SHORT REPORT

on the competition for the academic position

"Associate Professor"

in professional field 4.5. Mathematics (Probability and Statistics),

for the needs of Sofia University “St. Kliment Ohridski” (SU),

Faculty of Mathematics and Informatics (FMI),

announced in State Gazette No. 5 from January 17, 2025, and on the websites of FMI and SU.

The opinion has been prepared by: **Prof. DSc Mladen Svetoslavov Savov**, Faculty of Mathematics and Informatics, Sofia University “St. Kliment Ohridski”, professional field **4.5. Mathematics (Probability and Statistics)**, in my capacity as a member of the scientific jury for the competition according to Order No. RD-38-156 / 17.03.2025 of the Rector of Sofia University.

I. General Description of Submitted Materials

1. Application Details

The documents submitted by the candidate meet the requirements of the Law on the Development of Academic Staff in the Republic of Bulgaria (LDASRB), its Implementing Regulations (RLDASRB), and the Rules on the Conditions and Procedures for Awarding Scientific Degrees and Acquiring Academic Positions at Sofia University “St. Kliment Ohridski” (RCPASDOSU).

For participation in the competition, Chief Assistant Prof. Dr. Denitsa Parashkevova Grigorova has presented a list containing a total of **9 titles of publications**, including 9 publications in Bulgarian and international scientific journals and scientific forums, 0 studies, 0 monographs, 0 books, 0 certificates and patents, 0 textbooks and teaching materials. Additionally, **5** other documents have been submitted (in the form of official statements and certificates from employers, project leaders, funding organizations or project assigners, references and reviews, awards, and other relevant evidence) supporting the candidate's achievements. A CV, the required lists, summaries of the submitted articles, and a description of the candidate’s main scientific contributions are attached. The necessary supporting documents for holding the position of Chief Assistant Professor are also provided.

The submitted documents fully meet the requirements for the procedure. They are generally well-prepared, accurately reflect the candidate’s achievements, and substantiate that the candidate fulfils the minimum requirements of Sofia University “St. Kliment Ohridski” for obtaining the academic position of Associate Professor. I recommend that the citations be listed using numbered references rather than bullet points. This will facilitate referencing specific sources and improve the overall clarity of the document.

2. Details about the candidate

Denitsa Parashkevova Grigorova graduated from the Sofia High School of Mathematics "Paisii Hilendarski", after which she earned a bachelor's degree in applied mathematics (2007) and a master's degree in Probability and Statistics (2009) from the Faculty of Mathematics and Informatics (FMI) at Sofia University "St. Kliment Ohridski." In 2014, she defended her PhD thesis entitled "EM Algorithms for Probit Models with Random Effects", under the supervision of Assoc. Prof. Dr. Ralitza Gueorguieva. D. Grigorova has extensive teaching experience at FMI, where she has consecutively held the positions of Assistant and Chief Assistant Professor since 2012. She worked as a postdoctoral researcher at Bocconi University in Milan (2018–2020) and as a recognized researcher (R2) at the GATE Institute at Sofia University (2020–2023). She has participated in research projects funded by Sofia University, focusing on stochastic modelling, statistical analysis of medical data, and the development of software tools for statistical model estimation. Her academic output includes publications in international peer-reviewed journals and presentations at national and international conferences. She has received several awards, including distinctions from the International Society for Clinical Biostatistics (2013, 2015) and the Bulgarian Statistical Society (2010). Beyond her teaching and research work, D. Grigorova is actively involved in the scientific community as Secretary and National Representative of the Eastern Mediterranean Region of the International Biometric Society, as well as a reviewer and scientific committee member at international conferences.

3. Overall assessment of the candidate's scientific contributions and achievements

Chief Assist. Prof. Grigorova works in the field of applied statistics, with most of her publications based on the analysis of concrete empirical data. In addition, she has contributed to the methodological development of the ECM algorithm for correlated probit models. Building on previous research, the candidate extends the application of the ECM algorithm to the case of two correlated sequences of ordinal variables, as well as to a combination of correlated sequences of ordinal and continuous variables.

The candidate is currently applying various statistical methods, such as multiple regression, ANOVA, and others, in the investigation of different problems, primarily in medicine and pharmacology.

My overall assessment of the candidate's submitted works is positive; however, I will provide some recommendations and critical remarks below.

Assessment against normative requirements.

a) Chief Assist. Prof. Grigorova participates in the competition with **9 scientific publications** and **9 citations** thereof. The total score from these publications exceeds the minimum national requirements (according to Art. 2b, paragraphs 2 and 3 of the Law on Academic Staff Development in Bulgaria), as well as the additional requirements of Sofia University "St. Kliment Ohridski" for obtaining the academic position "Associate Professor" in the respective scientific area and professional field by 20 to 40%.

b) I confirm that the submitted papers have not previously been presented in other competitions.

c) I have not established, through the legally prescribed procedure, any plagiarism in the scientific works submitted for the competition.

4. Overall assessment of the candidate's teaching

The candidate has substantial teaching experience, both as a lecturer and as a teaching assistant. Chief Assist. Prof. D. Grigorova conducts her classes effectively, preparing high-quality teaching materials for her students. She plays an important role in the department's teaching activities by delivering specialized courses in applied statistics.

As a lecturer, she has taught several courses, including Introduction to Biostatistics, Biostatistics, Statistics and Empirical Methods, Mathematical Statistics, and Programming with R.

As a teaching assistant, she has contributed to the instruction of Linear Models with R, Introduction to Statistics, Introduction to Biostatistics, Biostatistics, Statistics (in English), Statistics and Empirical Methods, Probability Theory, and Mathematical Statistics.

In addition to her regular university courses, Dr. Grigorova has also taught a short course titled Statistical Data Analysis and its Computer Visualization, offered as part of teacher qualification programs and presented at the Spring Conferences of the Union of Bulgarian Mathematicians in 2016, 2017, 2020, 2022, 2023, and 2024.

5. Substantive analysis of the candidate's scientific and applied research contributions included in the materials submitted for the competition

I will provide a brief analysis of the articles submitted for the competition, grouping them into two categories – methodological developments and applications of statistical methods. In conclusion, I will briefly comment on the position of Chief Assist. Prof. Grigorova's works within the international literature.

Articles [8, 9] develop and apply an ECM algorithm for correlated probit models, building upon existing methodologies to enable the estimation of models involving two sequences of data—either two ordinal outcomes or a combination of ordinal and continuous outcomes—commonly encountered in longitudinal studies. The ordinal variables are modeled through latent Gaussian distributions. While the adaptation relies on established techniques, it requires solid technical skill and a strong familiarity with the literature to derive closed-form estimates for the numerous parameters, including the threshold levels of the latent variable that distinguish between the observed ordinal categories. The inclusion of the C-step in the ECM algorithm enhances numerical stability and accelerates the maximization of the likelihood function. The methodological contributions are supported by simulation studies and further complemented by Monte Carlo simulations for quantities that cannot be directly estimated via ECM. Article [9] also presents an application of the method to real data. All indications suggest that this approach has the advantage of explicitly incorporating the correlations between variables, offering not only computational but also statistical benefits. Additionally, an R package has been developed to implement the method.

In the remaining articles, Chief Assist. Prof. D. Grigorova applies a variety of fundamental statistical procedures to research in medicine and pharmacology. These publications do not aim to introduce new methods or develop statistical theory, but well-designed statistical analyses are of great practical importance. There are, in fact, strikingly irresponsible cases of careless or rushed statistical results in various areas of medicine. This highlights the importance of having competent experts involved in such work, and the candidate's contribution in this context is clearly positive. One notable study focuses on Alzheimer's disease [2], where the observation that the simultaneous presence of two types of errors in a patient may serve as a useful indicator for the development of screening tools. Another interesting example is the investigation of the effects of COVID-19 on cancer patients,

which surprisingly reveals that their relative risk is lower compared to the general population [1].

Among the citations of the candidate's work, most come from international research teams and are found across a variety of journals. In general, medical publications tend to attract greater attention due to the high publication activity and rapid article turnover in the field. A positive aspect, however, is that article [9] has received four independent citations, one of which is in one of the top statistical journals. This provides a well-needed balance in list of citations.

6. Critical Remarks and Recommendations

I have two main recommendations for Chief Assist. Prof. Dr. D. Grigorova. The first concerns the need to further activate her research activity and engage more broadly in the scientific community. The second is to seek opportunities for collaboration with international researchers, which would undoubtedly contribute to her professional development as a scholar. I note that the candidate has already taken steps in this direction. In addition, I would recommend that, if possible, Dr. Grigorova continue her work in the development of theoretical foundations. For better or worse, the growing presence of artificial intelligence is likely to lead to the automation of many specific procedures from input to output. In my opinion, the true added value of researchers in the future will lie in their ability to interpret, understand, and improve the methods themselves.

7. Personal Impressions of the Candidate

I know Chief Assist. Prof. Denitsa Grigorova as a capable lecturer and a colleague with whom I can engage in thoughtful and rational discussions on various professional challenges and issues. I expect and rely on her to be among the colleagues who will contribute to the development and expansion of the department—something particularly needed in the field of applied statistics.

8. Conclusion on the Candidacy

Having reviewed the materials and scientific works submitted for the competition, and based on the analysis of their significance and the scientific and applied contributions they contain, I confirm that the candidate's academic achievements meet the requirements of the Law on the Development of Academic Staff in the Republic of Bulgaria (ZRASRB), its implementing regulations, and the relevant regulations of Sofia University "St. Kliment Ohridski" for holding the academic position of Associate Professor in the respective scientific area and professional field of the competition. In particular, the candidate fulfills the minimum national requirements for the professional field, and no plagiarism has been established in the submitted scientific works.

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

II. Overall Conclusion

Based on the above, I **recommend that** the scientific committee propose to the competent body of the Faculty of Mathematics and Informatics at Sofia University "St. Kliment Ohridski" to appoint Chief Assist. Prof. Denitsa Parashkevova Grigorova to the academic position of Associate Professor in professional field 4.5. Mathematics (Probability and Statistics).

…… 2025 Prepared by: Prof. Dr.Sc. Mladen Savov