REVIEW
of competition for the academic position of "professor"

in the field of higher education:	4. Natural sciences, mathematics and informatics
professional direction:	4.6. Informatics and computer science
scientific speciality:	Informatics (Modern technologies for preservation, accessibility and protection of scientific and cultural heritage)
announced in:	State Gazette no. 102 of 01.12.2020 and on the IMI website
for the needs of:	Institute of Mathematics and Informatics (IMI) Section "Software Engineering and Information Systems"

The review was prepared by:
Dr. Ivan Kolev Koychev, Professor
at the Faculty of Mathematics and Informatics
at Sofia University “St. Kliment Ohridski”,
in his capacity as a member of the scientific jury of the competition,
according to Order № 11 / 29.01.2021 of the Director of IMI.

Only a candidate has submitted documents for participation in the announced competition:

Assoc. Prof. Dr. Galina Todorova Bogdanova, IMI-BAS

1 General description of the submitted materials

The candidate has submitted a complete set of documents by the requirements of the regulations of IMI-BAS for the candidates for the academic position "professor”.

1.1 Details of Candida rounds

Assoc. Prof. Dr Galina Bogdanova **participated in the competition with 25 publications** that have not been used to obtain the educational and scientific degree "Doctor" and to hold the academic position of "Associate Professor" and are in the subject of the competition. Their distribution by categories is:

- 2 publications with impact factor (1 in category Q2 and 1 in category Q3 in WoS);
- 9 publications with impact rank (Scopus);
- 12 publications that are only indexed in Scopus or WoS;
- 2 chapters from books.

Besides are presented a **manual on web accessibility**, an online questionnaire and a report from a **survey of the accessibility** of 100 websites of public institutions in Bulgaria

A list of **281 citations from 59 publications** in which the candidate is a (co) author, derived from the SONIX system, as well as a general list of citations derived from Scopus, are presented. From the second list are selected **44 citations** with which Assoc. Prof. Bogdanova participates in the competition.

According to Galina Bogdanova's profile **in Scopus her H - index** is **7.** According to her profile in **Google Science her H - index** is 13**.**

There are also presented:

- list of **defended doctoral students - 4;**
- list of **participations in research projects**: 18 projects, of which **17** are research participations, of which national - 10, international - 7 (as in 4 of them she is a leader), and 1 is for support of an international event;
- list of **participations in editorial boards** of volumes of scientific series, thematic collections or collections of papers at scientific forums (editor-in-chief - 11; member of the editorial board - 1; technical editor - 1);
- list of **participations in the creation of digital scientific collections and museum collections** (team leader - 4; participant - 2);
- list of **participations in the creation of online platforms and software modules** (7);
- list of **lectures, special courses, seminars and schools** (topics: cultural and historical heritage and web accessibility);
- list of **participations in the organization of exhibitions** in Bulgaria (25) and abroad (1);
- list of **memberships in organizational and program committees of scientific forums** (53 events; international forums: chairman of OC - 7, member of OC - 11; national forums: chairman of PC - 10, chairman of OC - 7, member of PC - 6, member of OK - 12);
- list of **award-wined "best article in a scientific forum"** (2);
- list of **participations in councils, commissions and other expert bodies** of institutions external to BAS;
- list of **expertise, consultations and opinions.**

1.2 Details about the candidate

The candidate graduated from the Technical University - Sofia (then VMEI) with a master's degree in "Heat Energy and Nuclear Energy" (1980) and a second **master's degree in "Applied Mathematics" (1981).**

In the period 1996-2000, she was a doctoral student at IMI-BAS with research supervisor Prof. Stoyan Kapralov. In 2000 he successfully defended his **doctoral dissertation** on "Limits for optimal codes".

From 1981 to 1988 he worked as a programmer at the Territorial Computing Center, Veliko Tarnovo. Since 1989 he has been working at IMI-BAS, V. Tarnovo branch, first as a mathematician, then as a research associate, and **since 2002 as an associate professor**.

Galina Bogdanova's main **research interests** are in the fields of coding, information protection, databases, data analysis, semantic technologies, ontologies, digitization of cultural and historical heritage, web accessibility technologies and others.

The professional CV and references of the candidate testify to energetic **multilateral and successful activity** as an organizer, expert, lecturer, head of doctoral students, leader and participant in project teams.

1.3 1.3 General characteristics of the scientific works and achievements of the candidate

Galina Bogdanova's research work can be categorized in the following areas:

- **coding and protection of information -** in scientific terms - construction and classification of linear, nonlinear and optimal codes with certain properties; and in scientific-applied - protection schemes with watermark;
- **methods and technologies for preservation, digitization and presentation** of scientific and cultural heritage - application of integrated approaches for organization, protection, management and presentation of digital archives and repositories;
- **adaptation and application of the developed methods and technologies** to other applied areas, such as **healthcare, training,** etc.;
- **methods and standards for the provision of digital accessibility** for people with special needs - building methodology and web accessibility of public websites and electronic textbooks.

The **scientific papers** submitted at the competition **contain original results,** as the references to other people's works are adequately marked.

The candidate fulfils or significantly exceeds the criteria of the minimum requirements for the academic position "professor" in IMI-BAS, as follows in the groups:

- group A: defended doctoral dissertation "Limits for optimal codes" in - 50 points;
- group B: 5 publications with SJR - 100 points;
- group D: 20 publications (1 in category Q2 in WoS, 1 in category Q3 in WoS, 4 with SJR, 12 indexed, 2 chapters from books) - a total of 342 points with a required 220 points;
- group D: 44 quotations are presented in Scopus - 264 points with a required 140 points;
- group E: 4 defended doctoral students, 10 participations in national, 3 participations in international, 4 manuals of national research projects - 440 points at required 150 points.

The specific requirement of art. 3, para 1, item 3 of PURPNSZAD in IMI for at least 10 publications in editions with IF or SJR is also fulfilled - Galina Bogdanova has presented 11 such publications.

1.4 Characterization and evaluation of teaching activities, project work and other activities

The candidate has significant **teaching experience** - conducting lectures, special courses, seminars and schools in areas such as digitization of cultural and historical heritage and web accessibility; leading internship programs and master's theses total over 25; and has **4 successfully defended doctoral students and 2 current students,** which shows that she can attract and lead young researchers.

From the facts stated in section 1.1, it is clear, that candidate is **participating in several successful research projects (17),** in some of them, she has been a team leader.

Her activity in the popularization of scientific results through the **organization of several exhibitions, virtual museum collections and scientific events also** stands out. Significant is her merit is the establishment of the event series "Cultural and Historical Heritage: Preservation, Presentation, Digitization" and the interdisciplinary seminar "Information Society", which is the core of a research network with participants from over 20 universities, institutes, libraries and museums.

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

The scientific and scientific-applied contributions of the candidate in the scientific works submitted for the competition can be grouped in the following directions:

1.5.1 Research related to information processing and protection

Theoretical contributions related to coding and protection of information ([6], [18], [21] and [22]). In this direction, the candidate's contributions are in the development of algorithms and programs for research, construction and classification of linear and nonlinear codes with certain properties (linear, equidistant, constant-weight, etc.). In [18] the developed software system QPlus is presented - for research and training in the field of coding theory. Another part of the publications is related to developed methods for construction, classification and research of optimal codes of a given class with fixed parameters. In [6], [21] and [22] some classes of nonlinear codes (equidistant and constant-weight) are studied and new constructions of codes are realized. In [21] the problem of constructing equidistant codes on an alphabet of arbitrary size q is considered. In [22] the problem of classification of optimal ternary constant-composition codes is considered. In [6] the problem of finding the limits of the size of ternary equidistant codes is studied.

Engineering contributions related to information processing, analysis and protection ([2], [19], [20], [25]). In [2] methods for the protection of interactive systems and digital archives against unauthorized distribution of digital content are studied. Developed and analyzed a method for correcting errors based on Reed-Solomon (PC, Reed-Solomon) and Heming code. The behaviour of different PC codes after the application of different types of attacks in digital watermark protection was studied. An improved watermark error correction scheme is presented. A method based on Discrete Wavelet Transform is used for embedding and extracting a watermark. The results are implemented in the interactive system of the North + project, interactive web presence and secure data protection. The developed methods are applied for the protection of digital archives and copyrights, for example in the folklore archive [19]. Methods for development, analysis and protection of a multimedia archive of folklore objects are presented in [25], which were implemented in the development of a prototype web system that contains the archive fund of the Institute of Folklore at BAS (IEFEM). In [20], a new co-filtering/recommendation algorithm is proposed, based on the detection of functional dependencies for error correction in a data set using fractal dimension. The developed algorithm was experimentally evaluated and compared with some similar algorithms.

1.5.2 Development of methods and technologies for preservation, digitization and presentation of scientific and cultural heritage

The research in this direction is the work of joint interdisciplinary teams, some of which are led by the candidate and the results of combining the work of different specialists are presented in [7], [17], [19], [23], [24]. Approaches for organization, management and protection of data in digital archives and repositories have been studied and developed. Article [7] presents the new solutions in the field of digitalization of the national folklore heritage, created within the National FolkKnow Program: "Technologies based on knowledge for creating digital resources and virtual presentation of significant collections of Bulgarian folklore heritage" (2006 -2012). Solutions related to the design of digital repositories for cultural artefacts are presented in [23]. The presentation of knowledge in the field of cultural and historical heritage is discussed in [17]. The article [19] discusses methods for the protection of objects in a multimedia folklore archive. In [24] technologies for the creation and indexing of digital resources for the needs of people with visual impairments are presented. The experience in digitization and data protection of Bulgarian cultural artefacts has been shared with colleagues from India, Belarus and Switzerland, and has been used to create multimedia archives in these countries [5].

1.5.3 Tools and platforms for digitization and preservation of cultural heritage

The works in this direction investigated software services provided by some **cultural heritage** application interfaces [10]. Tools have been developed that use these interfaces to search for and visualize data. The organization of digital resources in OntoWiki structure using graph databases as a platform for management and presentation of digital resources with application in the field of cultural and historical heritage is studied. [4]. An online platform (portal) FolkKnow has been developed for organizing and storing knowledge about folklore heritage [7]. With the help of the created software environment and modules, the digitized resources are organized and presented, thus preserving the memory of the nations for future generations [19] and [7].

Publications [3], [12] and [16] present developments related to **healthcare**. Publication [3] presents methods for organizing, managing and building knowledge bases for the Holter Monitoring System (HMS) in the field of healthcare. During the development of the ontological model HMS, models and tools have been adapted, created for the online platforms for the presentation of objects of the cultural and historical heritage. A web-based information system in the field of medicine based on cloud technologies has been developed [12]. The aim is to store and analyze cardio records of patients with various cardiac diseases obtained through a Holter monitoring system. The system analyses the entered physiological data, calculates and visualizes important parameters for the patient's health. It also provides opportunities to monitor the development of the disease and the effect of treatment for a given patient. The peculiarities of designing a medical software system for physiological data analysis, which considers the needs of people with visual impairments, are discussed in [16].

1.5.4 Approaches, methods and standards for ensuring accessibility and training of people with special needs

Under the guidance of Assoc. Prof. Bogdanova, research has been carried out related to the creation of approaches and methodology to **support the training of people with special needs** [1], [8], [16], [26] and [27]. The achieved practical results in this direction are the established scientific network with a centre, in the city of Veliko Tarnovo, and the network for accessibility on the site of Horizons Foundation.

In particular, a **web accessibility manual** [26] (in Bulgarian) and an online questionnaire have been compiled. For its compilation, standards and legislation related to web accessibility for people with special needs have been studied and analysed, both at the national and European level. Under the leadership of G. Bogdanova, the first large-scale scientific study on the problems of web accessibility in Bulgaria was conducted with an emphasis on people with visual impairments. A study was conducted on the accessibility of public websites in Bulgaria, examining 100 websites of public institutions (2015-2016). The survey was repeated for some of the problem sites with the lowest rating from the first survey (2019-2020). Summary results of these studies are published in [1]. The results of the study were analyzed and disseminated in a report presented by Assoc. Prof. Bogdanova [27], based on which recommendations were prepared and sent to public sector institutions and organizations. As a result of the analyzes, the conclusions and as a step forward in ensuring the rights of people with disabilities, a national network for web accessibility (http://webaccess.horizonti.bg) was created. The results of the conducted research are the basis for discussions, revision of the ongoing and formation of new accessibility policies. In 2017, by order of the Minister of Transport, Information Technology and Communications, a national interdepartmental working group on the

transposition of Directive 2016/2102 of the European Parliament was established. The basis for the work of this working group is the developed manual [26].

The problems of building a website accessible to people with various disabilities are discussed in [8]. Here are some basic guidelines that website developers need to follow to accomplish this task. Some tools for testing the accessibility of web content on sites are discussed. A model has been developed to create a physiological data analysis software system that considers the needs of people with visual impairments [16].

Another sub-area in this area addresses issues related to the **accessibility of educational technologies** for people with disabilities [9], [11], [13] and [14]. Under the guidance of Assoc. Prof. Bogdanova, a study was made of the state of accessibility of web educational resources for visually impaired people [9]. The collected data were analyzed and as a result, practical recommendations and guidelines for overcoming barriers to access to education for people with special educational needs were developed. A study of common barriers in cyberspace for users with visual impairments is presented in [11]. The use of educational games for training in the field of military-historical heritage is considered in [14], and a specific game has been developed. A model for accessibility of the developed educational game, oriented to people with visual problems, has been developed [13]. The most important standards and legislation related to the accessibility of serious educational games for people with special needs have been studied and analysed [24].

1.5.5 Conclusion of the content analysis of the contributions

The publications of Assoc. Prof. Bogdanova with which she participates in the competition are collective, and in most cases, the team of authors includes her doctoral students. Although there are no special separation protocols for the publications, her **leading role and significant contribution** are undoubted, as evidenced by the fact that they are in the field of her long-standing scientific interests and expertise.

The research results of Assoc. Prof. Bogdanova are **recognized both nationally and internationally**, as evidenced by her participation in international teams with relevant publications, as well as the many citations from various research teams around the world of her work, especially in the field of coding. There is no detected plagiarism in her scientific works

1.6 Critical notes and recommendations

I have no critical remarks on the works and the submitted materials for the competition.

1.7 Personal impressions of the candidate

I do not know the candidate personally.

1.8 Conclusion on the application

After getting acquainted with the materials and scientific works presented in the competition and based on the analysis of their significance and the scientific and scientific-applied contributions contained in them, I confirm that **the scientific achievements meet the requirements** of ZRASRB, PPZRASRB, the procedure for acquiring scientific degrees and for holding academic positions in BAS and the Regulations for the conditions and the procedure for acquiring scientific degrees and for holding academic positions in IMI at BAS. In particular, the candidate meets the minimum national

and institutional requirements in the professional field. Based on what has been said so far, I confidently give **a positive assessment** of the candidate Assoc. Prof. Bogdanova.

2 General conclusions

Based on my positive assessment, I propose that the Scientific Jury propose to the Scientific Council of IMI-BAS **to select the candidate Assoc. Prof. Dr Galina Todorova Bogdanova for the academic position "Professor"** in higher education 4. Natural Sciences, Mathematics and Informatics, professional direction 4.6. Informatics and computer sciences, scientific speciality Informatics (Modern technologies for preservation, accessibility and protection of the scientific and cultural heritage) announced in SG no. 102 of 01.12.2020 for the needs of IMI-BAS.

date: 21.03.2021 **Prepared the review:**

/ Professor Dr. Ivan Koychev /