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Skolkovo Institute of Science and Technology

Jury Member Report – Doctor of Philosophy thesis.

Name of Candidate: Elena Egorova

PhD Program: Computational and Data Science and Engineering

Title of Thesis: Signature Codes for Multiple Access Channels, Digital Fingerprinting Codes and Symmetric Group Testing

Supervisor: Prof. Grigory Kabatyansky

Name of the Reviewer: Maxim Fedorov

I confirm the absence of any conflict of interest	**Signature: Maxim Fedorov** **Date: 26-03-2020**

The purpose of this report is to obtain an independent review from the members of PhD defense Jury before the thesis defense. The members of PhD defense Jury are asked to submit signed copy of the report at least 30 days prior the thesis defense. The Reviewers are asked to bring a copy of the completed report to the thesis defense and to discuss the contents of each report with each other before the thesis defense.

If the reviewers have any queries about the thesis which they wish to raise in advance, please contact the Chair of the Jury.

Reviewer's Report

Referee's Report on the doctoral thesis by Elena Egorova

``SIGNATURE CODES FOR MULTIPLE ACCESS CHANNELS, DIGITAL

The main achievement of the Thesis is development of a *consistent* uniform approach for theoretical exploration of three distinct areas from information theory, cryptography, and mathematical statistics.

Foundations of the approach are explained in Chapter 1, which gives a rigorous description of most of all known models of deterministic multiple access channels together with state of the art results on signature codes for these channels; this Chapter also explains how signature codes allow one to investigate two other topics

of the dissertation, namely, digital fingerprinting codes, especially for multimedia protection, and non-adaptive group testing.

I note that signature codes for multiple access channels play the key role in this approach (and, consequently, in the Thesis); consequently, Chapter 2 and Chapter 3 deal with signature codes for three different channels, namely, A-channel, B-channels and weighted binary adder channel. I would like to emphasize that this work presents the first explicit construction of signature codes for A-channel with a polynomial in code length complexity of decoding. Also let me note that nontrivial upper (i.e., non-existence) and lower (existence) bounds for B-channel were unknown before the Egorova's results.

In the last chapter the author shown that the results of previous chapters are general and can be applied to other areas. For instance, the signature codes for A-channel transform can be converted into good digital multimedia fingerprinting codes as well as into efficient non-adaptive group testing procedures for the so-called symmetric model.

Finally, I would like to say that the Thesis is clearly written, it has a logical structure and it is good illustrated by formulae and figures. Its results were presented on more than dozen international conferences, and they were published in three journal papers (international) and four conference proceedings (also international). The overall amount of published works is well above the Skoltech standards (and greatly exceeds international standards for a PhD in this area).

The results are novel and original; the author is the main contributor to these results as far as I can judge.

Summarising of the above I think that the thesis is of excellent quality and it certainly satisfies Skoltech standards for a PhD thesis; therefore, I recommend that the candidate should defend the thesis by means of a formal thesis defense.

Provisional Recommendation
I recommend that the candidate should defend the thesis by means of a formal thesis defense YES