FACULTY
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Advisor's evaluation of the doctoral thesis of Debarati Das "New Bounds for Combinatorial Problems and Quasi-Gray Codes"

Debarati's PhD thesis provides several interesting and significant results contributing to various algorithmic problems and combinatorics. To name just a few of the results, a major result is the sub-quadratic algorithm for constant factor-approximation of edit distance, an important theoretical and practical problem. This result is viewed as a breakthrough, it was published in the top conference IEEE Symposium on Foundations of Computer Science (FOCS'18) where it received the Best paper award and it was invited to the special issue of the Journal of ACM. Another original result is the construction of Gray codes over non-binary alphabets with logarithmic decision tree complexity which is in sharp contrast to the recently confirmed long-standing conjecture in the binary case that their complexity must be linear. A substantial contribution is also the work on combinatorial models of algorithms for Boolean Matrix Multiplication and the associated super-quadratic lower bounds. Thus **the thesis contains original results that greatly meet and exceed requirements for a PhD thesis**.

As the results were obtained with various collaborators let me comment briefly on Debarati's contribution to these results. The edit distance algorithm is a rather complex procedure and Debarati contributed to it substantially by devising a sampling scheme, one of the main technical parts, that greatly improved the overall algorithm and later allowed further improvements. She also suggested and led the research efforts for application of the technique in the context of pattern matching, another part of her thesis. One of the most technically and combinatorially challenging parts of her thesis are the lower bounds for combinatorial models for Boolean Matrix Multiplication. It is fair to say that the proofs are largely hers and they are a testament to her mathematical abilities. Thus it is safe to say that Debarati contributed substantially to each result presented in the thesis, and she clearly demonstrated her ability to carry out independent research.

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Her good standing in the research community is witnessed by the fact that she was invited to several research visits abroad and workshops including one on Fine-grained complexity in Bertinoro.

On a personal note, it was always a pleasure to work with Debarati on our common projects.

I fully recommend granting Debarati Das the PhD degree.

Sincerely,

Prof. Mgr. Michal Koucký, Ph.D.
Professor and director
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