Computability and Randomness in Paris 2011

Tuesday, June 7

(Room 0C05)

9:00 - 9:30 Coffee.

9:30 - 10:15 Thorsten Kräling, *The partial orderings of the c.e. ibT- and cl-degrees*

A set A is cl-reducible to a set B if A is Turing-reducible to B via a reduction where the oracle questions to determine whether x is in A are bounded by x+c for some constant c. A is ibT-reducible to B if this constant can be chosen to be 0. Considering the structures of the computably enumerable ibT- and cl-degrees, it turns out that most proven results that hold for one of these structures hold for the other one as well. In the talk we exhibitit a property, expressable in the language of the orderings, that holds for the c.e cl-degrees but not for the c.e ibT-degrees.

10:30 - 11:15 André Nies, *Randomness meets computable analysis*

I will talk about recent interactions of randomness and computable analysis. I discuss randomness and K-triviality in computable metric spaces. Further, I will give an update on the program to characterize all algorithmic randomness notions via differentiability. Recent progress is in higher dimensions.

11:30 - 12:15 Stijn Vermeeren, *Notions of computable randomness*

I will talk about computable randomness, and the partial and non-monotonic versions of this notion. In particular, I will present my own construction of a partial computable random sequence that is not total injection random.

12:15 - 14:00 Lunch and coffee.

14:00 - 14:45 Alexander Shen, *Kolmogorov complexity and logical connectives*

In this talk I'll try to survey some (rather old) results relating Kolmogorov complexity to intuitionistic logic (Muchnik, Vereshchagin, Chernov and others). It is natural to interpret conditional complexity $C(a|b)$ as the complexity of a problem "generate a when b is given, or, in other words, the complexity of implication $b \to a$. Other propositional formulas, e.g., $(a \to b) \to c$, or $(a \vee b) \to c$, or $(a \leftrightarrow b)$ also have natural interpretations of this type, and their complexity is not obvious. In turns out that in all these three cases the complexity can be expressed in terms of classical Kolmogorov complexity, but it is not always the case, and that this interpretation is closely related to intuitionistic logic and gives a complete semantics for its positive fragment.

15:00 - 15:45 Fabien Givors, *Sub-computabilities*

Every recursively enumerable set of integers (r.e. set) is enumerable by a primitive recursive function. But if the enumeration is required to be one-one, only a proper subset of all r.e. sets

qualify. Starting from a collection of total recursive functions containing the primitive recursive functions, we thus define a sub-computability as the structure of the r.e. sets that are one-one enumerable by total functions of the given collection. Notions similar to the classical computability ones are introduced and variants of the classical theorems are shown. The similarity between sub-computabilities and (complete) computability is surprising, since there are so many missing r.e. sets in sub-computabilities. This similarity hints at a general framework for computability, in which other computabilities, especially hyper-computabilities, can be embedded.

15:45 - 16:15 Coffee.

16:15 - 18:30 Time for discussion (in conference room or room 6C92).

18:30 Departure for restaurant.

Wednesday, June 8

(Room 0C02)

9:00 - 9:30 Coffee.

9:30 - 10:15 Pascal Vanier, *Tilings and Π_1^0 classes*

In this talk, we will show that given any Π_1^0 subset P of $\{0,1\}^{\mathbb{N}}$ there is a tileset τ with a set of configurations C such that $P \times \mathbb{Z}^2$ is recursively homeomorphic to $C \setminus U$ where U is a computable set of configurations. As a consequence, if P is countable, this tileset has the exact same set of Turing degrees.

10:30 - 11:15 Laurent Bienvenu, *Randomness extraction: a computability perspective*

Imagine you want to generate a random sequence of bits, but all you have at your disposal is an imperfect source of randomness (for example a biased coin or the bits representing your computer's memory which contains some randomness but also some regularities). Is it possible to algorithmically turn this weak source into a perfect (or close-to-perfect) one? This is the problem of randomness extraction, which is a very active research topic in mathematics and computer science. There are of course many ways to interpret the above question, and in this talk will discuss this question from the perspective of computability theory. The main tool computability theory offers to tackle questions related to randomness is Kolmogorov complexity, which measures the 'amount of randomness' contained in finite objects (such as binary strings). Objects are defined to be 'random' if they have maximal Kolmogorov complexity. We can therefore focus on a particular interpretation

of the above question: given an object of non-maximal Kolmogorov complexity, is it possible to effectively transform this object into one of maximal (or close-to-maximal) Kolmogorov complexity? We will survey the impressive progress which has been made over the last five years regarding this last question.

11:30 - 12:15 Antoine Taveneaux, *How much randomness is needed for statistics?*

Kjos-Hanssen showed that Hippocratic and Galenic randomness coincide in the case of Martin-Löf randomness, in this talk continue this work and try to give similar results for other randomness notions.

12:15 - 14:00 Lunch and coffee.

14:00 - 14:45 Chris Porter, *Randomness and truth-table reducibility*

According to Demuth's Theorem, if one applies a total Turing functional to a Martin-Löf random sequence, as long as the output of this procedure does not completely destroy the random character of original sequence (by mapping it to a computable sequence), then we can effectively recover a Martin-Löf random sequence from the output sequence. That is, the output sequence will be Turing equivalent to a Martin-Löf random sequence. In my talk, I will discuss the extent to which Demuth's Theorem can be generalized, by considering different notions of randomness (such as Schnorr randomness and computable randomness) and by considering more restricted ways of recovering randomness from the output sequence (most notably, via wtt-reductions).

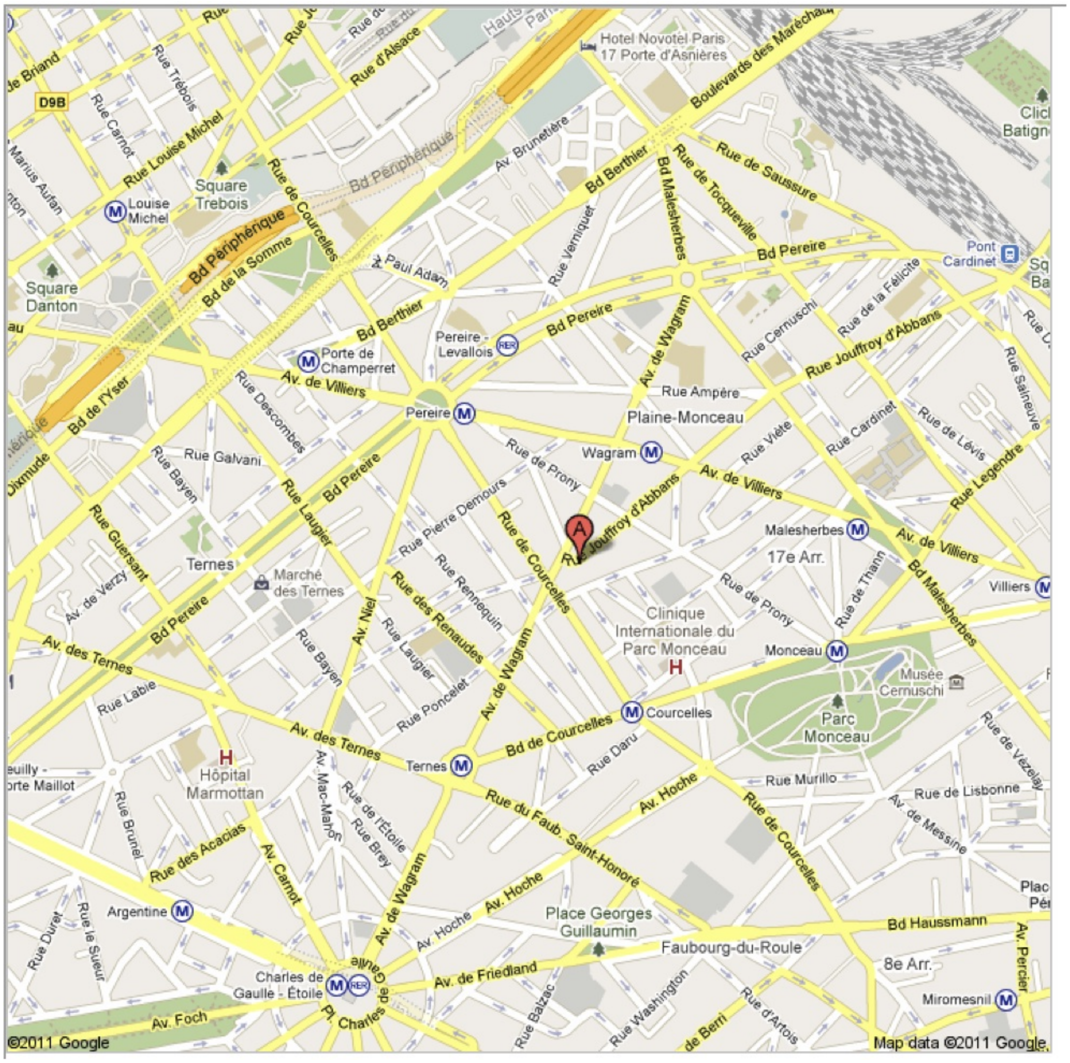
15:00 - 15:45 TBA, *TBA*

15:45 - 16:15 Coffee.

16:15 - 18:30 Time for discussion (in conference room or room 6C92).

Conference Dinner

The conference dinner will start at 19:30 at restaurant Félix, at 99 Rue Jouffroy d'Abbans, 75017 Paris. The nearest subway stop is "Wagram", but it is not so far from "Charles de Gaulle Etoile" which is much easier to reach. You can go there by your own means (and at your own risks :-)) or go with the group leaving at 18:30 from the conference room.



Menu

Starters

Tartare de saumon à l'aneth et citron vert
Salmon tartare with dill and lime
or
Oeuf bio poché sur fondue de poireaux et crème de ciboulette.
Poached organic eggs on leek fondue and chive cream

Mains

Filet de bar rôti au coulis de basilic, riz rouge
Roasted seabass filet on a basil coulis with red rice
or
Magret de canard au cidre, poêlée de pleurotes.
Duck magret (breast) prepared with cider and pan-fried pleurotus (mushroom)

Desserts

Salade d'agrumes au thé vert et menthe fraîche
Citrus fruit salad with green tea and fresh mint
or
Brioche façon pain perdu au caramel beurre salé, glace crème brûlée.
French toast style brioche with salted caramel and crème brûlée ice cream