S T A T E M E N T   R E P O R T

under the procedure for public defence of the PhD Thesis entitled:

"Network Coding and Analogues of Designs"

under the procedure for acquisition of the educational and scientific degree "Doctor"

by **Nevyana Dimitrova Georgieva**

In the Scientific field: 4. Natural Sciences, Mathematics and Informatics,
Professional field: 4.6. Informatics and Computer Science
Doctoral program: "Informatics",
Department of Informatics, New Bulgarian University

The Statement Report has been prepared by prof. Maya Miteva Stoyanova, Ph.D., Deputy Dean of FMI, Department of "Algebra", Faculty of Mathematics and Informatics, Sofia University "St. Kliment Ohridski", Professional field 4.5. Mathematics, in my capacity as a member of the scientific jury, according to Order 3-RK-233/05.05.2022 of the Rector of the New Bulgarian University.

1. General characteristics of the PhD thesis and the presented materials

The presented PhD thesis is 78 pages long and consists of an introduction, three chapters and a bibliography of 85 titles. The abstract, within 15 pages, summarizes the content of the dissertation, clearly and accurately reflecting both the main contributions of the doctoral student and where the results are tested. The PhD thesis is based on results published in three publications of the PhD student, one of them is published in Designs, Codes and Cryptography and there is an impact factor, the second is in the Annual of Sofia University, FMI, and the third is in the Serdica Journal of Computing. The materials and documents presented by PhD student Nevyana Georgieva certify that all the requirements of the Act on Development of the Academic Staff in the Republic of Bulgaria (ADAS in the Republic of Bulgaria) and its regulations have been met. Nevyana Georgieva fulfills the minimum national requirements under Art. 2b. para. 2 and para. 3 of the ADAS in the Republic of Bulgaria.

2. Short CV and personal impressions of the candidate

Nevyana Dimitrova Georgieva was born in 1985. In 2009 she acquired a Bachelor's degree in Mathematics (Applied Mathematics) from the Faculty of Mathematics and Informatics at Sofia University "St. Kliment Ohridski ". In 2012 she received a Master's degree in Mathematics, Probability and Statistics, FMI, Sofia University. By order № 61 of 26.10.2012 she was enrolled as a full-time doctoral student in the doctoral program "Informatics", Department of Informatics, New Bulgarian University with research supervisor Professor Ivan Landzhev. She was expelled with the right to protection by order № 3-PK-350 from 19.07.2017.

Since 2009 she has been a part-time lecturer, assistant, and is currently a mathematician at the Department of Geometry at the Faculty of Mathematics and Informatics at Sofia University "St. Kliment Ohridski".

I know the teaching work of PhD student Nevyana Georgieva at the FMI of Sofia University and from personal conversations with students I have information that she is a well-received and respected colleague at the FMI. On the other hand, I attended the presentations of the scientific results of PhD student N. Georgieva at the International Workshop "Algebraic and Combinatorial Coding Theory" and the National Seminar on Coding Theory "Prof. Dr. Stefan Dodunekov ", where I also have good impressions of the candidate. I believe that PhD student Nevyana Georgieva is a built scientist with in-depth knowledge of the topics of the presented PhD thesis.

3. Analysis of the dissertation and evaluation of the contributions

The PhD thesis of Nevyana Georgieva addresses the problem of existence of designs in projective coordinated geometries over finite chain rings. Such geometries are called geometries of Hjelmslev. The obtained results in the PhD thesis have both a new theoretical contribution in the field and an applied character in the coding theory and network coding in particular. The PhD thesis can be considered as a contribution to the construction of optimal network codes (for example, with the maximum number of words given other parameters).

Chapter 2 presents the motivation of the doctoral student for research in the topic of the PhD thesis, as well as introduced all the concepts and known results needed and used in the following chapters to correctly describe the new results obtained in the PhD thesis.

Chapter 3 is devoted to the existence and uniqueness of the standard form of matrix that generates module over finite chain ring, which describes algorithms (based on the standard form) for working with modules. The main contributions in this chapter are described in Theorem 3.3 and Theorem 3.8.

Chapter 4 of the PhD thesis is devoted to obtaining the necessary and sufficient conditions for the existence of spreads in projective geometries of Yelmslev. The main theoretical results in this chapter are described in Theorems 4.10 - 4.12.

The scientific contributions of doctoral student Nevyana Georgieva (5 according to the presented list) are presented on page 9 in the Abstract.

4. Approbation of the results

There are three publications presented by PhD student Nevyana Georgieva, reflecting the results of the PhD thesis, one of them is independent and two are co-authored with the supervisor. One of the joint publications has an impact factor IF: 1.524 and falls into the second quartile, which brings 60 points to fulfilment the minimum national requirements of Art. 2b. al. 2 and para. 3 of the the Act on Development of the Academic Staff in the Republic of Bulgaria. The other two publications (in the Annual of Sofia University, FMI and in the Serdica Journal of Computing) are referenced in MathSciNet and zbMATH, which brings 18 points for each of the two publications. As a result, with 96 points (if 30 points are needed), the candidate Nevyana Georgieva covers and exceeds the minimum national requirements under Art. 2b, para. 2 and 3 of the ADAS in the Republic of Bulgaria, required for the acquisition of the educational and scientific degree "Doctor" in Professional field 4.6. Informatics and Computer Science.

I have no information and no suspicions of plagiarism in the presented dissertation and scientific papers on this procedure.

I have no information about citations to the publications.

5. Abstract

The abstract in Bulgarian is 15 pages long. It is prepared according to all requirements and correctly reflects the content of the dissertation and the scientific contributions of the doctoral student.

6. Critical notes

I have no essential critical remarks.

7. Conclusion

Having become acquainted with the PhD 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 confirm** that the presented PhD thesis and the scientific publications to it, as well as the quality and originality of the results and achievements presented in them, fulfils the

requirements of the ADAS in the Republic of Bulgaria, the Rules for its Implementation and the corresponding Rules at the New Bulgarian University for acquisition by the candidate of educational and scientific degree "Doctor" in the Scientific field 4. Natural Sciences, Mathematics and Informatics, Professional field 4.6. Informatics and Computer Science. In particular, the candidate <u>fulfills</u> the minimum national requirements under Art. <u>2b</u>. para. 2 and para. 3 of the <u>ADAS</u> in the Republic of Bulgaria in the professional field and no plagiarism has been detected in the scientific papers submitted for the competition.

Based on the above, **I strongly recommend** the scientific jury to award to **Nevyana Dimitrova Georgieva** the educational and scientific degree "Doctor" in the Scientific field: 4. Natural Sciences, Mathematics and Informatics, Professional field: 4.6. Informatics and Computer Science, Doctoral program "Informatics", Department of Informatics, New Bulgarian University.

June 9, 2022,   Signature:
Sofia   Prof. Maya Stoyanova, PhD