

(English translation)

REVIEWER'S OPINION

on Competition procedure for the position of Associate Professor in the field

4.5 Mathematics (Mathematical Logic)

Announced by Sofia University St. Kliment Ohridski, Faculty of Mathematics and Informatics in the State Gazette, issue 87/19.10.2021 and on the Sofia University St. Kliment Ohridski web page

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Sofia University St. Kliment Ohridski, Faculty of Mathematics and Informatics, professional field

4.5 Mathematics (Mathematical Logic) in his capacity of Scientific Jury Member following

Order# RD 38-591 / 10.12.2021 of the Rector of Sofia University St. Kliment Ohridski

The only candidate in this competition procedure for Associate Professor is **Ivan Dimitrov Georgiev, Ph.D.**

The candidate was admitted to the competition by the Scientific Jury appointed by Order# RD 38-589 / 10.12.2021 of the Rector of Sofia University St. Kliment Ohridski.

I. GENERAL DESCRIPTION OF THE SUBMITTED MATERIALS

1. Details of the application

To participate in the competition, Dr. Georgiev presents all the documents required by law and regulations for its application:

- curriculum vitae,
- scanned diplomas (for higher education with an appendix to it and for the scientific-educational degree "Doctor" in professional field 4.5 Mathematics (Mathematical logic));
- certificate of work experience showing that he was a full-time Assistant Professor in the field of Mathematics from 01.10.2009 to 12.07.2016 and and Ch. Assistant Professor to 01.09.2021 at the University Prof. Asen Zlatarov;
- documents proving the fulfillment of the requirements under Art. 105, para. 1, item 2 of the Rules on the conditions and procedure for acquiring science degrees and holding academic positions in Sofia University St. Kliment Ohridski (winner of the award Professor Ivan Soskov for 2014, contract with Sofia University for part-time lecturer, contract with Union of Bulgarian Mathematicians for creating and evaluating

mathematical problems for a national competition; participation in the national program Young scientists and postdoctoral students) ;

- medical certificate for mental and physical health;
- certificate of criminal record for lack of imposed penalty "deprivation of the right to practice a certain profession or activity";
- a list of all publications (20, such as: 7 with WoS impact factor, 5 with SJR only, 1 in Annual of Sofia University St. Kliment Ohridski, Faculty of Mathematics and Informatics, referenced in Zentralblatt and 7 in other peer-reviewed publications) and a list of publications submitted for participation in this competition (8 in number, such as: 4 with WoS impact factor, 3 with SJR only, 1 in Annual of Sofia University St. Kliment Ohridski, (FMI), referenced in Zentralblatt);
- Filled form showing the fulfillment of the minimum national requirements for 4.5 Mathematics and the additional requirements of Sofia University St. Kliment Ohridski (indicator C - 105 points, indicator D - 204 points, indicator E - 56 points);
- list the citations with a complete bibliographic description of the cited and the citing publications;
- statement on the original scientific contributions and declarations from the co-authors of the joint publications for separation of the scientific merit;
- statement for the indicators under art. 112, para. 2 of the Rules on the conditions and procedure for acquiring science degrees and holding academic positions in Sofia University St. Kliment Ohridski (participation in seminars and scientific conferences, participation in research projects, list of reviews, description of teaching activities);
- scientific papers submitted for participation in the competition;
- summaries of the publications submitted for the competition in Bulgarian and English;
- a copy of the announcement in the State Gazette.

The documents submitted in the competition by the candidate fully comply with the requirements of the Law on Development of Academic Staff in Republic of Bulgaria (ZRASRB), the State Rules of Procedure for its application, the Rules for Acquisition of Scientific Degrees and Occupation of Academic Positions at Sofia University St. Kliment Ohridski.

To participate in the competition, Dr. Ivan Dimitrov Georgiev presented 8 articles, 4 of which were published in renowned scientific journals, referenced and indexed in WoS (2 in Q2, 1 in Q3 and 1 in Q4; the list has numbers respectively 1, 3, 5 and 2), 3 are published in the papers of prestigious international conferences, referenced and indexed in SCOPUS with SJR (in the list are numbers 4, 6 and 7 respectively) and 1 is published in the Annual of Sofia University, FMI, and referenced in the Zentralblatt. Four of these articles are by one author, 2 by two co-authors and 2 by

three co-authors. The author's list of publications clearly and unambiguously notes the contribution of Dr. Georgiev in each of the articles, as his contribution in the joint articles is certified by the signatures of the co-authors.

2. Details on the candidate

Dr. Ivan Georgiev is a graduate of Faculty of Mathematics and Informatics, Sofia University St Kliment Ohridski - in 2007 he graduated with a Bachelor's degree in Informatics, in 2009 he completed the Master's programme Logic and Algorithms and acquired a Master's degree in Mathematics. In 2016, as a doctoral student at the Department of Mathematical Logic and its applications, with supervisor Prof. Dimiter Skordev, he defended his dissertation on "Subrecursive Computability in Analysis" for the educational and scientific degree "Doctor" in professional field 4.5 Mathematics (Mathematical Logic).

From 01.10.2009 to 31.08.2021 he worked as an Assistant (until 12.07.2016) and Chief Assistant Professor at the University Prof. Asen Zlatarov.

During the summer semesters of 2017/18 and 2018/19 academic years, he was a part-time lecturer at FMI and taught a course "Computability in Analysis" to Master's programme Logic and Algorithms, also elective for the bachelor programmes.

Dr. Ivan Georgiev participated with papers in 26 scientific seminars and conferences in the period 2011-2021, including Schloss Dagstuhl (2021), Panhellenic Logic Symposium (2019), Computability in Europe (2011, 2012, 2014, 2016, 2018, 2021), Computability and Complexity in Analysis (2012, 2017, 2019) and others.

Participated in 6 projects: for support of the development of doctoral students, postdoctoral students, young scientists and postgraduates, for bilateral scientific cooperation (2), for fundamental research, for research in priority areas, as well as in some funded by Scientific Research Fund at Sofia University.

Dr. Ivan Georgiev is a member of 3 international scientific organizations: Association for Symbolic Logic, Computability in Europe, Computability and Complexity in Analysis.

3. General characteristics of the scientific works and achievements of the candidate

Dr. Ivan Georgiev's research is mainly in the field of computational analysis, an area that is in a sense a symbiosis of classical mathematical analysis and the computability theory, which has attracted noticeable interest in recent years. Of the 8 publications submitted for the competition, 6 are in this field and are thematically grouped: subrecursive representation of irrational numbers ([1] and [4]) and uniformly and conditionally computable real functions [2], [3], [5] and [8]). The other two papers presented ([6] and [7]) refer to multidimensional intuitionistic fuzzy quantifiers. They are a product of the work of Dr. Ivan Georgiev on a research project for in priority areas, #DFNI -

I02 / 5, and are indicative of his ability to understand specific problems arising in the modeling of practical tasks, and to contribute in them understandable, standard mathematical definitions.

The articles submitted for the competition have not been used in other procedures for obtaining a scientific degree and holding an academic position. They are published as follows:

- [1] – в Annals of Pure and Applied Logic, 2021, WoS IF 0,678 for 2020 and Q2;
- [2] – Compte rendus de l'Académie bulgare des Science, 2020, WoS IF 0,378 for 2020 and Q 4;
- [3] – Annals of Pure and Applied Logic, 2020, WoS IF 0,678 for 2020 and Q2;
- [4] – LNCS vol. 10936, Springer, Cham, 2018, Scopus SJR 0,283 for 2018;
- [5] – Logical Methods in Computer Science, 2017, WoS IF 0,508 for 2020 and Q3;
- [6] – in the series Learning Systems: From Theory to Practice, SCI vol 756, Springer, Cham, 2018, Scopus SJR 0,183 for 2018;
- [7] - 2016 IEEE 8th International Conference on Intelligent Systems (IS), 2016, Scopus SJR 0,142 for 2017;
- [8] – Annuaire de l'université de Sofia “St. Kliment Ohridski”, FMI, 2017, Ref Zentralblatt (Zbl 07360337).

Attached to this competition are 6 unused citations in Scopus of two non-attached articles and 1 citation in Scopus of [6]. In fact, the article [6] has at least 4 citations noted in Scopus that are not auto-citations, but only one of them is used in the list of observed citations.

As the data above show:

- a) The scientific works presented for the competition meet the minimum national requirements (under Art. 2b, para. 2 and 3 of ZRASRB) and the additional requirements of Sofia University St. Kliment Ohridski for holding the academic position of Associate Professor in the scientific field and professional domain of the competition - indicator C - 105 points, indicator D - 204 points, indicator E - 56 points.
- b) The scientific publications submitted by the candidate do not repeat those from previous procedures for acquiring a scientific title and academic position.
- c) There is no legally proven plagiarism in the scientific publications submitted at the competition.

4. Characterisation and evaluation of the candidate's teaching experience

Dr. Ivan Georgiev has extensive experience in teaching as an Assistant and Chief Assistant Professor at the University Prof. Dr. Asen Zlatarov, Burgas, as well as a part-time lecturer at FMI. He taught courses of lectures and seminars in Higher Mathematics for various departments, including topics in linear and higher algebra, differential and integral calculus, differential equations and

elementary probability theory. Participated in the development of a course in Higher Mathematics, including systems for symbolic calculations. He taught courses of seminars in Computer Security and Computer Architectures for the students in Computer Systems and Technologies specialty.

In 2018 and 2019 he gave an elective course Computability in Analysis for the Master's programs in Logic and Algorithms and for the Bachelor's programs at FMI.

Considering my personal impressions of Ivan's ability to present mathematical knowledge in a clear and consistent way to the listeners, I highly appreciate his pedagogical skills.

5. Content analysis of the scientific and scientific-applied achievements of the candidate contained in the materials for participation in the competition

The 8 publications presented for the competition are correctly grouped in the author's reference in 3 research topics.

I. *Subrecursive representation of irrational numbers*. This topic includes articles [1] and [4], which are co-authored with two co-authors. The object of study are various representations of irrational numbers with sums of a special kind. The article [4] gives an explicit definition of an irrational number, for which non-trivial connections are proven between various kinds of apparently similar representations and their computational complexities. The article [1] significantly expands the results of [4] both on various representations and their computational complexities, and on the properties of certain kind of representations. In particular, for two of the special kinds of considered representations equipotent representations were found. An important role is played by the proposition proved by Dr. Ivan Georgiev, according to which the explicitly constructed numbers are Liouville numbers and therefore are transcendent. The obtained results are a significant scientific contribution in the field.

II. *Uniformly and conditionally computable real functions*. Articles [2], [3], [5] and [8], which are single-authored, belong to this topic. The article [5] is based on unpublished results from the dissertation of Dr. Ivan Georgiev. A characterization theorem for conditional computability, which avoids the use of operators and representations of real numbers is proven. It is a technically non-trivial generalization of Skordev's characterization theorem for uniformly computable real functions and has important and useful consequences. It is an essential scientific contribution of Dr. Ivan Georgiev.

The article [3] occupies a central place in this group, as well as among the publications submitted for the competition. It has been proven that the definite integral with M^2 -computable limits of a uniformly M^2 -computable analytic real function is itself M^2 -computable real number. This theorem is generalized to integrals with parameters and with varying limits. As an application of the obtained result Dr. Ivan Georgiev answered an open question: the Euler-Mascheroni constant is M^2 -computable. Nice scientific contribution. In [8] Ivan make use of the proof from [8] to deduce a sequence which tend to Euler-Mascheroni constant and has subexponential convergence rate. Main

results in [2] rely again on the main theorem from [3]: gamma function restricted to $(0, +\infty)$ and Riemann zeta function restricted to $(1, +\infty)$ are conditionally M^2 -computable. For that reason a theorem about preserving uniform computability under some kind one-point extensions is proven.

III. *Multidimensional intuitionistic fuzzy quantifiers*. This topic includes articles [6] and [7], which are co-authored with three co-authors. In these articles, a certain type of predicates is introduced, which are interpreted as multidimensional intuitionistic fuzzy quantifiers. Some of their very basic desired properties are proven. As can be seen from the declaration signed by the co-authors, the contribution of Dr. Ivan Georgiev is crucial for the correctness of the defined concepts and the proofs of the formulated propositions. Although far from the field of computational analysis, the work of Dr. Ivan Georgiev on this topic shows his ability to give a correct mathematical interpretation of concepts arising from the modeling of appliedly motivated concepts.

I find that the author's reference correctly presents the scientific contributions of Dr. Ivan Georgiev in the articles submitted for the competition. The co-authors of the articles have signed the parts of the author's reference, which refer to the contributions of Dr. Ivan Georgiev in these articles.

6. Critical remarks and recommendations

I have no critical remarks or recommendations.

7. Personal impressions of the candidate

I have known Ivan Georgiev from the introductory course in set theory (elective for Bachelor's programs at FMI) as capable and modest, an impression that was strengthened and developed when he was a student in the Master's program Logic and Algorithms. An expression of his organization, rich scientific language culture and understanding of the essence are the notes he prepared for a number of courses in the Master's program.

I have witnessed his growth as a researcher with extensive mathematical interests and knowledge. Combined with his clear thinking, patience and attention to the interlocutor, he formed himself as a promising quality teacher of mathematics. I have no doubts that the election of Dr. Ivan Georgiev as an Associate Professor will enhance the research and teaching capacity of FMI.

8. Conclusion on the application

After careful study of the materials and scientific works presented in the competition and based on the analysis of their significance and the scientific contributions contained in them, I confirm that the scientific achievements meet the requirements of ZRASRB, the Regulations for its application. and the relevant Regulations of Sofia University St. Kliment Ohridski for candidates for the academic position Associate Professor in the scientific domain and professional field of the

competition. In particular, the candidate satisfies the minimum national requirements in the professional field and no plagiarism has been established in the scientific publications submitted at the competition.

I give my **positive assessment** of the candidacy.

II. OVERALL CONCLUSION

Based on the above, I **strongly recommend** the scientific jury to propose to the competent authority for the candidate selection at the Faculty of Mathematics and Informatics at Sofia University St. Kliment Ohridski **to elect Ivan Dimitrov Georgiev, Ph.D** to take the academic position of **Associate Professor** in the professional field 4.5 Mathematics (Mathematical Logic).

February 8, 2022

Prepared the Opinion:

(Prof. Tinko Velichkov Tinchev, PhD)