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Logic Seminar Summer 2019:
Constraint Satisfaction Problems

Constraint Satisfaction Problems (CSP) form a class of decision problems with wide ranging applications. The traditional view (in artificial intelligence) regards these problems as variable assignment problems under given constraints (hence the name CSP); virtually the same problem is known in database theory in connection with unions of conjunctive queries. A common interpretation as *homomorphism problems* provides a mathematically unified view. The general instance of this homomorphism problem is the following: given two finite relational structures $\mathcal{A}$ and $\mathcal{B}$, decide whether there is a homomorphism $h\colon \mathcal{A} \to \mathcal{B}$. This is evidently an NP decision problem. Moreover, important NP-complete problems (like 3-colourability) may be obtained by fixing the target structure $\mathcal{B}$ (in this case: a triangle); other such specialisations are known to be polynomial time tractable. A long-standing conjecture by Feder and Vardi that CSP displays a corresponding *dichotomy* (avoiding any intermediate levels between NP and P) has only recently been confirmed.

The seminar will be based on survey articles and original papers dealing with the analysis of CSP, and in particular with key steps towards the dichotomy phenomenon. Methods from logic on the one hand, and from universal algebra on the other hand have greatly contributed to this field of research.

Background: A basic knowledge of mathematical logic or universal algebra; while some familiarity with complexity considerations can be helpful it is not a requirement. The seminar covers topics of interest in both mathematical logic and theoretical computer science.

A preliminary organisatorial meeting of potential participants will be held in the first week of the teaching term (date and time to be announced; please register by email to both the organisers).

Students interested in participating should register in TUCaN *and* send an email to the organisers: `eickmeyer/otto@mathematik.tu-darmstadt.de`