoras' theorem. I will then explain the first book in more details, particularly the first rigorous proof of the Pythagorean theorem that Euclid elaborated. In the second part, it will be your turn to talk! Indeed, those who wish may share their knowledge by presenting, in than 150 seconds, a proof of the Pythagorean theorem. Try to find the most elegant, simple, and original proof! But do not forget, I've got the one from Euclid!

Representations of Harmonic Donuts

Michael Snarski

What do a donut, real matrices with determinant one and the integers have to do with each other? What is the relationship between triangles, three letters, a 6-vertex directed graph – and how can one "represent" this relationship? What do R/Z, 2×2 orthogonal matrices and eigenspaces of the Laplacian $\Delta f = \frac{d^2 f}{dx^2}$ have in common?

As undergraduates, there are many fascinating connections between different fields of mathematics we have yet to explore. This will be an example-based, picture-motivated chalk-talk which hopes to give a glimpse of some big ideas in math and give you an idea of what certain "buzz" words mean.

Prerequisites include linear algebra (eigenstuff) and a first course in abstract algebra (familiarity with group structure).

Achieving All Radio Numbers

Benjmain(Ben) Sokolowsky

For a connected graph G, a radio labelling is a function $c : V(G) \to Z^+$ such that for every pair of vertices (u, v) in $V(G)$, the radio condition is satisfied:

$$distance(u, v) + \mid c(u) - c(v) \mid \geq diameter(G) + 1.$$

The span of a radio labelling c is the largest integer in the image of c. The radio number of a graph G is the smallest integer M such that $span(c) = M$ for some radio labelling c. It is known that a graph of n vertices has a radio number of at least n and at most $\frac{(n-1)^2}{2} + r$, where r is determined by the parity of n. This presentation discusses three-parameter graphs known as Sok graphs. We show that for all but two integers between the known minimum and maximum, there exists a Sok graph whose radio number is that integer. The results of this work entirely settle the question of what the possible radio numbers are for graphs of order n. In addition, we present a generalization of distance maximization, a well known technique for determining lower bounds of radio numbers, and show that the bounds are sharp for an infinite family of graphs.

Intuition and Probability

Colin Street

Intuition can be a powerful tool for day-to-day application, but it can also lead us to draw false conclusions. This talk will examine how some common cognitive biases conflict with statistics both in regular application and in some notable cases, and show how some simple applications of probability can help.

Required Background : none '

Lie Group Methods for Moving Mesh Algorithms

Simon Szatmari - *English talk with French slides*

In the realm of numerical computation, the aim is to approximate with the help of a computer the solutions of a PDE with as much speed and accuracy as possible. However, some PDEs still resist our attemps to solve them numerically.

Consequently, the use of Lie Groups has recently penetrated the domain of what is called Geometric Integration. More precisely, we can transform Iterative Methods into Canonical Iterative Methods that re- spect the subjacent Lie Group structures of the PDE.

My talk will focus on the following three aspects. To begin with, I will give an intuitive explanation of what Lie Groups are and how they work. It will be followed by a brief introduction to what Moving Mesh Methods are, how they work and why they are necessary. When combining the two ideas, I will demonstrate how Lie Group Methods come about, what enhencements they bring and what new avenues of research are currently explored.

Modeling Techniques of Genetic Information Flow: Past and Future

Caleb Tarzwell

This presentation will discuss the results and findings of an NSERC-USRA funded survey conducted in the summer of 2012 at the University of Northern British Columbia of modeling techniques in molecular biology. Numerous mathematical models have been proposed since Francis Crick's proposal of the Central Dogma of Molecular Biology. The Central Dogma has since been disproven but is still commonly used to describe the nonlinear and multidirectional flow of information between the nucleus and the ribosome. An introduction to the Central Dogma and the challenging problems which arise will be provided for listeners without a background in Molecular Biology. Three promising models will be presented: finite state machines, matrix algebra with connections to group theory, and hidden markov models. These mathematical and probabilistic models attempt to describe the flow of genetic information within a cell. The most common application has been describing the transition from DNA to RNA to protein. The three models will be presented with their relative merits and weaknesses and situations in which they are best employed. After the introduction of these, a dynamic model describing the complete flow of information within the cell will be presented consisting of various components of each of the three models. Future steps for this NSERC funded survey will then be discussed. The most intriguing of these are obtaining better prediction mechanisms for RNA and protein structure. The presentation will conclude with discussing the need for researchers with an interdisciplinary background to bridge the differences between

methodologies between mathematicians and molecular biologists to speed further developments in molecular biology.

Introducing Uniformly Distributed Sequences

Arman Tavakoli

I will motivate and introduce the idea of a uniformly distributed sequence using a Monte Carlo simulation. After a few example sequences, I will discuss a celebrated theorem by Hermann Weyl called Weyl's criterion. The rest of the talk will be about different kinds of uniformly distributed sequences.

Parallel Parking with Lie Algebras

Selim Tawfik

Using the language of Lie algebras, we will see that an idealized driver is always able to parallel park provided there is enough room for their vehicle to fit. We will start by quickly defining manifolds, vector fields, Lie groups, Lie algebras and Lie brackets, and stating important results connecting these notions.

Required Background: Basic differential geometry would help, but not strictly necessary.

Domination Polynomials of Graphs and Their Roots

Julia Tufts

We say that a set of vertices, S, is dominating if every vertex of the graph is in S or adjacent to a vertex in S. The domination polynomial of a graph G is the generating function of the number of dominating sets of each size in G.

The domination polynomial is a relatively new polynomial, and as is the case with other graph polynomials, the roots are of great interest. This talk will discuss the nature and location of the roots of domination polynomials. We find that the roots for certain families of graphs often create distinct patterns that we are able to analyze, and we also obtain a surprising result for the set of all domination roots.

Opportunities in Mathematical Biology

Rebecca Tyson

Mathematical Biology is an exciting discipline at the interface of mathematics and biology. Many biological questions are intractable when approached with biological techniques alone, but can be solved with the power of mathematical tools. The breadth and variety of the field is enormous, from differential equation modelling of forest fires or the inner workings of cells to interacting particle systems models of recolonization or evolutionary processes. We begin the session with an introduction to the field given by three speakers from the University of British Columbia, Okanagan and Vancouver campuses, and the University of Alberta. We then discuss graduate programs in mathematical biology in Canada, and future careers.

Knapsack-Based Crytography

Michael Wanless

At the heart of every public-key cryptosystem is a computationally difficult problem that provides security for the system. Thus, problems that are known to be hard hold a lot of interest for cryptologists and number theorists in general. An example of such a problem is the knapsack or subset-sum problem, which is proven to be NP-complete. This talk will provide an introduction to the ideas behind classical public-key cryptosystems based upon the knapsack problem, using the Merkle-Hellman cryptosystem as a case-study. We will examine how the security of these cryptosystems is tied to finding short vectors in lattices, and thus how the LLL algorithm can be used to break many such systems.

Prerequisites: An understanding of modular arithmetic is nearly esse

The Shortest Introduction to Semidefinite Programming

Gwen Yun Weng

Semidefinite programs often capture the mathematical essence of problems of various structures. Therefore, semidefinite programming is used in theoretical and practical explorations of a wide range of problems. This talk will cover the very basics of semidefinite programming and demonstrate its application to a typical eigenvalue optimization problem.

Required background: Basic Linear Algebra. Exposure to Linear Programming will be helpful.

Game Theory and Evolution

Toban Wiebe

Game theory is essential for understanding evolution. Organisms are in competition for survival; as such, there is a strategic aspect to natural selection. This talk will provide an introduction to game theory and its use in modelling evolution. Classical game theory examines equilibria produced by rational players using optimal strategies. Evolutionary game theory adds an extra stability condition for equilibrium: that no small mutant population can invade a population in equilibrium. The model can be further extended to analyze the dynamics of evolution. No prior knowledge of game theory is required.

A Winning Strategy

Wu, Steven

Billions are poured into a gambling industry annually that is designed for the house edge to rake in profits. A New York Times bestseller written by Edward O. Thorp resulted from the phenomenon discovered that flipped the odds of one casino game, Blackjack, in favour to the player. After a brief overview on the rules of how to play, features that distinguish it as capable of a positive expectation for the player, I will detail the pertinent mathematics that explain how each unique rule, from doubling down to the option of taking insurance, affects the expectation of the game. After describing what constitutes "Basic Strategy", I will show how Thorp manipulated the probabilities using card counting to produce a winning strategy that swept the nation through use of examples of certain game scenarios.

Required background: None, previous knowledge of the rules of Blackjack and expected value will help to follow along.

Statistical Refinement of Astrophysical Numerical Simulations

Miayan Yeremi

The process of star formation is the fundamental agent at determining how an isolated galaxy like our own evolves over the course of the universe. Many physical processes contribute to star formation (gravitation, magnetism, chemistry, radiation, and fluid dynamics). However, it is not understood exactly how these effects shape the process of star formation. Physical observations

from radio telescopes provide some insight into the process of star formation but alone do not provide the necessary information to understand exactly how the physical process evolves. Properly designing and experiment to study star formation is complicated by many factors. A single run of the computer model can take upwards of five thousand hours, in addition some of the input variables evolve during the code runs meaning that the inputs of the computer code are observed with error. Lastly, comparing code runs to physical observations is complicated by things, first we must compare three dimensional data cubes and secondly simple euclidean distances between these cubes is not correct measure of similarity between these two objects. In this talk we will discuss some recent work on the design and analysis of complex experiments to study star formation. The ultimate gal of this study is to provide a physically meaningful description of how stars evolve.

How Topologically Inclined Thieves Split Their Spoils

Jonathan Zung

More often than one might expect, a pair of thieves is confronted with the following problem. Having stolen a necklace with k different types of jewels, they wish to cut up the necklace so that each of the two receives the same number of jewels of each type. In 1985, thieves the world over rejoiced when Douglas West and Charles Goldberg showed us how to split such necklaces equitably with at most k cuts. Amazingly, their approach uses a topological argument. In this talk, I will present a slick proof of this result due to Alon and West.

General Information / Informations générales

4.1 Internet connections on campus / Connexions Internet sur les campus

UBC's Okanagan campus

Connect to the network "ubcvisitor". You will be directed to a website where you must enter in your email to log on.

Se connecter au réseau "ubcvisitor". Vous serez dirigés vers une page qui vous demande un email pour s'inscrire.

Okanagan College

Okanagan College does not have a visitor network that we can use. The school has provided us with a few usernames and passwords if you require internet for your presentation. These can be used for presentations only. The volunteer in your presentation room can issue you a username and password to use if you need it.

L'Okanagan College n'a pas de réseau pour les visiteurs. L'école nous a donné quelques noms et mots de passe pour ceux qui auront besoin d'une connexion internet pour leur présentation. Ils ne sont disponibles que pour les présentations. Le bénévole de votre salle de présentation s'occupera de vous les fournir.

4.2 Getting to/from Okanagan College and the closing banquet

There will be a day of talks held at Okanagan College (OC), **1000 KLO Rd**, on Friday, July 13th. All talks will be held in **Building E, The Centre for Learning**.

The closing banquet, will be held at the Ramada Hotel, **2170 Harvey Ave** (Hwy 97N).

Buses have been arranged to transport people to/from UBC's Okanagan campus to OC and to/from the Ramada Hotel for the closing banquet. If you need a ride to OC or the closing banquet, please sign up for the buses so that we can ensure everyone at the conference who needs a ride gets one. If you do not sign up for a bus, or you miss your bus, we cannot guarantee that you will be able to get on the next one.

Public transport does go to each of the venues. To get to OC from UBC take the #8 - Okanagan College and get off at Okanagan College. To get to the Ramada Hotel from UBC take the #97 - Express, get off at Cooper Rd near Orchard Park Mall, and walk approximately 450m east to the Ramada.

If you are driving to any of the venues, there is parking available. OC Facilities has told us that parking is free of charge on the day we are there. Parking is not free at UBC's Okanagan campus; you must purchase a parking pass from one of the ticket dispensers. If you decide to drive to the closing banquet, please decide on a designated driver beforehand. Please do not drink and drive! You are also more than welcome to leave your vehicle overnight at the Ramada and take the bus back to the university, or one of the volunteers can arrange a cab for you.

Aller et revenir de Okanagan college et du banquet final

Une journée de présentation sera tenue au Okanagan College (OC), **1000 KLO Rd**, le vendredi 13 juillet. Toutes les présentations seront donnes au **Pavillon E, The Centre for Learning**.

Le banquet final se tiendra au Ramada Hotel, **2170 Harvey Ave** (Hwy 97N).

Un transport en autobus a été prévu pour l'aller et le retour entre le campus de UBC Okanagan et l'Okanagan College ainsi que pour le banquet final au Ramada Hotel. S vous avez besoin d'un transport vers l'Okanagan College pour le banquet final, veuillez vous inscrire afin de s'assurer que tous ceux qui auront besoin d'un transport en auront un. Si vous ne vous inscrivez pas ou que vous manquez votre autobus, nous ne pouvons pas vous assurer que vous pourrez prendre le prochain transport.

Le réseau d'autobus dessert l'Okanagan College. Pour se rendre à 'C de UBC, prenez l'autobus #8 - Okanagan College et sortez à l'arrêt Okanagan College. Pour aller au Ramada Hotel à partir de UBC, prenez l'autobus #97 - Express, sotez à Cooper Rd près de Orchard Park Mall et marchez

environ 450m vers l'est.

Si vous vous rendez en automobile à l'un de ces deux endroits, des stationnements seront disponibles. Les stationnements de l'OC seront gratuits lors de notre passage. Le stationnement n'est pas gratuit sur le campus de UBC; vous devez acheter un ticket de stationnement à l'une des bornes. Si vous décider de conduire pour vous rendre au banquet, décidez d'un conducteur désigné. S'il vous plait, ne conduisez pas après avoir bu! Vous pouvez aussi laisser votre véhicule sur les lieux du banquet final et prendre l'autobus. Il est aussi possible d'appeler un taxi.

Friday, July 13 - Vendredi 13 juillet

- *Sign-up for buses to Okanagan College will happen Thursday, July 12th during coffee breaks and lunch. People presenting on Friday need to be on the 7:45am bus to pre-load presentations.*
- *Sign-up for buses to UBC Okanagan will happen Friday, July 13th during coffee breaks and lunch.*
- *L'inscription pour les autobus vers Okanagan College aura lieu le jeudi 12 juillet durant les pauses-caf et l'heure du midi. Les participants qui donnent une présentation le vendredi doivent prendre l'autobus de 7h45 afin de transférer leur diaporama.*
- *L'inscription pour les autobus vers UBC Okanagan aura lieu le vendredi 13 juillet durant les pauses-ca'e et l'heure du midi.*

Leave/Départ	Arriving / Arrivée	Bus/ Autobus
7:45	8:05	to/vers Okanagan College (2 buses)
8:25	8:45	to/vers Okanagan College (2 buses)
18:30	18:50	to/vers UBC Okanagan, via Scandia
19:20	19:30	to/vers UBC Okanagan, via Scandia
19:50	20:10	to/vers UBC Okanagan
20:30	20:50	to/vers UBC Okanagan (WIMS participants only)

Saturday, July 14th - Samedi 14 juillet

- *Sign-up for buses to the Ramada Hotel will happen Saturday, July 14th during coffee breaks and lunch.*
- *There is no sign-up required for buses leaving the Ramada Hotel.*
- *L'inscription pour les autobus vers le Ramada Hotel aura lieu le samedi 14 juillet durant les pauses-ca'e et l'heure du midi.*
- *Il n'y a pas d'inscription préalable pour les autobus du Ramada Hotel vers UBC Okanagan.*

Leave/Départ	Arriving / Arrivée	Bus/ Autobus
17:30	17:40	to/vers Okanagan College (2 buses)
18:00	18:10	to/vers Okanagan College (2 buses)
22:30	22:40	to/vers UBC Okanagan, via Scandia
23:30	23:40	to/vers UBC Okanagan, via Scandia
0:30	0:40	to/vers UBC Okanagan
1:00	1:10	to/vers UBC Okanagan (WIMS participants only)

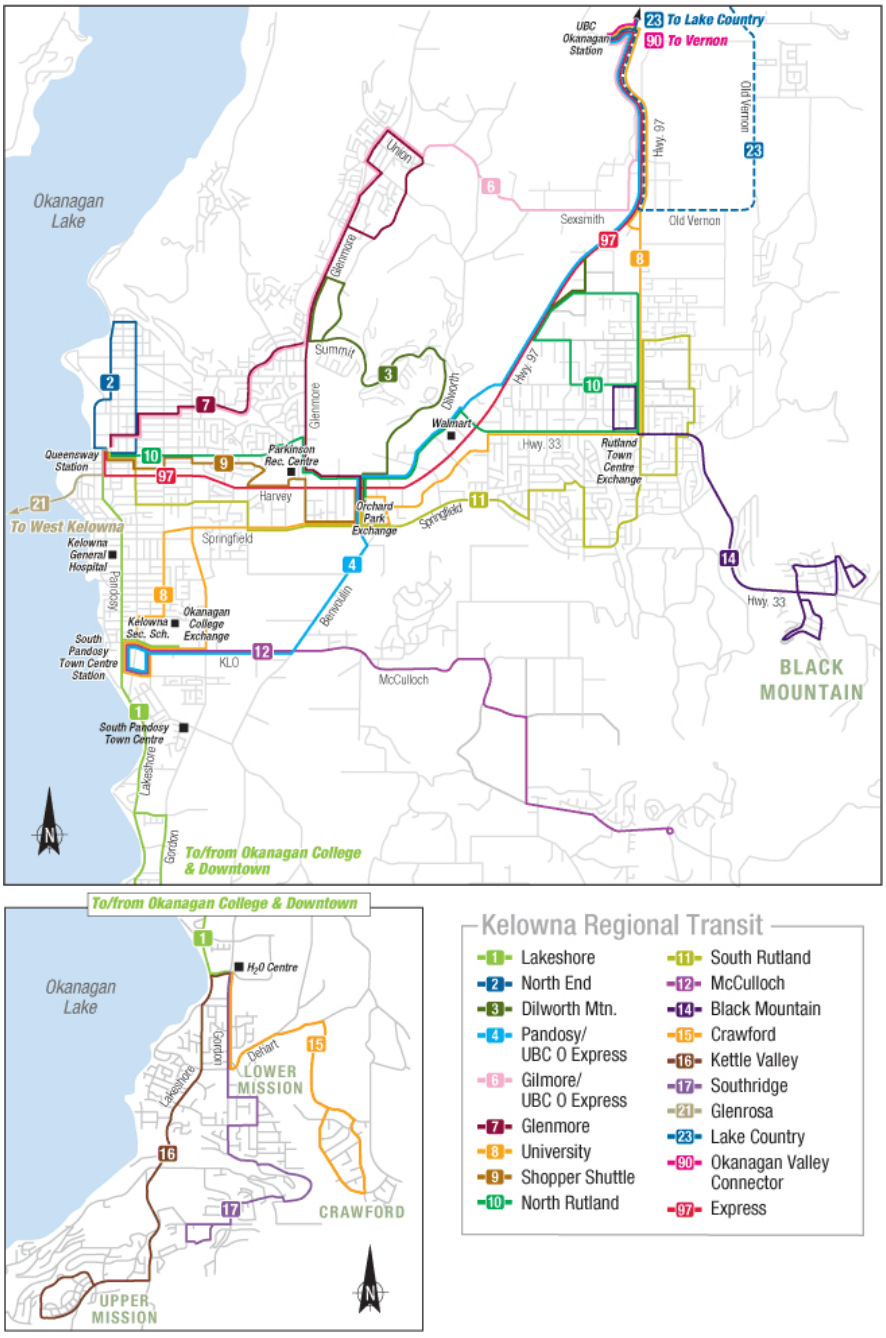
4.3 Kelowna transit information / Le transport en commun á Kelowna

The main bus that travels between UBC Okanagan campus and downtown is the 97 - Express. The bus that runs from UBC to Okanagan College to downtown is the 8 - Okanagan College. Fare for public transport is $2.25 and drivers carry no change.

You can view Kelowna transit schedules and maps at www.transitbc.com/regions/kel.

L'autobus principal qui dessert le campus de l'Université ainsi que le centre-ville est le #97-Express. L'autobus qui fait le parcours du Okanagan College vers le centre-ville est le #8-Okanagan College. Le coût d'un aller est de 2,75$. Ayez l'argent exact puisque les conducteurs n'ont pas de monnaie.

Vous pouvez trouver tous les trajets d'autobus et les horaire au www.transitbc.com/regions/kel.


UBC Okanagan Station
23 To Lake Country
90 To Vernon
Old Vernon
Hwy. 97
Okanagan Lake
Union
Glenmore
Sexsmith
Old Vernon
97
8
6
Summit
3
Dilworth
Hwy. 97
10
2
7
Walmart
Hwy. 33
Rutland Town Centre Exchange
Queensway Station
Parkinson Rec. Centre
10
97
9
Harvey
21
To West Kelowna
Orchard Park Exchange
11
Springfield
Springfield
Kelowna General Hospital
Pandosy
4
14
8
Hwy. 33
Kelowna Sec. Sch.
Okanagan College Exchange
Bernard
South Pandosy Town Centre Station
12
KLO
McCulloch
BLACK MOUNTAIN
1
South Pandosy Town Centre
Lakeshore
Gordon
To/from Okanagan College & Downtown
To/from Okanagan College & Downtown
1
H2O Centre
Okanagan Lake
Gordon
Lakeshore
Dehart
15
LOWER MISSION
16
17
CRAWFORD
UPPER MISSION
Kelowna Regional Transit
1 Lakeshore
2 North End
3 Dilworth Mtn.
4 Pandosy/ UBC O Express
6 Gilmore/ UBC O Express
7 Glenmore
8 University
9 Shopper Shuttle
10 North Rutland
11 South Rutland
12 McCulloch
14 Black Mountain
15 Crawford
16 Kettle Valley
17 Southridge
21 Glenrosa
23 Lake Country
90 Okanagan Valley Connector
97 Express

4.4 Great places to eat in Kelowna / Bons endroits où manger à Kelowna

Breakfast / Déjeuners

The Jammery, 8038 Hwy 97 N, www.jammery.com ($)

Bread Co., 363 Bernard Ave, thebreadcompany.ca ($)

Bohemian Cafe, 524 Bernard Ave, www.bohemiancater.com ($$)

Cafes / Cafés

The Cannery, 1289 Ellis St ($)

The Bean Scene, 274 Bernard Ave ($)

Lunch / Dîners

Bread Co., 363 Bernard Ave, thebreadcompany.ca ($)

Mediterranean Market, 1570 Gordon Dr ($)

Wood Fire Bakery, 2041 Harvey Ave ($$)

Dinner / Soupers

Fernando's Taqueria, 279 Bernard Ave ($$)

Twisted Tomato, 371 Bernard Ave, twistedtomatokitchen.com ($$)

Poppadoms - Taste India!, 948 McCurdy Rd, www.poppadoms.ca ($$)

DunnEnzie's Pizza, 1559 Ellis St, www.dunnenzies.com ($$)

Mon Thong Thai, 1876 Cooper Rd, www.monthong.ca ($$)

RauDZ, 1560 Water St, www.raudz.com ($$$)

Pubs

Doc Willoughby's Pub, 353 Bernard Avenue, www.docwilloughby.com ($$)

O' Flannigan's Pub , 319 Queensway ($$)

Rose's Waterfront Pub, 1352 Water St, www.rosespub.com ($$)

Turtle Bay Pub, 2850 Woodsdale Rd, Lake Country, www.turtlebaypub.com ($$)

$ under 10 per entree / Moins de 10 $
$$ 10-15 per entree / Entre 10 $ et 15 $
$$$ 15-25 per entree / Entre 15$ et 25$

4.5 Fun things to do in Kelowna / Activités amusantes à Kelowna:

Knox Mountain

Located north of the downtown area, about a 25min walk or 5min drive north from Queensway Bus Loop, down Ellis St. Alternatively, you can bus there on the #2 - North End Shuttle and get off at Cambridge Aveând Ellis St. There are many walking trails on this mountain, short, long, steep, and gentle. You may find people mountain biking on the trails. There is a look out halfway up and another at the top, which you can also drive to if you have a vehicle. From here you can take in the beautiful views of Okanagan Lake and its surrounding mountains, stretching off into the horizon. Take good walking shoes and plenty of water!

Cette montagne est située au nord de la région du centre-ville, à environ 25 minutes de marche ou 5 minutes de voiture au nord de Queensway Bus Loop, sur Ellis St. Vous pouvez aussi vous y rendre en autobus en prenant la #2 - North End Shuttle et en descendant au coin Cambridge Ave. et Ellis St. On retrouve sur cette montagne plusieurs pistes de randonnée, qu'elles soient courtes ou longues, abruptes ou douces. Certains font même de la bicyclette sur ces pistes. Il y a un point de vue à mi-chemin et un autre, au sommet de la montagne, où vous pouvez vous rendre en voiture. De là, vous pourrez admirer l'Okanagan Lake et les montagnes avoisinantes qui s'étendent jusqu'á l'horizon. N'oubliez pas de bons souliers de marche et beaucoup d'eau!

City Park and Beach

Located a hop, step, and a skip away from downtown Kelowna, at the end of Bernard Ave and parallel to Abbott St, City Park and its beach, on Okanagan Lake, is a great place to people watch, go swimming, and relax in the sun. Take your swimsuit and towel!

Situés tout près du centre-ville de Kelowna, au bout de Bernard Ave. et paralèle Abbott St., City Park et sa plage sur le bord de l'Okanagan Lake sont un bel endroit où aller pour admirer la vue, se baigner et relaxer un peu au soleil. Apportez avec vous votre maillot de bain et votre serviette!

Beyond the Crux

This climbing gym is located at #2 - 1414 Hunter Court. There are walls are fixed with auto belays so that you can climb away to your heart's content! A day pass is $15 and it is open

Monday to Friday, 4 - 10pm and Saturday, 11am - 5pm. For more information check out www.beyondthecrux.info.

Ce gymnase d'escalade est situ au # 2 - 1414 Hunter Court. Il y a des murs équipés d'auto-assureurs pour que vous puissiez grimpez autant que vous le voulez. La passe de journée coûte 15$ et le centre est ouvert du lundi au vendredi de 16h à 22h ainsi que le samedi de 11h à 17h. Pour plus d'information: www.beyondthecrux.info.

Rusty's Steakhouse

Don't let the name fool you, this is a billiard hall. They have 10-12 tables for just food and have a full menu available that can be brought to the tables. The key bonus for this place is they have a lot of tables, and it's very far from a 'dirty pool hall' - very open space, not smoky, newly renovated, clientele are mostly students and middle aged men... Located at #1 - 1525 Dilworth Dr. Checkout www.rustyssteakhouse.ca for more information.

Ne laissez pas le nom vous tromper, il s'agit d'une salle de billard. Une dizaine de tables sont disponibles pour manger et un menu complet est fait pour être servi directement aux tables de billard. L'avantage de l'endroit est qu'il y a un grand nombre de tables et qu'il n'y a aucune comparaison à faire avec les bars de billard miteux -tràs ouvert, pas enfumé, nouvellement rénové, la clientèle est constituée en grande partie d'étudiants et de jeunes hommes. Situé au #1 - 1525 Dilworth Dr. Allez au www.rustyssteakhouse.ca pour plus d'informations.

Walk the Mission Creek Greenway

The Greenway is a 17km pathway that runs throughout Kelowna from Lakeshore Drive, near the lake at Truswell Rd, up to the Rutland and Black Mountain areas. It is a gentle walk and is used by many Kelownians for walking, running, biking, and horseback riding along Mission Creek. For more information check out www.greenway.kelowna.bc.ca.

Le voie verte est une voie de 17 kilomètres de sentiers traversent Kelowna à partir de Lakeshore Drive, près du lac à la route Truswell Rd, jusqu'à Rutland et au secteur Black Mountain. C'est un trajet accessible utilisé par les habitants de Kelowna pour marcher, courir, faire du vélo et du cheval. Pour plus d'informations, visitez le www.greenway.kelowna.bc.ca.

Walk along the waterfront

A great place to go for a stroll is the path along the waterfront. It runs parallel to Water St, starting downtown at the corner of Bernard Ave and Abbott St, travelling north to Waterfront

Park. Here you'll find a quiet beach to chill out on. If you continue to the very end you'll come to a peaceful waterfowl sanctuary with a boardwalk running through it.

L'endroit parfait pour prendre une marche est la rive du lac Okanagan. Les quais sont paralléles á Water St, partant au centre-ville au coin de Bernard Ave et Abbott St, jusqu'au nord á Waterfront Park. Á cet endroit, vous trouverez une jolie plage pour relaxer. Au bout de cette plage se trouve un endroit magnifique qui vaut le détour.

4.6 CUMC 2013 Host Bids / Enchères pour accueillir le CCÉM 2013

The CUMC could not continue without its host school. We strongly encourage you to consider making a bid to host CUMC 2013 at your school. First you need to check with your home department to get approval for hosting. Once you get approval, inform one of the organizers that your school would like to put in a bid for CUMC 2013.

On Friday, July 13th at 5:30pm, representatives from each university that wish to be considered as next year host university will give a brief presentation about their school and city. Ballots will be distributed following the presentations and will be collected at lunch on Saturday, July 14. Each participating university is given one vote, regardless of how many of its students are attending the conference. In a change from previous years, the winner will be decided using the Schulze Method, a modern and widely-used voting system that uses a preferential ballot. Rather than voting for a single option, each university's ballot will allow the candidate host universities to be ranked in order of preference. The preferential ballots will then be input into a computer which uses the Schulze Method to determine the winner. We have chosen to use the Schulze Method because it is mathematically interesting, it is modern, it satisfies an extremely wide range of academic voting system criteria (Condorcet criterion, majority criterion, independence of clones, etc.), and it has been adopted by many reputable organizations such as the Wikimedia Foundation. The winning host university will be announced at the closing banquet.

Enchères pour accueillir le CCÉM 2013

Le CCÉM ne peut pas exister sans une université hôte pour l'accueillir. Nous vous invitons à penser à la possibilité de participer à l'enchère pour organiser l'évènement ln prochain. La première chose à faire serait de véfifier si le département de mathématiques de votre université est favorable à une telle candidature. Une fois lutorisation obtenue, informez un organisateur que votre école aimerait déposer sa candidature.

Le vendredi 13 juillet à 17:30, les représentants de chaque université participant à lnchère donneront une brève présentation à propos de leur école et de leur ville. Les bulletins de vote seront distribués suite aux présentations et seront rammassés le midi suivant. Chaque université participante a droit à un vote, peu importe le nombre d'étudiants présents. Contrairement aux dernières années, le gagnant sera déterminé par la méthode de Schulze, une méthode de vote moderne et largement utilisée qui utilise un vote à classement. Au lieu de voter pour une seule université, chaque bulletin permettra de voter pour une liste d'universités disposées en ordre de préférence. Le gagnant sera ensuite nommé par un ordinateur. Cette méthode a été choisie car elle est intéressante dn point de vue mathématique, elle est moderne, elle satisfait une grande partie des critères d'un vote (critère de Condorcet, critère de majorité, indépendance des clônes, etc.), et elle a été adoptée par des organisations reconnues comme la fondation Wikimedia. L'université gagnante sera annoncée au banquet de clôture du congrès.

4.7 Sponsors / Commanditaires

Official Sponsor / Partenaire Officiel


Okanagan College is pleased to welcome the participants of the Canadian Undergraduate Mathematics Conference. With four campuses spread throughout the Okanagan Valley, the College offers a broad range of career, continuing education, degree, developmental, trades and technologies, university studies, and vocational programs – including a Mathematics and Statistics Department that offers a wide variety of first- and second-year courses in mathematics and statistics that are eligible for transfer to post-secondary institutions across Canada.
The College's participation in this conference has been sponsored and supported by the Science, Technology and Health and Social Development portfolio, the Okanagan College Faculty Association (OCFA), the Applied Science Technologists and Technicians of British Columbia (ASTTBC) and the British Columbia Women in Technology (BCWIT).
The Science, Technology and Health and Social Development portfolio includes 17 different programs that serve more than 1,000 students at all four of Okanagan College's regional campuses. The portfolio acts as a stepping stone for a wide variety of careers and for further post-secondary education.
The OCFA represents more than 200 faculty members of Okanagan College. It serves to maintain and promote the professional status of the members of the Association, to regulate relations between faculty and Okanagan College through collective bargaining, and to function as a trade union pursuant to the laws of British Columbia.
ASTTBC is the professional association that governs applied science technologists, certified technicians and a number of technical specialists and is charged with regulating the standards of training and practice of and for its members and protecting the interests of the public. With more than 10,000 registrants, ASTTBC is one of the larger professional associations in B.C. and maintains high academic, and professional practice standards.
The BCWIT focuses on raising the profile of women working in technology to capture the interest of girls at a younger age through hands on events, and focused career counselling. The organization was established following a survey by ASTTBC which revealed only nine percent of its members are women.
O·C·F·A
Okanagan College Faculty Association
BCWIT
British Columbia Women in Technology
Applied Science Technologists & Technicians of British Columbia
ASTTBC technology professionals
Okanagan College
Science, Technology, and Health and Social Development
okanagan college

Silver Sponsor / Partenaire Argent

Pacific Institute for the Mathematical Sciences

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Canadian Mathematical Society

Westcoast Women in Engineering, Science & Technology

Centre de Recherche Mathématiques

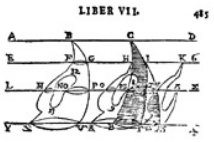
Applied Science Technologists & Technicians of BC

CMS Women in Math Committee

Contributors / Contributeurs

Golden Key International Honour Society

Department of Mathematics and Statistics, UNBC



The Canadian Society for History and Philosophy of Mathematics

UBC's Okanagan Campus AVP Students

4.8 Riddles and Games / Énigmes et Jeux

Crates of Fruit

You are on an island and there are three crates of fruit that have washed up in front of you. One crate contains only apples. One crate contains only oranges. The other crate contains both apples and oranges.

Each crate is labeled. One reads "apples", one reads "oranges", and one reads "apples and oranges". You know that NONE of the crates have been labeled correctly - they are all wrong.

If you can only take out and look at just one of the pieces of fruit from just one of the crates, how can you label ALL of the crates correctly?

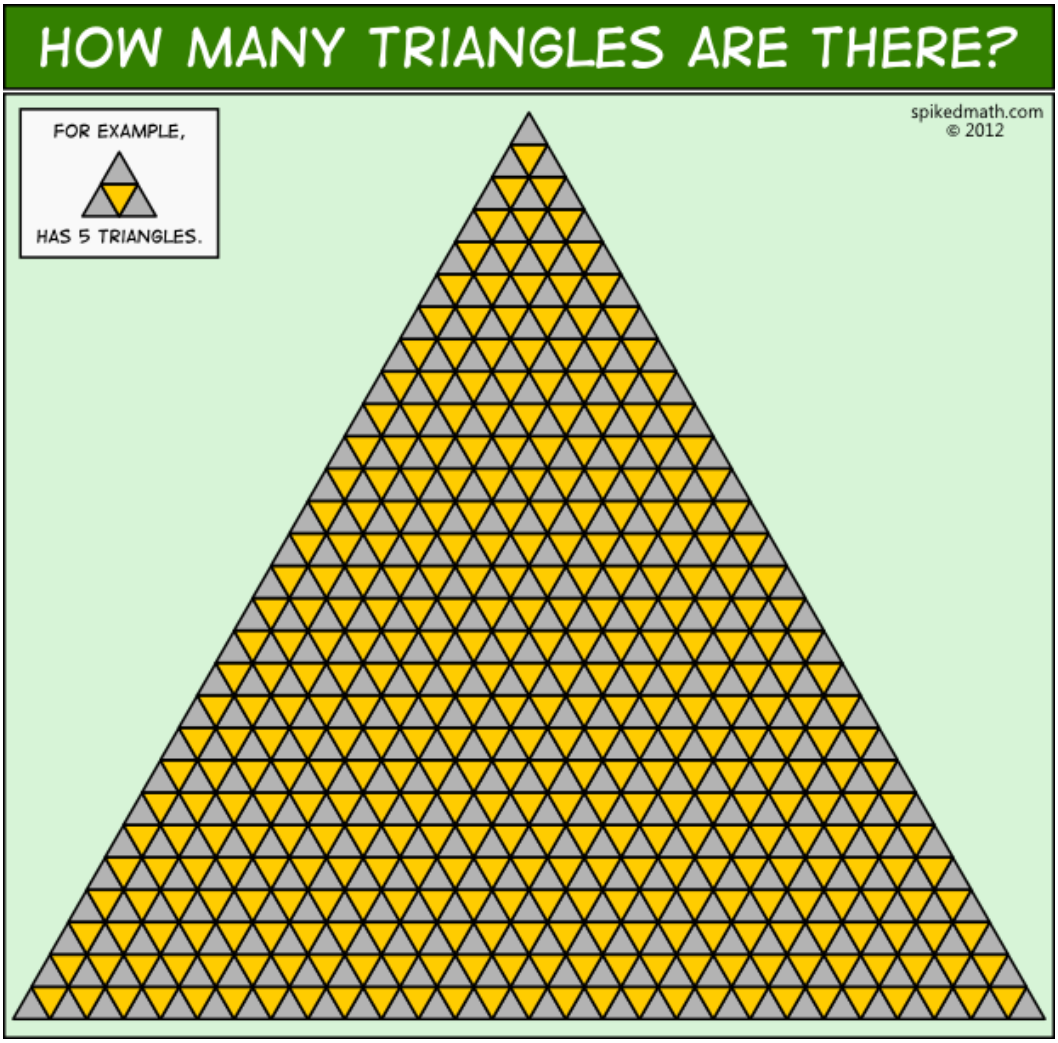
Explain Elevator

A Man works on the 10th floor and always takes the elevator down to ground level at the end of the day. Yet every morning he only takes the elevator to the 7th floor and walks up the stairs to the 10th floor, even when is in a hurry. Why?

Five Gears

There are five gears connected in a row, the first one is connected to the second one, the second one is connected to the third one, and so on.

How much faster would the last gear be if the second gear was twice the size of the first gear, and all the other gears were the same size as the first gear?



Rope Burning Puzzle

There are two lengths of rope. Each one can burn in exactly one hour. They are not necessarily of the same length or width as each other. They also are not of uniform width (may be wider in middle than on the end), thus burning half of the rope is not necessarily 1/2 hour.

By burning the ropes, how do you measure exactly 45 minutes worth of time?

33333 puzzle

Use each of the numbers one through nine exactly once to fill in the blacks and complete this equation.

$$\square\square\square\square\square - \square\square\square\square = 33333$$

The Emperor

You are the ruler of a medieval empire and you are about to have a celebration tomorrow. The celebration is the most important party you have ever hosted. You've got 1000 bottles of wine you were planning to open for the celebration, but you find out that one of them is poisoned.

The poison exhibits no symptoms until death. Death occurs within ten to twenty hours after consuming even the minutest amount of poison.

You have over a thousand slaves at your disposal and just under 24 hours to determine which single bottle is poisoned.

You have a handful of prisoners about to be executed, and it would mar your celebration to have anyone else killed.

What is the smallest number of prisoners you must have to drink from the bottles to be absolutely sure to find the poisoned bottle within 24 hours?

The Card Trick

I ask Alex to pick any 5 cards out of a deck with no Jokers.

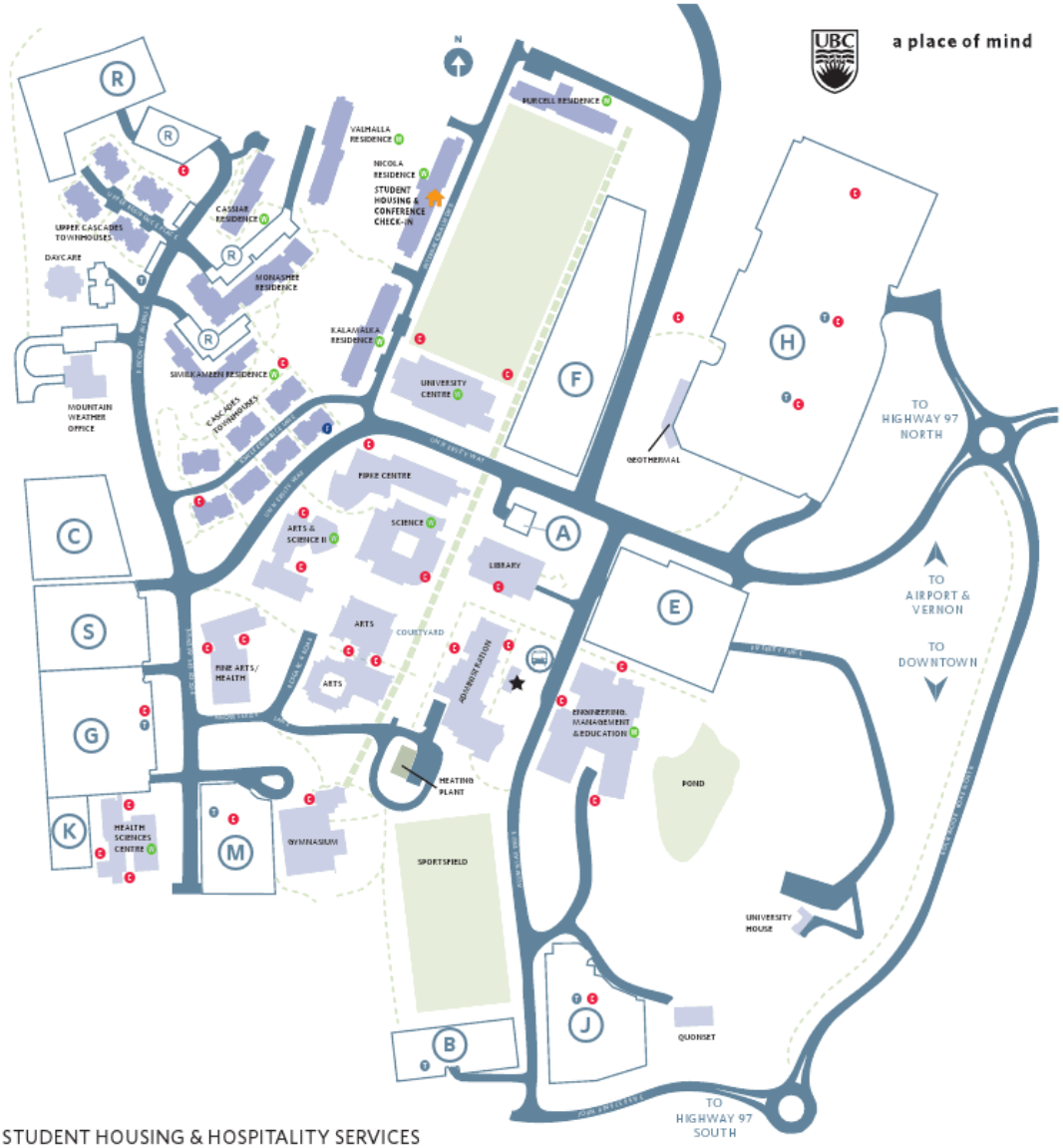
He can inspect then shuffle the deck before picking any five cards. He picks out 5 cards then hands them to me (Peter can't see any of this). I look at the cards and I pick 1 card out and give it back to Alex. I then arrange the other four cards in a special way, and give those 4 cards all face down, and in a neat pile, to Peter.

Peter looks at the 4 cards i gave him, and says out loud which card Alex is holding (suit and number). How?

The solution uses pure logic, not sleight of hand. All Peter needs to know is the order of the cards and what is on their face, nothing more.

4.9 Campus Maps / Cartes du campus

See next page



STUDENT HOUSING & HOSPITALITY SERVICES
OKANAGAN CAMPUS MAP

CONFERENCES & ACCOMMODATION
okanagan.ubcconferences.com

STUDENT HOUSING
housing.ubc.ca/okanagan

1290 International Mews, Kelowna, BC V1V 1V8
T 250.807.8050 | F 250.807.9157

LEGEND
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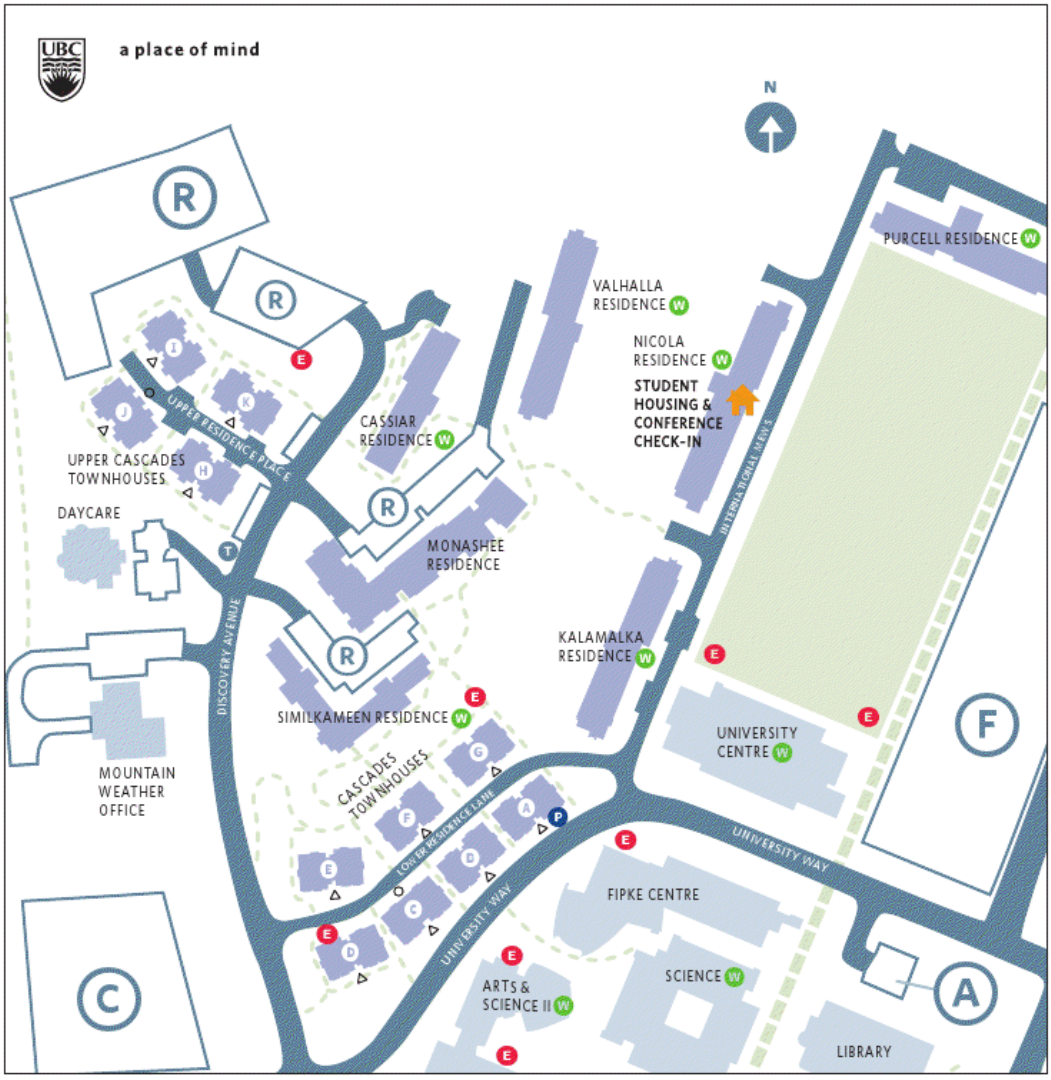
- EMERGENCY PHONE
- SECURITY OFFICE
- PARKING OFFICE
- WATER STATIONS
- WALKWAY
- STUDENT HOUSING & HOSPITALITY SERVICES CHECK-IN/ RECEPTION



STUDENT HOUSING & HOSPITALITY SERVICES
OKANAGAN HOUSING & ACCOMMODATION MAP

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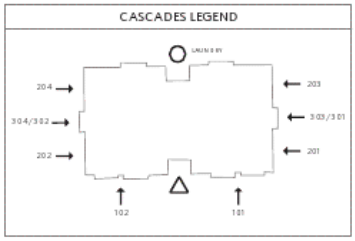

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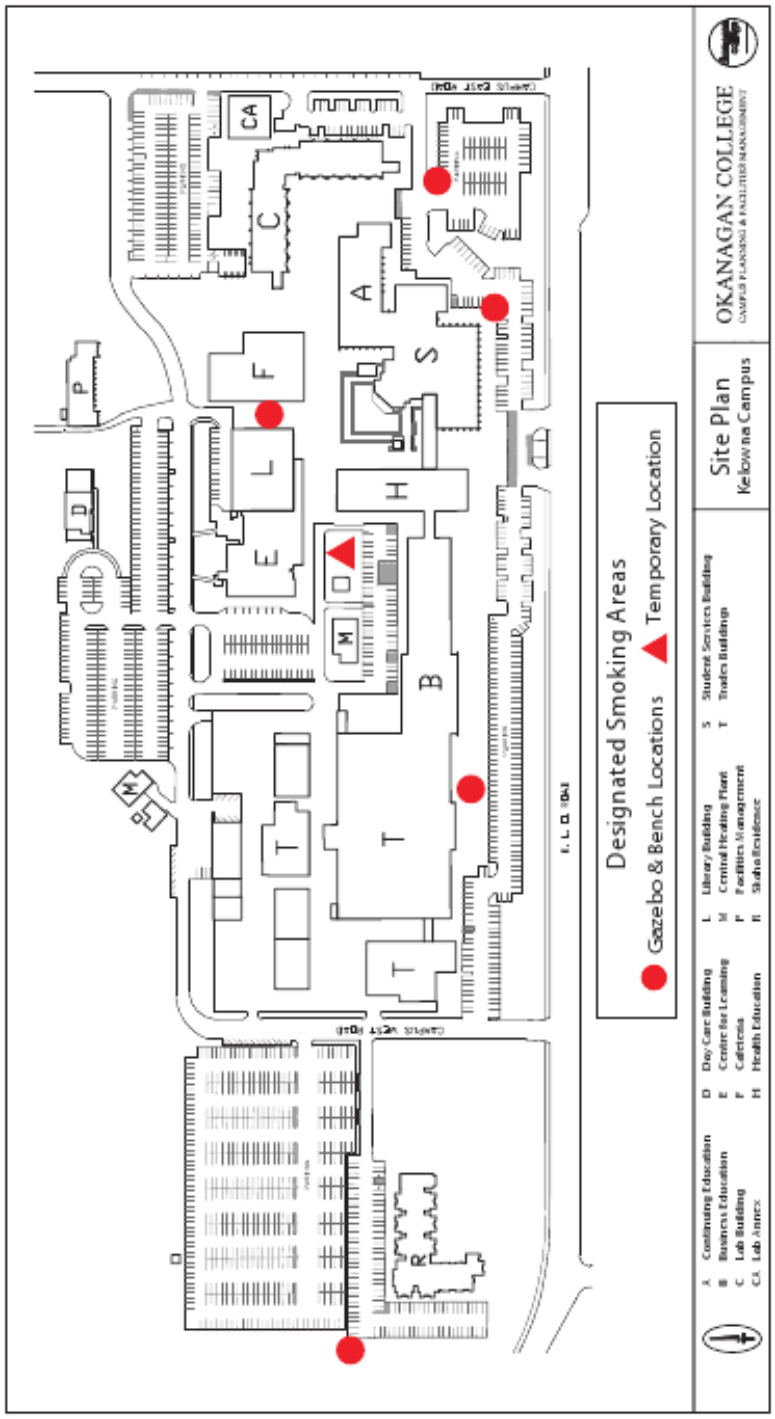
Designated Smoking Areas
Gazebo & Bench Locations
Temporary Location
Site Plan
Kelowna Campus
OKANAGAN COLLEGE
A Continuing Education
B Business Education
C Lab Building
CA Lab Annex
D Day Care Building
E Centre for Learning
F Cafeteria
H Health Education
L Library Building
M Central Heating Plant
P Facilities Management
R Skaha Residence
S Student Services Building
T Trades Buildings