Semester Report WS03 of Manuel Bodirsky

Name:	Manuel Bodirsky
Supervisor:	Prof. Dr. Hans Jürgen Prömel
Topics:	Constraint Satisfaction with Infinite Domains; Generation of Random Planar Structures;
PhD Student	At the program since April 2001

Fields of Research and Results

I work on two topics: constraint satisfaction and generation of random planar structures.

Constraint Satisfaction. In this semester I wrote my thesis which is about constraint satisfaction with infinite domains. A constraint satisfaction problem is given by a fixed finite structure, the *template*. The constraint satisfaction problem for this template is to check for a given finite structure whether there is a homomorphism to the template. This is intensively studied for finite templates. The framework of computational problems that I am investigating in my thesis is constraint satisfaction with an infinite, but well-structured template. We argue that countably categorical templates [9] are well-structured in the sense that many techniques for constraint satisfaction for finite templates still apply for countably categorical templates. Several of our previous algorithmic results fit into this framework [3, 8]. When writing the thesis I made several observations in this context that are mostly contained in [2].

Generation of Random Planar Structures. At ICALP'04 [6] we presented how to count and uniformly generate labeled planar graphs. Our goal is now the generation of unlabeled random planar graphs. For three-connected embedded and rooted planar graphs we can do this, reproving a result of Schaeffer [10]. Refining the techniques presented at EUROCOMB'04 [1] we can use this to also count and generate 2-connected unlabeled planar graphs [5]. Our initial work on counting and generating labeled and unlabeled *outerplanar* graph was accepted for publication in the Journal on Combinatorics, Probability and Computation [7].

Activities

Attended lectures, schools, workshops, conferences:

- Algebra and discrete mathematics in Hattingen, July 26-31, 2003.
- Block-course *Permutation groups, structures, and polynomials*, by Peter Cameron, January–March 2004, Charles University, Prague.
- Fall School on Computational Geometry, Neustrelitz, October 2 to October 4, 2003.

I gave talks at the following events:

- *Constraint Satisfaction with Countable Homogeneous Templates*, Computer Science Logic (CSL03), Vienna, August 25-30, 2003.
- *Generating Unlabeled 3-Regular Planar Graphs Uniformly at Random*, EUROCOMB'03, Prague, September 8-12, 2003.
- *Unrooting Planar Structures*, Workshop of the CGC, Neustrelitz, September 28 to October 1, 2003.
- *Constraint Satisfaction with Infinite Domains*, Forschungsseminar at Humboldt University Berlin, December 2003.
- *A New Algorithm for Normal Dominance Constraints*, Symposium on Discrete Algorithms (SODA'04), New Orleans, January 11-13, 2004.
- I will present *Efficiently Computing the Density of Regular Languages* [4] at LATIN'04, Buenos Aires, April 4-9, 2004.

Literatur

[1] M. Bodirsky, , C. Groepl, and M. Kang. Generating unlabeled 3-regular planar graphs uniformly at random. Presented at EUROCOMB'03, 2003.

[2] M. Bodirsky. Constraint satisfaction and monotone SNP. Preprint, submitted, 2004.

[3] M. Bodirsky, D. Duchier, J. Niehren, and S. Miele. A new algorithm for normal dominance constraints. In *Proceedings of the ACM-SIAM Symposium on Discrete Algorithms (SODA'04)*, pages 59–67, New Orleans, January 2004.

[4] M. Bodirsky, T. Gärtner, T. von Oertzen, and J. Schwinghammer. Efficiently computing the density of regular languages. In *Proceedings of Latin American INformatics (LATIN'04)*, 2004.

[5] M. Bodirsky, C. Groepl, and M. Kang. Generating unlabeled planar graphs. Submitted, 2004.

[6] M. Bodirsky, C. Gröpl, and M. Kang. Generating labeled planar graphs uniformly at random. In *Thirtieth International Colloquium on Automata, Languages and Programming (ICALP'03)*, pages 1095–1107, 2003.

[7] M. Bodirsky and M. Kang. Generating random outerplanar graphs. Submitted. Presented at the 1st workshop on Algorithms for Listing, Counting, and Enumeration ALICE 03. Accepted for publication in J. of Combinatorics, Probability and Computation, 2003.

[8] M. Bodirsky and M. Kutz. Pure dominance constraints. In *Proceedings of the 19th Annual Symposium on Theoretical Aspects of Computer Science (STACS'02)*, pages 287–298, Antibes - Juan le Pins, 2002.

[9] M. Bodirsky and J. Nešetřil. Constraint satisfaction with countable homogeneous templates. In *Proceedings of Computer Science Logic (CSL'03)*, pages 44–57, Vienna, 2003.

[10] G. Schaeffer. Random sampling of large planar maps and convex polyhedra. In *Proc. of the Thirty-first Annual ACM Symposium on the Theory of Computing (STOC'99)*, pages 760–769, Atlanta, Georgia, May 1999. ACM press.