THE FOURTEENTH COLLOQUIUMFEST

Pacific Institute for the Mathematical Sciences | University of Saskatchewan | College of Arts and Science, Department of Mathematics and Statistics, Department of Computer Science

Room 18, Edward School of Business, University of Saskatchewan

Friday, February 28

Colloquium Tea 1:00-1:30 pm, Thorvaldson Building, Room 274

CS Colloquium
1:30-2:20 pm

Robin Cockett
Department of Computer Science, University of Calgary
"Fixed points in programming: datatypes and protocols"

Abstract

A huge attraction of having an underlying abstract mathematical semantics -- in particular a categorical semantics -- is that this can provide an imperative which determines the language features and ensures that they interact correctly. Programming then becomes -- as some believe it should -- a mathematical exercise in which certain aspects of correctness are guaranteed by construction (from type checking).

This talk will describe how one can extract from a categorical semantics the features and operational semantics of a concurrent programming languages. While we are just beginning to explore this as a setting for programming, it is already clear that it is an expressive and ``intentionally'' rich language. It may well have significant implications for the design of concurrent languages of the future ....

The categorical semantics, on which this language is based, is a ``linear category'' -- this is a *-autonomous category with certain ``message passing'' features. The operational behaviour of the language is then largely determined by categorical fixed points at both the sequential and the concurrent level. The fixed points, at the sequential level, are just datatypes: they come -- as is well-known -- in two quite distinct (but dual) forms as initial algebras and final coalgebras. Concurrent fixed points, on the other hand, are called protocols: while they also come in two forms (corresponding to initial and final coalgebras) both forms behave in essentially the same way, because of the symmetric nature of the concurrent setting.

COFFEE BREAK (Room 201 McLean Hall)

Math & Stats Colloquium
3:30-4:20pm

Anthony Lau
Department of Mathematical and Statistical Sciences, University of Alberta
"Fixed point and related geometric properties on the Fourier and Fourier Stieltjes algebras of locally compact groups"

Abstract

In this talk, I shall discuss some recent results concerning various geometric properties including fixed point properties for nonexpansive mappings on weakly (or weak*) compact convex sets and Radon-Nikodym property on the Fourier and Fourier Stieltjes algebras of a locally compact group.

4:30-5:20pm

Amr Sabry
School of Informatics and Computing, Indiana University, Bloomington
"Discrete Quantum Theories"

Abstract

The idea of computable numbers is of foundational significance in computer science and has had a significant impact on logic. However, despite arguments and challenges noted by prominent researchers (e.g., Chaitin, Feynman, Minsky), most mathematical models, and hence most physical models (including models of quantum mechanics) depend on uncomputable numbers, that is, the continuum of real (or complex) numbers. This observation motivates a foundational study of quantum mechanics from a computational perspective. Our program is to investigate variants of quantum mechanics formulated with computable number systems, analyze their computational power, and compare to the conventional model based on uncomputable numbers, isolating and teasing apart various important aspects of quantum mechanics (order, inner product, metric, angles, geometry, probability, etc.) that are "encoded" in the real numbers and in the field of complex numbers.

6:30pm **Banquet**

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Saturday, March 1

10:00-10:50am — **Marlène Frigon**
Département de mathématiques et de statistique, Université de Montréal
"Fixed point results for contractions on a graph and applications to graph iterated functions systems"

11:10am-12:00noon — **Franklin Mendivil**
Department of Mathematics & Statistics, Acadia University
"Fractal set-valued measures"

Abstract

In this talk we will discuss the problem of generalizing the classical IFS notion of fractal to the setting of set-valued measures. The main theme is setting up the appropriate framework in this setting, which includes a useful metric on a space of measures along with a natural fractal operator which is contractive on this space.

We will present two different notions of set-valued measure and, for each of these, will present the framework along with some examples. We will finish the talk with a brief discussion on, and examples of, how fractal measures can be generalized to recursive partitioning schemes.

12:10-1:00pm — **Wieslaw Kubiś**
Institute of Mathematics, Czech Academy of Sciences
"On topological iterated function systems"

Abstract

We shall discuss a recently invented notion of a topological iterated function system, showing that it is equivalent to a system of weak contractions with respect to some compatible metric. (Joint work with T. Banakh, M. Nowak and F. Strobin.)

LUNCH Room 201 McLean Hall

2:30-3:20pm — **Tristan Tager**
Department of Mathematics, Indiana University, Bloomington
"Expecting the Unexpected: Surprises in the Hunt for Nonarchimedean Fractals"

Abstract:

We construct machinery sufficient for the generation of nonarchimedean fractals, but encounter several surprises along the way. This machinery will generalize the fact that, in a complete metric space, a fractal is a fixed point of an iterated function system on the space of compact sets over that metric space. Surprisingly, it turns out that to obtain a meaningful generalization, we need to broaden our notions of almost all of these concepts. Perhaps most surprising is why we require a new generalization of metric spaces, since several powerful ones already exist, and why we require a generalization of compactness, which is a frequently-used condition in nonarchimedean analysis.

3:30-4:20pm — **Ralph Kopperman**
Department of Mathematics, City College of New York
"A generalized metric notion of partial knowledge"

Abstract:

We would like algorithms that will obtain increasingly accurate representations of a desired number or object. About a quarter century ago, Steve Matthews invented a generalized metric that simultaneously models closeness and the partiality of knowledge. Complete partial metric spaces have a contraction fixed point theorem that gives conditions under which an algorithm will approach a desired object arbitrarily closely. Partial metrics can also be generalized to yield all topologies.

COFFEE BREAK

4:40-5:30pm	**Rene Bartsch** Fachbereich Mathematik, TU Darmstadt “Hyperspaces in topological categories”
Abstract	Hyperspaces form a powerful tool in some branches of mathematics: lots of fractal and other geometric objects can be viewed as fixed points of some functions in suitable hyperspaces - as well as interesting classes of formal languages in theoretical computer sciences, for example (to illustrate the wide scope of this concept). Moreover, there are many connections between hyperspaces and function spaces in topology. Thus results from hyperspaces help to get new results in function spaces and vice versa. Unfortunately, there is no natural hyperspace construction known for general topological categories (in contrast to the situation for function spaces). We will shortly present a rather combinatorial idea for the transfer of structure from a set X to a subset of P(X), just to motivate an interesting question in set theory. Then we will propose and discuss a new approach to define hyperstructures, which works in every cartesian closed topological category, and so applies to every topological category, using it's topological universe hull.
6:15pm	**The Kuhlmann's residence: Party with Feuerzangenbowle**