

STATEMENT REPORT

under the procedure for acquisition of the educational and scientific degree “Doctor“
by candidate **Deyan Zhivkov Dzhundrekov**,
of the PhD Thesis entitled: “**Graded Algebras and Noncommutative Invariant Theory**”,
In the Scientific field: **4. Natural Sciences, Mathematics and Informatics**,
Professional field: **4.5. Mathematics**,
Doctoral program “**Algebra, Number Theory and Applications – Topology**”,
Department “Algebra”,
Faculty of Mathematics and Informatics (FMI),
Sofia University “St. Kl. Ohridski” (SU),

The statement report has been prepared by: Prof. Maya Miteva Stoyanova, Ph.D., Dean of FMI, SU, professor in Professional field: 4.5. Mathematics, Department of Algebra, FMI, SU, as a chair of the Scientific jury for the defense of this Ph.D. thesis according to Order № RD 38-64/01.02.2024 of the Rector of the Sofia University.

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

The PhD thesis is in English and contains 84 pages and consists of an introduction (Chapter 1), three chapters, a conclusion and references from 56 titles in the presented bibliography.

Deyan Zhivkov Dzhundrekov has submitted all the necessary documents and materials required by the requirements of the Act for the Development of the Academic Personnel of the Republic of Bulgaria (ADAP of the RB), the Rules for Implementation of the ADAP of the Republic of Bulgaria (RIADAP of the RB) and the Rules on the Terms and Requirements for Acquisition of Scientific Degrees and Occupation of Academic Positions at Sofia University “St. Kliment Ohridski”. The presented list of the author’s publications on the topic of the dissertation shows that Deyan Jundrekov meets the minimum national requirements under Art. 2b of ADAP of the RB.

2. Short CV and personal impressions of the candidate

Deyan Zhivkov Dzhundrekov was born in 1994. In 2017 he graduated with a degree in Applied Mathematics at the Faculty of Mathematics and Informatics of the Sofia University “St. Kliment Ohridski” and obtained the Bachelor degree in Mathematics - Applied mathematics. In 2019 he obtained the Master degree in Mathematics, graduating in the MP "Algebra, Geometry and Topology" at the Algebra Department, FMI, Sofia University.

On February 10, 2020, he was enrolled as a full-time doctoral student at the Doctoral programme of Algebra, Topology and Applications, later renamed the Doctoral programme of Algebra, Number Theory and Applications (at the last accreditation) at the Department of Algebra, FMI, Sofia University "St. Kliment Ohridski". As of 10.02.2023, he has been dismissed with the right of defense. In the period 2015 - 2019, he was a part-time teacher at the "Complex Analysis and Topology" Department, FMI, SU. From 01.10.2019 to the present, he is an assistant at the "Complex Analyzes and Topology" Department, FMI, Sofia University “St. Kliment Ohridski”.

3. Content analysis of the scientific and applied achievements of the candidate, contained in the presented PhD thesis and the publications to it, included in the procedure

Chapter 1 (Introduction) and Chapter 2 are introductory. They describe historically how the tasks aimed at in the dissertation arose, as well as the numerous concepts and known facts necessary to carry out the research and obtain the presented results in the dissertation work.

Chapter 3 and Chapter 4 present the research carried out by the PhD student and his supervisor, presenting a number of original results. More precisely, the dissertation researches polynomial algebras of non-commutative variables invariant under the action of the symmetric group or its subgroups with additional Koryugin action. The main goal is to find a minimal generating set, or at least to determine whether the algebra under study is finitely or infinitely generated.

The scientific original contributions (nine in number) of Deyan Dzhundrekov are presented in the conclusion of the dissertation work, as well as in the Author's abstract. Some of these contributions are: for a field K of arbitrary characteristic, it is proved that the S -algebra of symmetric non-commutative polynomials of d variables has a generating set consisting of the power sums p_i ; a non-commutative analogue of Newton's formulas in the free associative S -algebra $(K\langle X_d \rangle, \circ)$ is obtained; a relation was established between the power sums p_i and the non-commutative elementary symmetric polynomials $e(i)$, for $i \leq d$; a non-commutative analogue of the fundamental theorem of symmetric polynomials is proved, as well as the problem of infinite generation of the algebra $(K\langle X_d \rangle \text{Sym}(d), \circ)$, when the field K has a positive characteristic p less than or equal to the number of variables, is reduced to the case where the two are equal; as well as five more original scores. All nine contributions are derived in Chapter 3, while Chapter 4 of the dissertation pursues the same objectives but replaces the symmetric group with the alternative group. These studies are not complete and are only in the case of 3 variables. The author of the thesis considers them as still unfinished and therefore does not announce them in his list of achievements, but in my opinion they are also of sufficient value and original contribution to the researched topic.

4. Approbation of the results

All the results described in the Ph.D. thesis have been published in 2 scientific publications, and both publications have an impact factor. One is in Q_1 and the other post is in Q_2 , making it 135 points. This is several times more than the required number of 30 points to cover the minimum national requirements (according to Art. 2b, Para. 2 and 3 of ADAP of the RB) The two publications are co-authored by the scientific supervisor Assoc. Silvia Bumova, as well as by Acad. Veselin Drenski and Prof. Martin Kasabov, but from the attached declarations of the co-authors I can conclude that the candidate's contribution to the joint publications is equal. The results of the dissertation have been presented at 7 scientific forums. I have no doubts and confirm that the PhD student's results are original and no plagiarism has been detected. Deyan Zhivkov Dzhundrekov has not provided information about citations of the publications presenting the results of the PhD thesis.

5. Qualities of the abstract

The extended abstract in Bulgarian contains 47 pages. It was prepared in accordance with all requirements and correctly reflects the content of the dissertation work and the scientific contributions of the doctoral student.

6. Critical notes and recommendations

I have no critical comments on the thesis. There are some remaining English words in the Abstract in Bulgarian, but this does not change the overall excellent impression of the correct reflection of the original results obtained by the PhD student.

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, meet the requirements of the Act on Development of the Academic Staff in the Republic of Bulgaria, the Rules for its Implementation and the corresponding Rules at the Sofia University “St. Kliment Ohridski” (FMI-SU) for acquisition by the candidate of educational and scientific degree “Doctor” in the Scientific field 4. Natural Sciences, Mathematics and Informatics, Professional fields 4.5. Mathematics, Doctoral programme “Algebra, Number Theory and Applications – Topology”. 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 competition.

Based on the above, **I strongly recommend** the Scientific jury to award Deyan Zhivkov Dzhundrekov, the educational and scientific degree “Doctor” in the Scientific field 4. Natural Sciences, Mathematics and Informatics, Professional fields 4.5. Mathematics, Doctoral programme “Algebra, Number Theory and Applications – Topology”.

Date: March 25, 2024

Signature:
Prof. Maya Stoyanova, Ph.D.