MATEMATISKA INSTITUTIONEN
STOCKHOLMS UNIVERSITET
Avd. Matematik

SJÄLVSTÄNDIGT ARBETE I MATEMATIK

Onsdagen den 20 april kl. 10.00–11.00 presenterar John Sass sitt arbete "Boolean polynomials and Gröbner bases: An algebraic approach to solving the SAT-problem" (30 högskolepoäng, avancerad nivå).

Handledare: Samuel Lundqvist

Plats: Sal 21, hus 5, Kräftriket

Abstract: Being NP-complete, the problem of deciding boolean satisfiability, or SAT-problem, is probably impossible to solve efficiently. Nevertheless, this hasn't stopped people trying, and in this paper we present one method based on abstract algebra. The paper contains a repetition of basic abstract algebra, as well as an introduction to Gröbner bases and the Buchberger algorithm. Then we will show how boolean formulas can be transformed into polynomials in the $\mathbb{Z}_2$-polynomial ring, so that satisfiability is preserved as solvability. After that we will take a closer look at the ideal generated by such polynomials and the so called field equations, and prove that any potential solutions to this ideal only has coordinates in $\mathbb{Z}_2$, precisely corresponding with solutions that satisfy the boolean formula. After that, we will show how a quick glance at a Gröbner basis of this ideal will tell if any solutions exist. Finally, there will be some technical discussion, heuristic suggestions and possible ways to develop the technique further.

Alla intresserade är välkomna!