Title: Bounded fixed-parameter tractability and $\log^2 n$ nondeterministic bits

Authors: J&#65533;rg Flum, Martin Grohe and Mark Weyer

Abstract: Motivated by recent results showing that there are natural parameterized problems that are fixed-parameter tractable, but can only be solved by fixed-parameter tractable algorithms the running time of which depends non-elementarily on the parameter, we propose a notion of *bounded fixed-parameter tractability*, where the dependence of the running time on the parameter is restricted to be singly exponential.

We develop a basic theory that is centred around the class EPT of tractable problems and an EW-hierarchy of classes of intractable problems, both in the bounded sense. By and large, this theory is similar to the established *unbounded* parameterized complexity theory, but there are some remarkable differences. Most notably, certain natural model-checking problems that are known to be fixed-parameter tractable in the unbounded sense have a very high complexity in the bounded theory. The problem of computing the VC-dimension of a family of sets, which is known to be complete for the class W[1] in the unbounded theory, is complete for the class EW[3] in the bounded theory.

It turns out that our bounded parameterized complexity theory is closely related to the classical complexity theory of problems that can be solved by a nondeterministic polynomial time algorithm that only uses $\log^2 n$ nondeterministic bits, and in particular to the classes LOGSNP and LOGNP introduced by Papadimitriou and Yannakakis (1996).

Last modified: Tue Oct 7 22:45:04 CEST 2003
Martin Grohe