Centre d'Analyse et de Mathématique Sociales

École des Hautes Études en Sciences Sociales
Centre National de la Recherche Scientifique UMR 8557
54 boulevard Raspail — 75006 Paris — FRANCE

Patrice Ossona de Mendez
Chargé de Recherche CNRS (HDR)
Invited Professor at Charles University, Prague
Associated researcher at Zhejiang Normal University
Editor-in-Chief of the *European Journal of Combinatorics*

August 25, 2023

Report on the thesis entitled

"Using gadget construction in structural convergence"

submitted by Tomáš HONS

to earn the Computer Science Master of Science degree at Charles University (Prague)

Structural convergence is a framework for convergence of graphs and relational structures based on the probability of satisfaction of first-order formulas, which was introduced by Nešetřil and Ossona de Mendez. In his thesis, Tomáš HONS considers how the replacement of the relations by gadgets affects the convergence of a sequence of relational structures (with emphasis on the elementary and local convergence). Precisely, Tomáš HONS considers a convergence sequence $(\mathbf{A}_n)_{n\in\mathbb{N}}$ of relational structures and a convergent sequence $(\mathbf{G}_n)_{n\in\mathbb{N}}$ of gadgets, and consider the sequence $(\mathbf{A}_n * \mathbf{G}_n)_{n\in\mathbb{N}}$ of relational structures obtained by replacing each occurrence of a given relation R in $\mathbf{A}_n$ by the gadget $\mathbf{G}_n$. The first result proved by Tomáš HONS in his thesis is that if $\mathbf{A}$ is an elementary limit of $(\mathbf{A}_n)_{n\in\mathbb{N}}$ and $\mathbf{G}$ is an elementary limit of $(\mathbf{G}_n)_{n\in\mathbb{N}}$, then $\mathbf{A} * \mathbf{G}$ is an elementary limit of $(\mathbf{A}_n * \mathbf{G}_n)_{n\in\mathbb{N}}$. Then Tomáš HONS refines this result by using the notion of *fragmented base structure*. In a second time, Tomáš HONS considers the problem of the local convergence of $(\mathbf{A}_n * \mathbf{G}_n)_{n\in\mathbb{N}}$. Tomáš HONS gives several examples witnessing that some non-trivial conditions have to be considered to ensure the local convergence, and give some instances of such positive results.

Appreciation.

The exposition is clear and of high quality, which is particularly remarkable for a subject that lies between discrete mathematics and finite model theory. The problems studied are natural, and the results obtained are substantial. Difficulties have been clearly identified and analyzed, and ways of overcoming them have been proposed and implemented.

This thesis reveals profound pedagogical and research skills, which will undoubtedly flourish during the doctoral studies. I am therefore strongly in favor of Tomáš HONS earning a Master of Science in Computer Science.

Sincerely,

Patrice Ossona de Mendez