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# THINK

University of Liverpool  
Inaugural Lecture  
Series 2007/08

The Vice-Chancellor, Professor Drummond Bone,  
invites you to an Inaugural Lecture by

**Professor Leslie Ann Goldberg**  
Chair of Computer Science

**Exploring computational complexity  
through graph homomorphisms**

Friday 23 May 2008

08

# EXPLORING COMPUTATIONAL COMPLEXITY THROUGH GRAPH HOMOMORPHISMS



Professor  
Leslie Ann  
Goldberg

Chair of Computer Science

'Computational complexity' is the study of the inherent difficulty of computational problems. The goal is to classify each problem according to its difficulty. Clearly, some problems are known to be tractable - for these we have fast, efficient algorithms. Other problems are known to be intractable - there are actually proofs that no algorithm could possibly solve these problems quickly, even with vastly faster computers and programming languages. These problems have been shown to be inherently intractable, so they would make good building blocks for constructing provably secure cryptosystems. In an effort to understand the fundamental principles underlying problem complexity - and in an effort to classify some of the many important computational problems whose complexity we have not resolved - researchers have developed a rich and deep understanding of the principles underlying computation. What is it that makes a problem hard? How can you tell whether a problem is tractable? There is a lot that we understand, and even more that we don't understand, for example, the answer to the famous 'P vs NP' problem. This talk will give a glimpse of the kind of classification theorems that are now known, by looking at an interesting and surprisingly general problem domain related to graph homomorphisms.

## Biography

Leslie Ann Goldberg grew up in Los Alamos, New Mexico, and studied at Rice University in Houston, Texas. She came to the UK in 1987 as a Marshall Scholar. Leslie completed her PhD in 1992 at the University of Edinburgh, under the supervision of Professor Mark Jerrum. From 1992-1995, she worked as a Research Fellow, and then as a Senior Member of Technical Staff in the Algorithms and Discrete Mathematics Department

of Sandia National Labs in the USA. From 1995-1996, Leslie worked in the Department of Computer Science at Warwick University, as a Lecturer, Senior Lecturer and Reader. In August 2006, she was appointed Professor of Computer Science at the University of Liverpool. Leslie's research is in the area of 'algorithms and computational complexity'. Her research focuses particularly on randomised algorithms, and on analysis of Markov-chain based sampling algorithms. This

research lies at the intersection of computer science, combinatorics, and probability. Leslie is the author of over 80 scientific papers and has served on many program committees and editorial boards. She is currently PC Chair of the 35th International Colloquium on Automata, Languages and Programming, and an Associate Editor of *SIAM Journal on Computing* and *ACM Transactions on Algorithms*.

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Lecture Theatre, Ashton Building, 3.30pm