Computability Theory and Applications: A Meeting in Honor of Robert I. Soare

May 14–15, 2011 • University of Chicago

Schedule

(All talks in Ryerson 251)

Friday, May 13

5:00–7:00	**Informal reception** (Tea Room)

Saturday, May 14

9:00–9:30	**Registration/Coffee/Treats** (Tea Room)
9:30–9:40	**Opening Remarks**
9:40–10:30	**Steffen Lempp**, University of Wisconsin–Madison *The priority argument—55 years later*
10:40–11:30	**Anil Nerode**, Cornell University *New vistas in feedback quantum control*
11:30–1:30	**Lunch**
1:30–2:20	**Leo A. Harrington**, University of California, Berkeley *From the inside, the unique non-computable computably enumerable set*
2:30–3:20	**Gerald E. Sacks**, Harvard University *E-closed model theory*
3:20–4:00	**Coffee/Treats** (Tea Room)
4:00–4:50	**Theodore A. Slaman**, University of California, Berkeley *Random reals, the Rainbow Ramsey Theorem, and arithmetic conservation*
6:00	**Dinner** (Quadrangle Club)

Sunday, May 15

9:00–9:30	**Coffee/Treats** (Tea Room)
9:30–10:20	**Carl G. Jockusch, Jr.**, U. of Illinois at Urbana–Champaign *Asymptotic density and computably enumerable sets*
10:30–11:20	**Julia F. Knight**, University of Notre Dame *Integer parts*
11:20–12:00	**Coffee/Treats** (Tea Room)
12:00–12:50	**Richard A. Shore**, Cornell University *Prime, atomic and homogenous models: the view from reverse mathematics*
12:50–1:00	**Closing Remarks**

Abstracts

Leo A. Harrington, University of California, Berkeley

From the inside, the unique non-computable computably enumerable set

It is a consequence of Soare's Extension Theorem that, as we vary through the non-computable c.e. sets A and look at the structures $(\mathcal{E}(A), \subseteq, \mathcal{R}(A))$ (the c.e subsets of A under inclusion with a predicate for the computable subsets of A), these structures are all isomorphic. As an attempt towards understanding this isomorphism type, we will look at sets of computable sets $\mathcal{R}$ such that the $(\mathcal{E}(A), \subseteq, \mathcal{R}(A))$ are isomorphic to $(\mathcal{E}, \subseteq, \mathcal{R})$ (the structure of all the c.e sets under inclusion with a predicate for $\mathcal{R}$). The collection of all such $\mathcal{R}$ forms an orbit under automorphisms of $(\mathcal{E}, \subseteq)$. This talk will attempt to say something (not much) about this orbit.

Carl G. Jockusch, Jr., University of Illinois at Urbana–Champaign

Asymptotic density and computably enumerable sets

I will describe recent work which is joint with Paul Schupp and mostly also joint with Rod Downey. A key sample result is that there is a computably enumerable set of density 1 which has no computable subset of density 1 . Furthermore, the degrees of such sets are exactly the nonlow c.e. degrees. (Here the (asymptotic) density of a set A of natural numbers is the limit of $|A \cap \{0, 1, ..., n-1\}|/n$, as n approaches infinity, provided this limit exists.) More generally, we consider the extent to which it is true that every c.e. set A has a computable subset B such that $A - B$ has small density in some sense.

Julia F. Knight, University of Notre Dame

Integer parts

I will describe joint work with Karen Lange, Paola D'Aquino, and Salma Kuhlmann, on integer parts for real closed fields, and on exponential integer parts for exponential real closed fields. When we try to answer model theoretic questions about these objects, we are forced to consider coding and ideas from computability. When we try to answer questions about the complexity of the objects, we are led to a deeper understanding of the model theory and algebra.

Steffen Lempp, University of Wisconsin–Madison

The priority argument—55 years later

I will review the history of the priority argument, both in its development and in its exposition in research papers and textbooks.

Anil Nerode, Cornell University

New vistas in feedback quantum control

I and my long time co-worker Wolf Kohn have developed a systematic theory with algorithms for extracting feedback quantum controllers for both nanoscopic and macroscopic processes. We are in process of having some of the more important

applications implemented in silicon. I will give some idea of the new methods and how they arise somewhat indirectly from our twenty years previous work on hybrid systems and optimal control on Finsler manifolds, and from ideas of Weyl, Segal, and their successors.

Gerald E. Sacks, Harvard University

E-closed model theory

Completeness and compactness for E-closed, inadmissible, initial segments of L.

Richard A. Shore, Cornell University

Prime, atomic and homogenous models: the view from reverse mathematics

Bob Soare, along with various students and colleagues, has intensively investigated classical model theoretic theorems about prime, atomic and homogeneous models from the viewpoint of computability theory. While still heavily relying on recursion theoretic methods and results, we carry this investigation into the realm of reverse mathematics by analyzing the proof theoretic strength of a variety of such theorems. We discuss previous work with Hirschfeldt and Slaman on prime and atomic models as well as new work with Hirschfeldt and Lange on homogenous ones.

Theodore A. Slaman, University of California, Berkeley

Random reals, the Rainbow Ramsey Theorem, and arithmetic conservation

In joint work with Chris Conidis, we investigate the question "To what extent can random reals be used as a tool to establish number theoretic facts?" Let 2-RAN be the principle that for every real X there is a real R which is 2-random relative to X. By arguments of Csima and Mileti, $RCA_0 + 2\text{-}RAN$ implies the Rainbow Ramsey Theorem for pairs, a variation on the usual Ramsey Theorem. We show that the Rainbow Ramsey Theorem is not conservative over RCA_0 for arithmetic sentences. Then, we show that 2-RAN is conservative over $RCA_0 + B\Sigma_2$ for Π^1_1-sentences. Thus, the set of first-order consequences of 2-RAN is strictly stronger than $P^- + I\Sigma_1$ and no stronger than $P^- + B\Sigma_2$.

Lunch information

There are a number of lunch options near the meeting venue.

- Just across the small quad to the north of Eckhart Hall is the Reynolds Club, which houses Einstein Brothers Bagels, a food-court with Subway, Robinsons #1 Ribs, Bene Pizzeria, Wokery Stir-Fry, Southern Tsunami Sushi, and Saffron Indian Cuisine, and the Hallowed Grounds coffee shop.

- Northeast of Ryerson and Eckhart Halls, along 57th Street, there are several restaurants, including Edwardo's Natural Pizza, Zaleski & Horvath MarketCafe, Medici on 57th, and Noodles Etc.

More information about eateries and coffee shops is available at

`chicagolife.uchicago.edu/city/hp_dining.shtml`.

If going for lunch to one of the restaurants, we recommend breaking up into groups of six or fewer for faster seating (or—in many places—seating, period).

Credits

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Acknowledgements

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