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REVIEW

in the competition for the academic position of "Associate Professor"
in the field of higher education **4.** Natural sciences, mathematics and informatics;
4.5 Mathematics (Mathematical Analysis and Operations Research)
at the Technical University of Varna,
published in the State Gazette No. 61 of 23.07.2021 and on the website of the Technical University - Varna,
with **just one candidate** Assistant Professor Diana Kirilova Nedelcheva PhD.
Reviewer: Andrey Ivanov Zahariev, PhD
Guest - Professor at Plovdiv University "Paisii Hilendarski"
Faculty of Mathematics and Informatics, Department of Mathematical Analysis.

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1. General information and biographical data

By Order №639 / 21.10.2021 of the Rector of the Technical University of Varna I was appointed a member of the scientific jury of the competition for the academic position "Associate Professor" at the Technical University of Varna in the field of higher education 4. Natural Sciences, Mathematics and Informatics; 4.5 Mathematics (Mathematical Analysis and Operations Research).

As a member of the jury, I have received all necessary documents attached to the application submitted by **the only candidate**, Assistant Professor Diana Kirilova Nedelcheva, PhD to the Technical University of Varna for admission to the competition. The documents are well designed and arranged. The candidate Assistant Professor Diana Kirilova Nedelcheva presented the necessary information to meet the minimum national requirements and the additional requirements of the Technical University of Varna. He presented also a diploma for PhD degree, obtained in 2015.

The presented documents include everything necessary according to the regulations of the Technical University of Varna as follow:

1. Application to the Rector.
2. Curriculum vitae (CV - European model).
3. Employment contract for the academic position "assistant" or "chief assistant".
4. Diploma for PhD degree.
5. Detailed reference for compliance with the minimum national requirements and the requirements of Annex 1 of these Regulations on the applicable groups of indicators to which the necessary evidence is attached;
6. The scientific papers related to the competition.
7. Abstracts of papers up to one page for each paper.
8. Other related documents proving the scientific, teaching and /or implementation activity, according to art. 22, para. 2 and para. 3.

Assistant Professor Diana Kirilova Nedelcheva was born in 1982 and she completed her secondary education in 2001 at the MG "Dr. P. Beron". At the Faculty of Mathematics and Informatics at the

University of Plovdiv "Paisii Hilendarski" he obtained consecutive bachelor's degrees in mathematics (2005), master's degree in Applied Mathematics (2007) and professional qualification as a teacher of mathematics (2003). Diana Nedelcheva holds consecutive positions Assistant (2007) and Chief Assistant (2016) at the Technical University of Varna and obtain diploma for PhD degree from the Institute of Mathematics and Informatics at the Bulgarian Academy of Sciences in 2015.

2. General description of the submitted materials.

The additional requirements of the Technical University of Varna regarding the taking up an academic position "Associate Professor" include the ability to meet the additional requirements of the Institute of Mathematics and Informatics at the Bulgarian Academy of Sciences, which are higher than the national minimum requirements. In view of this fact, I will mainly comment on the satisfaction of the additional requirements of the Institute of Mathematics and Informatics at the Bulgarian Academy of Sciences.

Taking into account the obtained PhD degree from IMI of BAS in 2015, we can conclude that he meets the minimum national requirements and indicator "A" of 50 points. The PhD thesis is registered in NACID with scientific-metric indicators and satisfies the requirement that the publications on it have not less than 30 points. The candidate submits for participation in the competition the book "Fixed Point Theory", ISBN 978-954-20-0818-7, which is indexed in the database COBISS.BG-ID - 43329800, volume 139 pages, two authors, as a monograph. From the presented separation protocol, it is evident that Assistant Professor Diana Nedelcheva, is the author of 90% of the text. On this basis, I conclude that the presented monograph satisfies the requirements of the LRAB and therefore the candidate satisfies the requirement for the group of indicators "B" of 100 points.

The 6 articles submitted by the candidate for participation in the competition have been published in refereed journals as follows: 2 of them are in journals refereed in WoS with quartile Q2, and the remaining 4 in journals refereed in SCOPUS with SJR, as well as one published book based on his Ph.D. thesis, which is also indexed in the COBBIS database (ISBN - 978-954-20-0819-4, COBISS.BG-ID - 43434504), with a score of 260 points on the group of indicators "D". This result meets the requirements of ZRASB and exceeds the additional requirements of IMI to BAS by at least 220 points on the group of indicators "D".

Assistant Professor Diana Kirilova Nedelcheva has 9 citations in WoS and / or SCOPUS, as well as one citation from MathSciNet and /or zbMATH and therefore satisfies the requirement for the group of indicators "D" with 76 points, which score is higher than the additional requirements of IMI to BAS of 70 points.

There is no requirement for the minimum number of points for the group of indicators "E" in the AASB regarding the holding of the academic position of "Associate Professor". The additional requirements of IMI to BAS for the group of indicators "E" are a minimum of 20 points. The Assistant Professor Diana Kirilova Nedelcheva with her participation as a member in three national projects satisfies the requirement for the group of indicators "E" with 30 points.

It follows from the analysis that the candidate satisfies and even exceeds all the minimum national requirements, as well as the additional ones of IMI at BAS.

3. General characteristics of evaluation of research and applied research.
According to the attached report, the candidate has divided his scientific contributions into two areas:

    A. Optimization of sets, in which we can attached the following works:
1. M.H. Geofroy, Y. Marcelin, D.K. Nedelcheva; Convergence of relaxed minimizers in set optimization, Optimization Letters 2017, 11 (8): 1677-1690. DOI: 10.1007 / s11590-016-1079-4 (IF 1.013), Q2.
2. M. Gaydu, M.H. Geofroy, C. Jean-Alexis, D.K. Nedelcheva; Stability of minimizers of set optimization problems, Positivity 2017, 21 (1): 127-141. DOI: 10.1007 / s11117-016-0412-6 (IF 0.92) Q2.
3. D. Kamburova and D.E. Nedelcheva: "Variational Principles for supinf Problems with Constraints Geometry, Integrability and Quantization, 2020, pp 163-169. DOI: 10.7546 / giq-21-2020-163-169.

    B. Fixed Point Theorems and Applications Economics in Equilibrium Research in Noncompetitive Markets.
4. D. K. Nedelcheva: "Altering Points in Partial Metric Space Geometry, Integrability and Quantization, 2020, pp 221-231. DOI: 10.7546 / giq-21-2020-221-231.
5. M. Hristov, A. Ilchev, D. Nedelcheva B. Zlatanov; "Existence of Coupled Best Proximity Points of p-Cyclic Contractions Axioms 2021, 10 (1), 39; doi.org/10.3390/axioms10010039
6. G. Gecheva, D. Nedelcheva, M. Ruseva and B. Zlatanov: "Applications of Coupled Fixed Points for Multivalued Maps in the Equilibrium in Duopoly Markets and in Aquatic Ecosystems Axioms 2021, 10 (2).
7. D. Nedelcheva, R. Marinov: "Fixed point theory monograph, University Publishing House at the Technical University - Varna, ISBN 978-954-20-0818-7.
8. D. Nedelcheva: "Methods for solving generalized equations, PhD Thesis book, University Publishing House at the Technical University - Varna, ISBN 978-954-20-0819-4

    In publications [1] and [2] Diana Nedelcheva and her co-authors consider an optimization problem (P), which examines the set of minima of a set-valued mappings, where X and Y are real Banach spaces, and Y is partially ordered by non-empty, closed, convex and pointed cone. The main goal of the authors is to study the asymptotic behavior of sequences from optimization problems (Pn). More precisely, a sequence of optimization problems (Pn) is considered, the data of which are in a certain way converge to the data of the optimization problem (P) and the convergence of the set of minimizers of (Pn) to the set of minimizers of (P) is studied too. They study a wide range of relaxed minimizers, called ρ-minimizers, and study their stability in common Banach spaces. One of the problems considered in these works is the study of the Pareto minimizer and (weak) minimum Pareto points, which is a classic problem from the theory of non-competitive markets. Two new concepts for convergence PKL (Painlevé-Kuratowski like) and Γ (type)

convergence of a number of problems instead of convergence of sets have been introduced. Using the fact that the studied Banach spaces are infinite spaces, the authors can consider and the case when the interior of the cone of the ordinance can be an empty set, which often happens in applications. The results generalize the results of Lemaire and Zeng, Zhang, Xue, which results were obtained only for weak minimizers as well as the results of Li, Wang, Lin, where the condition of compactness is replaced by the weaker conditions of closedness and convexity.

In [3] are obtained some modern results related to variational principles for **supinf** problems for a function of two variables with additional constraints. Using the sufficient conditions, derived by D. Gaumont, D. Kamburova and J. Revalski under which a bounded bottom and semi-continuous from bottom objective function can be disturbed by a continuous function with arbitrarily small norm, in such a way that the **supinf** problem for the disturbed function has a solution are considered. As a special case of the **supinf** problem studied, the Strtackelberg problem for two "leader-follower" companies was also considered, which gives a new look at the equilibrium problem in non-competitive duopoly markets.

In [4] a composition of two multivalued mappings with values in partial metric spaces is considered. A number of theorems for the existence of fixed points have been proved, which generalize and supplement some results, the main result of which is a generalization of the fixed-point theorem by A. L. Dontchev and H. Frankowska for partial metric spaces. They used more general assumptions containing Bianchini-Grandolfi calibration functions instead of pseudo-shrink ambiguous mappings. We will note that even in the case of partial metric space, the main result of the authors includes the theorems of A. Benterki.

In the articles [5] and [6] the properties of fixed-point pairs for p-cyclic mappings or for multi-valued images are studied. Sufficient conditions are obtained for the presence of points of best approximation or for fixed points. The fixed-point pairs were introduced in 1987, but in view of their lot of applications in recent years, the research in this direction has intensified. One such application is in the theory of non-competitive markets, where the obtained from the candidate results give a new look at Carnot's theory. In [6] an application of fixed-point pairs for multivalued mappings in the theory of duopoly markets is considered. An interesting application of the results for set-valued mappings in the study of equilibria in aquatic ecosystems is also presented.

The main goal of the authors in the monograph [7] is to provide an up-to-date overview of the problems related to the theory of fixed points as well as to prove some theorems for double fixed point for the shrinking set - value operators and some unambiguous results, in particular its results in this direction. In the first chapter some generalizations of the fixed-point theorem are considered. Results were obtained for fixed point pairs and fixed-point pairs for mapping pairs. The results obtained in paragraph 1.2 are applied to solve generalized equations with a parameter in Banach spaces, where the studied mappings are differentiable by Fréchet, or continuous by Holder. The applications of the obtained results are illustrated by solving nonlinear programming problems. The stability of the considered methods has been studied too. Chapter 2 is devoted to the theory of fixed points in partially ordered Banach spaces with respect to a cone. Multi-valued mappings, single-image compositions and multi-valued mappings compositions were studied. Sufficient

conditions have been obtained for the existence and uniqueness of fixed points. Some of the results are illustrated with non-trivial examples. Chapter 3 deals with the problem of fixed points in partial metric spaces. The existence of common fixed points for pairs of ambiguous or unambiguous mappings has been studied. Sufficient conditions for the uniqueness of the fixed point for classes of pairs of unique mappings are obtained. The question of the presence of fixed-point pairs and pairs of multivalued mappings in partial metric spaces has been studied. The conclusion summarizes the contributions of the authors in this monograph. Some of the results presented in the monograph are new and not yet published.

In a presented book [8] published on the basis of the Ph.D. thesis of Assistant Professor Diana Nedelcheva discusses problems for solving a generalized equations with and without a parameter. Newton's method, chord method, chopping method, implicit function theorem in chord and chopping methods are considered. The book gives an overview of some of the trends in fixed-point theory for multivalued mappings. The book is not only based on the author's dissertation, but includes other results, which makes it useful in training masters and doctoral students in higher education 4. Natural Sciences, Mathematics and Informatics.

4. Assessment of the pedagogical preparation and activity of the candidate.

I have no immediate impressions from the pedagogical activity of the candidate Assistant Professor Diana Nedelcheva. From the attached report on the **pedagogical activity and employment** can be established that Assistant Professor Diana Nedelcheva has led the following courses for bachelors and masters: Mathematics 1 and 2, Applied Mathematics, Numerical Methods and Mathematical Statistics, VM 1, Mathematics (preparatory course), Statistics, Mathematical Statistics and Selected Chapters in Mathematics. This allows to draw a conclusion about the high level of pedagogical training and activity of the candidate.

5. Main scientific and scientific-applied contributions.

In addition to the total number of 8 publications (6 articles, one monograph and one book) of Assistant Professor Diana Nedelcheva, has six conference papers and total of 17 citations, 16 of which in WoS and / or SCOPUS and one in MathSciNet. It makes a good impression that all citations are from colleagues outside Bulgaria, which shows that the studied problems are of interest to colleagues from around the world. The publications with which Assistant Professor Diana Nedelcheva participates in the competition, generalize some important results and gives many applications from other fields of science.

I have not detect "plagiarism" in the works of the candidate in the sense of ZRAS in the Republic of Bulgaria.

6. Significance of contributions to science and practice.

The results obtained by the candidate are applicable to the theory of fixed-points and ambiguous mappings and in the study of equilibrium in non-competitive markets, where a new look at Carnot's theory is given. Very interesting are and the applications of the obtained results in

the problem of equilibrium in non-competitive duopoly markets, as well as in the study of steady states of the aquatic ecosystems.

7. Critical remarks and recommendations.

I recommend Diana Nedelcheva to publish textbooks for students from the Technical University - Varna in the subjects she teaches. I recommend continuing joint research with colleagues from France.

8. Personal impressions and opinion of the reviewer.

I do not have direct personal impressions of the candidate, but according to the presented scientific production by Assistant Professor Diana Kirilova Nedelcheva, in my opinion shows that sufficient results have been obtained, both in quantity and quality for holding the academic position of "Associate Professor". From the submitted documentation it can be seen that it satisfies all the requirements of the Law for the Development of the Academic Staff in the Republic of Bulgaria (ZRASRB), BAS.

CONCLUSION

The above-provided analysis gives me a reason to form the following personal opinion: I give my positive assessment and **I recommend to the Scientific Jury to prepare a report-proposal to the Honorable Scientific Council of the Faculty of Computer Sciences and Automation for the election of Assist. Prof. Diana Kirilova Nedelcheva, PhD for the academic position "Associate Professor" in the Technical University of Varna** in the field of higher education 4. Natural Sciences, Mathematics and Informatics 4.5 Mathematics (Mathematical Analysis and Operations Research).

10.12.2021   Signature: ....

/ Prof. Andrey Zahariev, PhD /