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# SPECIAL ISSUE "CONFERENCE ON COMPUTATIONAL COMPLEXITY 2013" GUEST EDITOR'S FOREWORD

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This special issue contains the full versions of five papers that were presented at the 28th Annual IEEE Conference on Computational Complexity (CCC 2013) held in Palo Alto, California, from June 5, 2013 to June 7, 2013. These outstanding papers were selected in consultation with the program committee from among the twenty-nine papers that appeared in the conference. They were invited for submission and subsequently subjected to the standard refereeing process of the journal.

In the paper *Random arithmetic formulas can be reconstructed efficiently*, by Ankit Gupta, Neeraj Kayal, and Youming Qiao, the authors give a randomized algorithm that reconstructs a random arithmetic formula from black box access to the formula. The reconstruction problem is considerably harder than the well-known polynomial identity testing problem, and the present paper represents the most general model of arithmetic formulas for which a reconstruction algorithm is known, although it considers the average case rather than worst-case setting. This paper also develops tools from algebraic geometry in order to achieve the main result.

In the paper *How low can approximate degree and quantum query complexity be for total Boolean functions?*, by Andris Ambainis and Ronald de Wolf, the authors consider approximate versions of two measures of Boolean function complexity, degree and exact quantum query complexity. They prove a lower bound of

$\Omega(\log n/\log\log n)$ for both of the approximate measures, which should be contrasted with the $\Omega(\log n)$ bound lower bound for the exact versions. They further establish that these lower bounds are the correct answers, by exhibiting quantum algorithms for functions on which these bounds are achieved.

In the paper *On the power of non-adaptive learning graphs*, by Aleksandrs Belovs and Ansis Rosmanis, the authors characterize the power of the non-adaptive learning graph model, a very successful framework for designing quantum query algorithms. The characterization shows limits to this approach and in particular that improvements to current algorithms for the well-known triangle-finding problem will have to go beyond the non-adaptive learning graph model. This paper received the 2013 Ronald V. Book Prize for the Best Student Paper.

In the paper *The correct exponent for the Gotsman-Linial conjecture*, Daniel Kane proves an upper bound on the average sensitivity of polynomial threshold functions. For fixed-degree polynomials on $n$ variables, this result gives a bound in which the exponent on $n$ is $1/2$, which agrees with the exponent predicted by the Gotsman-Linial conjecture. This paper was the co-recipient of the Best Paper Award.

Finally, in the paper *On uniformity and circuit lower bounds*, by Rahul Santhanam and Ryan Williams, the authors prove a variety of complexity results that revolve around the theme of reducing non-uniformity. They prove that several uniform complexity classes (P, NC, LOGSPACE, and NP) do not have "medium-uniformity" fixed-polynomial size circuits (for circuit types appropriate for each class). They also give results about reducing non-uniformity in collapse consequences involving small complexity classes, and results about derandomization of the class $\mathrm{TC}_0$.

I wish to thank the authors of the aforementioned papers for submitting to the special issue, the referees for their thorough and timely reviews, and Joachim von zur Gathen and the journal staff for their efforts in bringing this special issue to fruition.

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