Scientific report of Kamil Kloch

Name:	Kamil Kloch
Supervisor(s):	Stefan Felsner
Field of Research:	Partial Orders
Topic:	Online chain partitioning of upgrowing semi-orders
PhD Fellow	at the program from February to August 2005

Field of Research

During my seven-month scholarship at the Technical University in Berlin I worked on the properties of the online partial orders. Plenty of research has been done in the field especially in the last twenty years. One of the tackling questions in this area is the problem of the online chain partitioning of an order. As for now, in the general case a quadratic lower-bound and the exponential upper-bound [2] is the best known result. For the class of upgrowing orders, a matching quadratic upper- and lower-bound was proven by Felsner in [1]. From this result many interesting questions arose. One of them was the online chain partitioning of semi-orders. During my stay in Berlin, in joint work with prof. Felsner and my colleagues from Kraków we managed to give some exact solutions to the problem.

Results

A partial order P is called a semi-order if there exists a function I which assigns to each element x of the order a closed unit interval $I(x) = [i_x, i_x + 1]$ of the real line so that $x < y$ in P if and only if $I(x) < I(y)$ (i.e. if $i_x + 1 < i_y$). The online chain partitioning of a semi-order can be viewed as a two-person game. The game is played in rounds. The first player builds the online order, one point at a time. The second player responds by making an irrevocable assignment of the new point to one of the chains of the chain partition. In the upgrowing variant of the game the new point presented by the first player has to be a maximal element in the present order. The performance of the second player is measured by comparing the number of chains used with the the number of chains used by an optimal offline algorithm, i.e., with the width of the order. We proved a matching lower- and upper-bound of $\lfloor(\sqrt{5}+1)w/2\rfloor$ on upgrowing semi-orders of width w. In the general, non-upgrowing case we proved a matching lower- and upper-bound of $2w - 1$.

My stay in Berlin had turned out productive and successful. I had an opportunity to work on posets together with prof. Felsner and to attend CGC lectures. I got to know other Marie-Curie Fellows as well as Colleagues from the Institute. We talked a lot, exchanged opinions and think of working together on some problems. The scientific atmosphere in Berlin suited me really fine.

Activities

Talks

- *Online chain partitioning of upgrowing semi-orders*
  XIX Forum Informatyki Teoretycznej, Karpacz, April 15th, 2005
- *Online chain partitioning of upgrowing semi-orders*
  CGC-Colloquium at the FU Berlin, April 25th, 2005
- *Compact visibility representation of plane graphs*
  Seminar "Grap Drawing", Bad Freienwalde, July 9th, 2005
- *Fooling Alice*
  Noon Seminar of the Workgroup "Diskrete Mathematik", June 2005

Attended schools and lectures

- *Enumerative Combinatorics*
  CGC Spring School, June 1–4, 2005
- *Discrete Structures*
  TU Berlin, Lecture, 2005
- *Algorithms for Matroids*
  TU Berlin, Lecture, 2005

Preview

- *European Conference on Combinatorics, Graph Theory and Applications (EuroComb)*
  Berlin, September 5–9, 2005

References

[1] S. Felsner, *On–line chain partitions of orders*, Theoret. Computer Science, 175, 283–292, 1997

[2] H. A. Kierstead, *An effective version of Dilworth theorem*, Transact. Amer. Math. Soc., 268(1): 63–77, 1981.

[3] W. T. Trotter, *Combinatorics and partially ordered sets: dimension theory*, John Hopkins Press, 1992