R E V I E W
by
Professor Dr. Maria Petkova Hristova

of the material presented for participation in a competition
for appointment to the academic position of **"associate professor"**
in area of higher education **4. Natural Sciences, Mathematics and Informatics**,
professional field **4.6. Informatics and Computer Science** (Programming and Use of Computers)
for the needs of the **department of Computer and Information Technology**
of the **Prof. Dr. Asen Zlatarov University, Burgas,**
regarding the candidate Chief Assistant Dr. **Deyan Georgiev Mavrov**

1. General Description Of The Procedure and the Candidate

By order No. 294/19.09.2022 of the Rector of the Prof. Dr. Asen Zlatarov University I have been selected a member of the Scientific Jury in the competition for appointment to the academic position of "associate professor" in professional field 4.6. Informatics and Computer Science (Programming and Use of Computers), announced in the State Gazette in issue 45/17.06.2022. This review has been compiled according to the decision made during the first meeting of the Scientific Jury on 4.10.2022 and is in compliance with the requirements of article 2, paragraph 5 of the Rules for Implementation of the Development of Academic Staff in the Republic of Bulgaria Act (ППЗРАСРБ) and article 2, paragraph 4 of the Rules on the Conditions and Procedures for the Acquisition of Scientific Degrees and the Appointment to Academic Positions of the Prof. Dr. Asen Zlatarov University, Burgas.

This review is based on the documents submitted for participation in the competition by its single candidate – Chief Assistant Dr. Deyan Georgiev Mavrov, who has presented the following documents to participate in the competition during the required date period:

1. Application to the Rector to be admitted to the competition
2. Copy of the State Gazette announcement
3. Creative autobiography (CV)
4. Copies of the applicant's diplomas:
   4.1. Copy of higher education diploma
   4.2. Copy of diploma for the educational and scientific degree of "Doctor"
5. Document proving the length of the applicant's work service
6. Documents regarding the applicant's participation in science research projects
7. Report on the applicant's teaching activity
8. Declaration in compliance with paragraph 18
9. Report on the applicant's coverage of the position's minimal requirements
10. Full list of publications
11. List of the publications used to participate in the competition
12. Author report and abstracts of the applicant's works
13. Report on the citations of the applicant's publications
14. Copies of the applicant's works
15. Copies of the applicant's educational publications

The material kit supplied in paper form by Chief Assistant Dr. **Deyan Georgiev Mavrov** complied with article 67, paragraph 2 of the Rules on the Conditions and Procedures for the Acquisition of Scientific Degrees and the Appointment to Academic Positions of the Prof. Dr. Asen Zlatarov University, Burgas.

According to the Development of Academic Staff in the Republic of Bulgaria Act (article 24), the Rules for Implementation of the Development of Academic Staff in the Republic of Bulgaria Act (article 53) and the Rules on the Conditions and Procedures for the Acquisition of Scientific Degrees and the Appointment to Academic Positions of the Prof. Dr. Asen Zlatarov University, Burgas (article 67, paragraph 1), candidates for the position of "associated professor" must comply with the following terms:

- they must have acquired the educational and scientific degree of "Doctor", which for the case of regulated professions must be in the same field
- they must have had:
    - at least two years of service in the academic position of "assistant" or "chief assistant", or
    - at least five years of service as part-time teachers in a higher education institution, or at least two years as members of a scientific research team at either the same or another higher education institution, or a scientific organization.
- they must have presented a published monographic work or an equivalent list of publications fitting the profile of the announced competition, according to group "B" of Appendix 1, which must be narrowly specialized and must not repeat those submitted for the acquisition of the educational and scientific degree of "Doctor" or the scientific degree "Doctor of Sciences".
- they must fulfill the corresponding minimal national requirements and the minimal requirements set in the Rules imposed by the Prof. Dr. Asen Zlatarov University
- they must have had no plagiarism discovered in their works through the legally established procedure
- they must have taken part in scientific research projects that have concluded with scientific and applied science results, or have creative or athletic achievements, which include contributions to the respective field
- they must have developed a curriculum for a discipline and a lecture course for a discipline

Chief Assistant Dr. Mavrov complies with the conditions set in article 67, paragraph 1 of the Rules on the Conditions and Procedures for the Acquisition of Scientific Degrees and the Appointment to Academic Positions of the Prof. Dr. Asen Zlatarov University, Burgas, since he has provided:

- Diploma No. 0046, issued June 28, 2016 by the Prof. Dr. Asen Zlatarov University, Burgas, for the scientific degree of "Doctor"
- An official notice from the Prof. Dr. Asen Zlatarov University, Burgas, certifying that Chief Asst. Dr. Deyan Georgiev Mavrov is employed on a main contract and his teaching service has proceeded as follows: from 5.11.2012 to 19.10.2016 he held the position of "Assistant" and since 19.10.2016 he has held the position of "Chief Assistant".

2. Personal Characteristics of the Candidate

Dr. Deyan Georgiev Mavrov graduated from the Burgas Free University and is a Bachelor in Informatics and Computer Science and a Master in Business Information Technology in the same university. He previously worked in the Regional Inspectorate of the Education of Burgas. In 2012

he became an assistant in the Prof Dr. Asen Zlatarov University's Faculty of Natural Sciences, in the Computer and Information Technology department; since 2016 he is a chief assistant. In 2016, at the Prof Dr. Asen Zlatarov University, he defended a dissertation titled "Software Implementation and Application of Index Matrices" and he received the educational and scientific degree of "Doctor" in Computer Systems and Technologies. He is a member of the Union of Scientists of Bulgaria.

According to a certificate issued by the Scientific Research Institute at the Prof Dr. Asen Zlatarov University and a report on Chief Asst. Dr. Deyan Mavrov's scientific research activity signed by the candidate himself, he has taken part in the teams of 9 scientific research projects:

➢ Four projects through the Ministry of Education and Sciences Scientific Research Fund – *"New Instruments for the Extraction of Data and Their Modeling"* (2016 – 2020); *"InterCriteria Analisys – a New Approach in Decision Making"* (2014 – 2016); *"An Integrated Approach for Modeling the Spread of Forest Fires"* (with the Institute for the Forest at the BAS); *"Theoretical Research and Applications of the InterCriteria Analysis"* (with the Institute of Biophysics and Biomedical Engineering at the BAS)

➢ The national science program titled *"Information and Communication Technologies for a Unified Digital Market in Science, Education and Security"* (ИКТвНОС) (2018 – 2021) with the Ministry of Education and Sciences.

➢ The international project *"European Night of Scientists"*, Horizon 2020, Call: HORIZON-MSCA-2022- CITIZENS-01-01, HORIZON

➢ 3 internal university projects.

3. General Characteristics of the Research Papers Presented for the Competition

Chief Asst. Dr. Deyan Mavrov is participating in the competition with *12 papers*. The entire work produced by the candidate falls thematically in the competition's professional field 4.6. Informatics and Computer Science. With none of the works is there a match between the publications presented for the defense of the educational and scientific degree of "Doctor" and those submitted for the academic position of "Associate Professor". Therefore, all works are to be taken into account for the final assessment in this competition. All publications are in English. In 2 of the publications Dr. Mavrov is listed first in the list of authors, 4 have him in second place, 3 in third; 7 of the works have more than three authors. Five of the co-authors have signed declarations for equal participation in the works listed by Dr. Mavrov. The presented works by the candidate for the competition are original and to my knowledge there is no plagiarism present.

Chief Asst. Dr. Deyan Mavrov is submitting two scientific publications [Nos. 1.1. and 2.2.] as equivalent to a moographic work in accordance with the "B" group of indicators (indicators 3 and 4) of Appendix 1 (from the Rules on the Conditions and Procedures for the Acquisition of Scientific Degrees and the Appointment to Academic Positions of the Prof. Dr. Asen Zlatarov University), table 1 for the minimal points required for each scientific degree and academic position (requirements of the Asen Zlatarov University) for the area of higher education 4. Natural Sciences, Mathematics and Informatics, professional field 4.6. Informatics and Computer Science. In [1.1.] an application software program called ***FireGrid*** is presented, which performs a two-dimensional simulation of fire spread using Atanasov's Game Method for Modeling (GMM) which is based on cellular automata. The software implements a fire spread model with one or more starting points of ignition over an orthogonal grid of square cells whose values change according to a predefined set of rules. The application allows to search for a fire's starting point(s) by subtracting the final configuration from the initial one and decrementing all affected cells by one. The fire spread pattern

can be given before the start of the simulation, and as an extra option during the simulation manual control is allowed by selecting the cells that are to start burning at the next iteration.

The other publication [1.2] is dedicated to simulating the fire that burned in the Kresna Gorge in Bulgaria in 2017 by taking into account the wind, characterized by its direction and force. The fire's impact is evaluated in iterations in the form of temporal intuitionistic fuzzy sets that save the information about the rate of burnt and unaffected areas. The results from the *FireGrid* product are compared with the results from the *FlamMap* software application. For the first time, the basic properties of the operations and operations defined over temporal intuitionistic fuzzy pairs are presented. Both papers are published in specialized scientific editions which are indexed in the worldwide scientific information databases (Web of Science and/or Scopus) – 1.1 is from the *International Journal Bioautomation*, which has an SJR (30 points), while 1.2. is from the open access journal *Mathematics* (published by MDPI) with an Impact Factor and falling into the Q1 category (75 points).

The remaining 10 publications from the list submitted for review [Nos. 2.1. to 2.10.] are in group "Г" and are published in *International Journal Bioautomation, IEEE; International Conference on Intelligent Systems; Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence), Computational Intelligence and Neuroscience and Lecture Notes in Bioinformatics; Biochimica et Biophysica Acta - General Subjects; Advances in Intelligent Systems and Computing; Proceedings of the 16th Conference on Computer Science and Intelligence Systems (FedCSIS); Mathematics, Lecture Notes in Networks and Systems.*

Six of the publications in this group are peer-reviewed and indexed in WoS, 10 in Scopus, 7 have an SJR, three are in proceedings of IEEE conferences. Two publications [Nos. 2.5. and 2.9.] fall into JCR Q1, one [No. 2.4.] in Q2 and one in Q4 [No. 2.3.].

Chief Asst. Dr. Deyan Mavrov has also submitted a full list of his publications, consisting of 24 works in total.

Impact of the candidate's scientific publications on local and foreign scientific literature

The candidate has submitted a list of 95 discovered citations (excluding self-citations) in peer-reviewed editions indexed in Web of Science or Scopus of 8 scientific works produced with his participation. This is additional evidence of these papers' high professional level and their international significance. No information was provided about Dr. Mavrov's h-index values in Scopus and Web of Science.

Regarding the compliancee with the minmal national requirements by groups of indicators for appointment to the academic position of "assistant professor" in professional field 4.6. Informatics and Computer Science (according to article 26, paragraph 2 and 3 of the ЗРАСРБ and article 24, paragraph 4) and the Rules on the Conditions and Procedures for the Acquisition of Scientific Degrees and the Appointment to Academic Positions of the Prof. Dr. Asen Zlatarov University

From Chief Asst. Dr. Deyan Georgiev Mavrov's report on the fulfillment of the minimal requirements for participation in the competition for the academic position of "assistant professor" it can be plainly seen that:

- **for group "A"** Dr. Mavrov has presented information on his possession of the educational and scientific degree of "Doctor"
- **for group "B"** (*indicators 3 and 4*) the candidate **has gathered 105 points** from a required minimum of 100 points

- **for group "Г"** (*indicators 5 to 10*) – **384 points** (when 200 points are needed to fulfill the minimal national requirements and 300 points are needed to fulfill the minimal requirements of the Prof. Dr. Asen Zlatarov University)

- **for group "Д"** (*indicator 11*) – the citations in scientific editions, monographs, collective books and patents, peer-reviewed and indexed in world-known databases of scientific information (Web of Science and Scopus) accumulate a total of **760 points** (when the required minimum is 50 points in the minimal national requirements and 100 points in the minimal requirements of the Prof. Dr. Asen Zlatarov University)

- **for group "E"** (*indicators from 12 to the end*) – **a total of 102.5 points** from a required 100 points according the the Prof. Dr. Asen Zlatarov University's minimal requirements (70 points from "participation in projects" and 32.5 points from "educational publications for university students" /indicator 20/)

The grand total number of points is **1401.5** when the minimal national requirements call for 400 points and the Prof. Dr. Asen Zlatarov University's minimal requirements call for 650 points for an appointment to the academic position of "assistant professor" in aprofessional field 4.6. Informatics and Computer Science. Chief Asst. Dr. Deyan Mavrov completely covers and exceeds all requirements for the indicators.

4. Evaluation of the Candidate's Teaching Activity

'According the report which the candidate for the competition has signed himself, his teaching work and methodical activity comprises of:

- teaching classes to students in the Bachelor degree programs of various specializations from the Faculty of Natural Sciences, the Faculty of Technical Sciences, the Faculty of Social Sciences and the Technical College in the Prof. Dr. Asen Zlatarov University in the following disciplines: "Synthesis and analysis of algorithms", "Informatics", "Programming and Use of Computers, part I and II", "Introduction to Programming", "Object-Oriented Programming", "Programming Languages", "Modelling and Design of Software Systems", "Audio-Visual and Information Technologies in the Education".

- teaching practice classes to students studying in Master's degree programs with the specializations "Software Technologies", "Computer Systems and Technologies" and "Innovations in the Teaching of History in Secondary School" in these disciplines: "Software Technologies", "Programming", "Programming for the Microsoft.NET Framework" and "Information and Communication Technologies and Working in a Digital Environment".

- participation in the development of the curriculum for the following disciplines: "Programming and Use of Computers, part II", "Synthesis and Analysis of Algorithms", "Programming Languages", "Object-Oriented Programming, part I and II"

- reviewing the Master's theses of various students
- supervising one student's work on his Master's thesis

Another thing that can be added to Dr. Mavrov's pedagogical activities and teaching contributions is his work with a co-author of a textbook titled "Object-oriented Programming, Part I – C++" (2022, 256 pages), with a collective of authors on "A Handbook for the Laboratory Classes in Informatics" (2013), as well as his sole work on "A Handbook for the Laboratory Classes in Synthesis and Analysis of Algorithms" (2022). These books are written professionally, are methodically sound, and are useful for students in the respective disciplines. They can also be of interest for a wider circle of specialists.

I give a high evaluation of Chief Asst. Dr. Mavrov's teaching and methodical work.

5. Summary of the Scientific and Applied Science Contributions

The main scientific, applied science and applied contributions of candidate Dr. Deyan Mavrov are objectively formulated in the author report he has provided. Based on the candidate's works it can be concluded that his scientific interests mainly lie in *finding ways to apply the theoretical apparatuses of intuituinistic fuzzy logic and index matrices to practical analysis of various types of data and as an additional tool in data analysis.*

The contributions can be systematized by thematic areas in the following way:

5.1. Applications of InterCriteria Analysis (ICA)

InterCriteria Analysis, developed together with Acad. K. Atanassov and Assoc. Prof. V. Atanassova (part of Dr. Mavrov's dissertation) generates intuitionistic fuzzy evaluations on the relations between each pair in a set of criteria that assess the same objects, where the evaluations lie in an index matrix. ICA, along with Pearson and Spearman's correlation analysis, was applied to numeric data from medicine [2.1. and 2.5.], respectively from analysis of blood plasma thermogram data from patients with colon cancer and ICA analysis of calorimetric data from blood plasma proteom.

In [No. 2.2.] ICA was applied to data related to the integrated transport system of the city of Burgas for the purpose of optimization of the city's transport system by reducing redundant lines.
A variant of ICA for finding triples of input parameters was used in [No. 2.4.] as an auxiliary method to reduce the number of variables at the input of neural networks. In this way the total time needed to train neural networks can be reduced, and by that the time needed to process data and images.

In [No. 2.6.] the level operator $N\gamma$ was used to determine a new way to define the thresholds on which two criteria are considered in consonance; and a new method of calculating the γ parameter is proposed, which uses the intuitionistic fuzzy triangle and the topological operators "interior" and "closure".

5.2. Using Software Libraries For Work with Index Matrices (IMs)

These programs make it easier to execute and amend statistical and other types of algorithms that use IMs and the operations with them to reach their final result, especially when working with IMs containing intuitionistic fuzzy pairs. The libraries allow working with IMs of different types of values. New data types were developed to store intiotionistic fuzzy pairs, interval-valued pairs and IFPs of interval-values. In [No. 2.10.] a one-factor intuitionistic fuzzy ANOVA (1-D IFANOVA) using index matrices was implemented, and the programs developed were applied to analyze the influence of the "geographic location" factor of countries on the spread of COVID-19. In [No. 2.7.] a two-factor intuitionistic fuzzy ANOVA (2-D IFANOVA) using IMs was implemented and the proposed computer program was used to analyze the factor combination of "population density" and "climate zone" for the countries in Europe and its influence on the spread of COVID-19 in them.

An intuitionistic fuzzy approach for selecting a subcontractor for outsourcing using IMs and interval-valued intuitionistic fuzzy pairs was implemented in [No. 2.8.]. Here, an optimal intuitionistic fuzzy multicriteria decision making problem using interval-valued pairs for finding subcontractors was formulated and a new method for selecting the most appropropriate candidates was proposed.

5.3. Creating Generalised Net Models

In [No. 2.3.] and [No. 2.9.] Generalized Net models are proposed, respectively, of a cluster analysis process using STING, where a Statistical Information Grid is applied in data mining; and of a system for fire prevention surveillance of a forest terrain with the help of Unmanned Aerial Vehicles (UAVs) for the purpose of preventing and quickly discovering forest fires.

5.4. Developing application software for two-dimensional fire spread analysis

Using Atanassov's Game Method for Modeling on a square-cell grid that describes terrain and vegetation density over it, in [No. 1.1.] an application program was developed for the two-dimensional analysis of fire spread, while in [No. 1.2.] it was applied over a model of an area where an actual fire has occurred.

I accept the author's report on his contributions, and on the basis of the characterization made of the scientific, applied science, applied and teaching contributions of the candidate it can be concluded that they are significant for science, practice and the educational process. They consist of applications for new and improved methods and algorithms for the solving of important problems and tasks from the scientific area of the competition, as well as for the optimization of their previously existing solutions. They can be construed as an enrichment of the existing scientific area with new knowledge, models and applied aspects.

6. Critical Notes and Recommendations

I do not have any essential critical notes on the candidate's presentation. Nonetheless, I would need to put emphasis on some critical considerations:

- Two of the student textbooks, titled "Object-oriented Programming, Part I – C++" by Lyudmila Dimitrova, Deyan Mavrov (2022) and "A Handbook for the Laboratory Classes in Informatics" by a collective (2013) were presented without a title page, publisher and reviewers.
- The list of publications lacks a work written solely by the candidate.

I would recommend Chief Asst. Dr. Mavrov to show activity in the area of international teaching through external mobility with the aim of teaching through the Erasmus+ programme, as well as to show more self-dependence in his future work and creative endeavours.

The remarks and recommendations made here do not negate or underestimate the significant results shown before and the positive impression from the scientific production of the candidate for the competition.

7. Personal Impressions

I am not personally familiar with the candidate and thus have no personal impressions.

CONCLUSION

The documents and materials presented by Chief Asst. Dr. Deyan Georgiev Mavrov are in full compliance with the requirements of the Development of Academic Staff in the Republic of Bulgaria Act (ЗРАСРБ), the Rules for Implementation of the ЗРАСРБ, the minimal national requirements for appointment to the academic position of "associate professor" in professional field 4.6. Informatics and Computer Science, according to article 26, paragraph 2 and 3 of the ЗРАСРБ and the Rules on the Conditions and Procedures for the Acquisition of Scientific Degrees and the Appointment to Academic Positions of the Prof. Dr. Asen Zlatarov University, Burgas.

The candidate's works contain original scientific, applied science and applied contributions, which have found international recognition by being accepted in journals and scientific books, published by international academic publishing houses.

All this gives me the justification to give my **positive evaluation** of the materials presnted, and I propose to the honored scientific jury to vote in favor of awarding **Chief Assistant Dr. Deyan Georgiev Mavrov the academic position of "associate professor" at the Prof. Dr. Asen Zlatarov University, Burgas, in professional field 4.6. Informatics and Computer Science (Programming and Use of Computers).**

1.11.2022   Reviewer: ..

                                        /*Prof. Dr. Maria Hristova*