OPINION REPORT

on the procedure for obtaining
educational and scientific degree "Doctor"

by

Candidate: Tedis Arben Ramaj,

Dissertation thesis title: "Algebraic methods for studying some combinatorial configurations and their applications",

Professional field: 4.5 Mathematics,

Doctoral program „Algebra, Topology and Applications", Department of Algebra,

Faculty of Mathematics and Informatics (FMI), Sofia University "St. Kliment Ohridski",

This opinion report has been prepared by Assoc. Prof. Todorka Gerasimova Alexandrova, PhD, Institute of Mathematics and Informatics at the Bulgarian Academy of Sciences, as a member of the scientific jury for the current procedure for obtaining educational and scientific degree "Doctor" according to Order № РД-38-129/01.03.2021 of the Rector of Sofia University.

1. General description of the dissertation thesis and the presented materials

The dissertation thesis consists of 86 pages, containing table of contents, an introduction, author`s scientific contributions, list of publications, declaration of originality of the results, three chapters and a bibliography with 45 titles.

2. Short CV and personal impressions of the candidate

Tedis Ramaj received her Master's Degree in Mathematics from the University of Tirana, Tirana, Albania in 2013. In 2018 she enrolled as a part-time doctoral student at FMI, Sofia University, doctoral program "Algebra, Topology and Applications", Department of Algebra, and in February 2021 she fulfilled the requirements for starting the procedure of her dissertation defense. Since November 2020 she has been working as an assistant professor at the Faculty of Natural Sciences of the University of Tirana.

I do not know Tedis Ramaj in person but from the presented materials and the presentations made under the current procedure for obtaining the educational and scientific degree "Doctor", I have good impressions of the candidate.

3. **Analysis of the scientific and applied achievements of the candidate contained in the presented dissertation thesis and the publications for the procedure**

The first chapter of the dissertation thesis describes some basic notations and properties of orthogonal arrays as well as their relations to error-correcting codes. The second and third chapters are devoted to the scientific results obtained in the dissertation.

The main scientific contributions of the thesis are as follows:

- Development of a combinatorial method for computation and reduction of the possibilities of distance distributions of ternary orthogonal array for given parameters OA(M, n, q, t).

- Derivation of an analytical expression of the matrix in Theorem 2.3.1 used for the evaluation of the distance distributions of a given orthogonal array, which allows the faster and more effective calculation of distance distributions.

- Proof of the nonexistence of OA(108,18,3,3) and (108,17,3,3) ternary orthogonal arrays.

- Obtained analytically upper bounds for the covering radius of orthogonal arrays.

- Application of a procedure for reduction of the possible distance distributions of an orthogonal array in order to improve the bound by one under certain assumptions.

The scientific results obtained in the dissertation are new, interesting and significant, and would be of great practical application.

4. **Approbation of the results**

The presented dissertation thesis is written based on the contents of three scientific publications, one of which published in a scientific journal with Impact Factor, one in a scientific journal indexed in MathSciNet, and one in proceedings of international conference, indexed in Scopus. All publications are co-authored with the supervisors of the doctoral student, and one of them is co-authored with T. Marinova as well. I assume that the candidate's contribution to the joint publications is equivalent. The obtained results have been presented at six international and national conferences and forums. In the presented materials on the current procedure no information has been provided on citations of the candidate`s publications.

From the presented reference form for the fulfillment of the minimum national requirements it can be seen that the points for the candidate`s materials of the current procedure on indicator "Г" are 72, which exceeds more than twice the minimum national requirements (according to Art. 2b, (2), (3) ADASRB) and respectively the additional requirements of Sofia University "St. Kliment Ohridski " for obtaining the educational and scientific degree" Doctor". From the presented document for the check of the originality of the dissertation thesis it

can be seen that there is no plagiarism proven in the legally established order in the presented dissertation work and the scientific papers used in this procedure.

5. Qualities of the abstract

The abstract of the dissertation thesis consists of 26 pages and it is presented in Bulgarian and English. It reflects correctly the contents, results and contributions of the dissertation.

6. Critical comments and recommendations

A significant amount of spelling mistakes are noticed in the dissertation and the abstracts in Bulgarian and English. In the abstract in Bulgarian there are some words left in English that need to be deleted or translated. I would recommend, if possible, that these inaccuracies are corrected in the final versions of the documents.

7. Conclusion

Having become acquainted with the dissertation thesis presented in the procedure and the accompanying scientific papers, and on the basis of the analysis of their importance and the scientific and applied contributions contained therein, **I do confirm** that the dissertation presented and the scientific publications to it, as well as the quality and originality of the results and achievements presented in them, meet the requirements of the Act on Development of the Academic Staff in the Republic of Bulgaria (ADASRB), the Regulations for its Implementation and the corresponding Regulations on the Terms and Requirements for Acquisition of Academic Degrees at Sofia University "St. Kliment Ohridski" for acquisition by the candidate of the educational and scientific degree "Doctor" in the Scientific field 4. Natural Sciences, Mathematics and Informatics, Professional field 4.5 Mathematics. In particular, the candidate **meets the minimal national requirements** in the professional field and **no plagiarism** has been detected in the scientific papers submitted for the current procedure.

Based on the above said, I **strongly recommend** to the scientific jury to award Tedis Arben Ramaj, the educational and scientific degree „Doctor" in the Scientific field 4. Natural Sciences, Mathematics and Informatics, Professional field 4.5 Mathematics.

20. 04. 2021   Signature: ....

Sofia   (Assoc. Prof. Todorka Alexandrova, PhD)