

REVIEW

by Professor Nikolai M. Yanev, Dr.Sc.,
Institute of Mathematics and Informatics, BAS,
member of a scientific jury in a competition for the occupation of
the academic position "Professor" at FMI-Shumen University
according to 4.5. Mathematics (Probability and Statistics),
announced in SG no. 63, 06/08/2022

I. Requirements to the candidate and documentation

The competition refers to the academic position of "professor" in professional direction 4.5. Mathematics (Probabilities and Statistics), announced in SG no. 63 of 06.08.2022 for the needs of the FMI at the University of Shumen "Episcopo Konstantin Preslavski", Department of "Economics and Mathematical Modeling". The jury was appointed by order of the Rector of the " Episcopo Konstantin Preslavski" Shumen University RD-16-201/04.10.2022.

The only candidate in the competition is associate professor Dr. Pavlina Kalcheva Yordanova, who currently holds this position at FMI-ShU in Probability Theory and Mathematical Statistics. The submitted documents for participation in the competition were examined by a specially created committee and were accepted by decision of the FS of FMI-SHU (protocol FD-02-02/21.09.2022).

I have received 21 documents (or sets of documents) in paper form for evaluation in the competition, which are described in detail in the application for participation in the competition. Here are some of the more essential ones: CV, diplomas, list of publications and copies of them, reference for contributions and citations, reference for fulfilling the minimum national requirements and the additional requirements under ZRAS, etc., all very detailed and properly formatted, which gives me grounds to accept them for consideration and to state that all formal requirements of the procedure have been met.

The candidate's CV (in 24 pages) is prepared in accordance with the requirements of the European model and contains data on a number of serious achievements. Here are some of them in brief.

In 1996, Pavlina Yordanova graduated as a mathematician at FMI-SHU, majoring in Mathematics with a specialization in Econometrics, and in 1998 she also received a diploma as a teacher in mathematics and informatics. In 2006, she obtained a doctorate in TV and MS by defending a dissertation at IMI-BAN on the topic "Multidimensional Functional Extreme

Criterion" with supervisor Prof. Dr. Elisaveta Pancheva (author's abstract is attached). From 1996 until now, she has been working at "Episcopo Konstantin Preslavski" Shumen University, since 1997 she has been an assistant, since 2002 - senior assistant, since 2004 – head assistant, and since 2014 she is an associate professor. During the period 2002-2022, she participated in various courses and seminars, obtaining a number of other qualifications. She has strong computer skills (R, Python, SPSS, MATLAB, Latex, etc.). She speaks English and Russian.

The educational and teaching activity (for bachelors and masters) of P. Yordanova is impressive: 17 different types of lectures in the field of TV and MS, Random processes, Econometrics, Financial mathematics; 21 different types of seminar exercises in the fields of TV&MS, Econometrics, Random processes, DIS, MA-2, Numerical methods, Analytical geometry, Financial mathematics, Projective geometry, Statistical methods in biology, Mathematics 3 and 4; 16 different types of laboratory exercises in TV and MS, Econometrics, Statistical modeling, Random processes, Queuing Theory, Information technologies, Informatics, Multimedia systems. In addition, P. Yordanova also has 7 successfully defended students. She is the head of the master's program "Statistics and Econometrics". Obviously, she goes above and beyond the usual hours for a professor.

We should especially note that P. Yordanova has given lectures and has implemented 11 projects for joint scientific activity with universities in Portugal, Poland, Austria and Chile.

P. Yordanova was also the head of one international research project (2017-2020) and a member of another one (2015-2019). She participated in 3 national scientific contracts. She was the head of 6 intra-university projects of SHU and was a member of 10 such projects. All contracts are duly submitted with complete documentation.

P. Yordanova was editor-in-chief (2015-2019) of ProbStat Forum (An e-journal in Probability, Statistics and Optimization), invited editor of J. Appl. Statistics and Associate Editor of Stochastic Analysis and Applications. She was also a member of the editorial board of 5 other journals. P. Yordanova has also repeatedly been a reviewer for a number of prestigious international journals. In Mathematical Reviews alone, she has 29 published reviews. She was a member of a number of scientific juries and was repeatedly invited as an expert in various commissions and projects.

P. Yordanova's scientific interests are broadly speaking in the field of Probability Theory, Mathematical Statistics and Stochastic Processes. The list of scientific publications of P. Yordanova is also impressive. First we should note that she has 35 scientific articles in a number of prestigious international scientific journals and proceedings with an impact factor or impact rank. She has also produced one monograph (in English), 2 textbooks and 2 manuals

(collections). In addition, P. Yordanova has 6 articles in refereed journals and 25 articles in anonymously refereed journals, as well as 6 preprints and one poster.

18 additional organizational and management activities are noted in the resume (course manager, organizer and leader of sessions and seminars, member of committees, etc.).

To participate in the competition, P. Yordanova submitted a monograph, one textbook, one guide and 20 articles with an impact factor (IF, 13 in number) or with an impact rank (SJR, 7 in number), referenced and indexed in Web of Science and Scopus, who have not participated in previous competitions. They have the following quartile distribution (in year of publication): Q1 - 3, Q2 - 1, Q3 - 7, Q4 - 1. The citation index for these articles contains 45 citations, all in journals with an impact factor or rank, being given and their corresponding quartiles. Detailed summaries of the presented publications are presented in Bulgarian and English. There is also a detailed reference to the original scientific contributions, a declaration of authorship and full separation protocols (with equal participation of P. Yordanova). This scientific output will be analyzed in detail in the next section.

P. Yordanova has presented 42 reports at international conferences and seminars at home and abroad, some of which by invitation.

The report on the fulfillment of the minimum national scientific requirements (according to the RSASPB) is presented in detail on 28 pages and shows that P. Yordanova has 1536 points out of the required minimum of 600 points, i.e. the latter is exceeded 2.5 times.

The reference on the additional indicators (from the rules of the ZRASRB) is also impressive and is presented on 18 pages. The educational activity is reflected through 17 types of lectures, 22 types of seminar exercises, 16 types of laboratory exercises, 7 successfully defended diplomas. 11 lectures and projects at universities abroad are presented, as well as many additional activities at the SHU. The publications and their citations that have already been discussed are also presented.

Finally, let us note that P. Yordanova is currently a member of 3 Bulgarian scientific organizations (Bulgarian Statistical Society, SMB, SUB) and 8 international ones, including ISI (International Statistical Institute) and AMS (American Mathematical Society). In addition, he is a member of the FS of FMI-SHU and a member of the OS of SHU.

From the inspection, there was no finding of absence or presence of violations in the procedure and of inadmissibility of the candidate to the competition. On the contrary, the high quality of the submitted materials for the competition and the full satisfaction of all formal regulatory requirements is obvious. All this gives me reason to proceed to the following sections, according to the relevant regulations.

II. Analysis of research and scientific and applied activity

First of all, we should note that the 21 articles presented in the competition (one of which is actually an editorial introduction) have been published in a number of renowned international journals with an impact factor (12 in number of articles) or in collections with impact rank (8 in number). The journal articles are distributed as follows: 6 in SAA (Stochastic Analysis and Applications) and one each in J. of Applied Statistics, Extremes, Applied Mathematical Modelling, Chemometrics and Intelligent Laboratory Systems, Lithuanian Mathematical Journal, Ecological Complexity. The total impact factor of these articles is $IF=19.65$ in the year of publication and $IF=21.422$ for 2021, respectively. Note that 6 of the articles are in the prestigious AIP series (American Institute of Physics Conference Proceedings), 1 in Lecture Notes of Computer Science and 1 in Pliska Studia Mathematica, as their total $SJR=1.545$. All of these 20 articles were published in the period 2016-2021 and clearly could not have participated in other procedures. Of these, 3 are independent and the others are with co-authors, as follows: 8 with one co-author, 1 with three co-authors, 1 with four, 2 with six, and 2 with seven. There are corresponding separation protocols for all of them with equal participation of P. Yordanova, although in some works the leading role of the candidate is clearly evident. Of the co-authors, three are from Bulgaria, and the remaining 18 are foreigners.

In the attached scientific reference, the candidate divided the presented articles into five groups (2 with 5 articles, 1 with 4 articles and 2 with 3 articles). The proposed 14-page abstracts briefly summarize the main lines of research and explain some of the main results. Also attached is a 10-page reference to the original contributions. All of them are clearly and thoroughly presented and outline an undoubtedly serious scientific production with a serious international presence and recognition. A number of serious lemmas and theorems have been proved in several fields and which find interesting applications in financial mathematics and ecology.

Some of these articles are also related to the presented monograph of P. Jordanova (in English) **Probabilities for p-outside values and heavy tails**, Konstantin Preslavski Publishing House, 2020, 178 pages. It concerns the articles of the so-defined group A [7, 8, 11] and group B [1, 3, 4, 9, 19]. Broadly speaking, this scientific output is devoted to the study of probabilistic properties of heavy-tailed distributions (group A), and on the other hand to the construction and study of relevant statistical estimates for such distributions (group B). In fact, we could briefly call this the «quantile approach», since heavy-tailed distributions are known to have no central

characteristics, so a number of constructions using quantiles are introduced to characterize these distributions.

The monograph is presented through 5 chapters and an Appendix. Chapter 1 is introductory in nature and presents a number of interesting facts from the theory of heavy-tailed probability distributions that are used substantially later in the following chapters. §2.1 of Chapter 2 defines the so-called p -fence (p -fences – left and right) and the corresponding left and right p -outside values. For the characteristics thus introduced, a number of interesting and useful properties presented in 9 Propositions and 7 Corollaries are proved. In §2.2, this theory is applied to a number of special cases that are important for applications. These 22 Examples are well presented and additionally illustrated with 6 graphs and 2 tables. As is well known, Mathematical Statistics solves the inverse problem of Probability Theory, and this is very well illustrated in Chapter 3, where, based on the probabilistic results of Chapter 2, so on are constructed and investigated. IPO and IPO-MM statistical estimates (Estimators) using the empirical quantiles. The obtained studies are presented in 8 Theorems, among which there are interesting asymptotic results, for example THEOREM 3.6, which is actually an analogue of the Central Limit Theorem. A general estimation algorithm is described in §3.1, and a simulation study method is described in §3.2. Seven Examples are discussed and 19 Figures are presented. In Chapter 4, by appropriate transformations of relations from specially selected ordered statistics, parameter estimates of observed tails of distributions are obtained. Asymptotic normality is proved in Theorem 4.2 under sufficiently general conditions. 5 particular (but sufficiently complex) cases are studied in more detail, for which 5 Theorems are proved and interesting simulation studies are proposed, illustrated with 13 graphs. Finally, Chapter 5 applies the well-received theoretical estimates from Chapter 3, using known statistical observations from other authors. A number of advantages of these estimates are shown, which are also illustrated by simulation through 11 Figures and one Table.

In conclusion, it should be noted that the presented monograph is a serious and high-level scientific study, which undoubtedly covers all the requirements that can be made to a "major doctoral dissertation" in the field of TV and MS (dmn).

In the third group B, 4 articles [2, 12, 14, 17] are presented, which examine processes and dynamic models, inspired mostly by some areas of financial mathematics. For example, in [17] problems related to interest rates are considered, and the investigated nonlinear model uses Ornstein-Uhlenbeck processes and is an essential generalization of Parker's second-order linear stochastic equation. Applications in pension funds are also being considered. The works [12] and [14] are also related to interest rates, and the considered models are based on Gamma-

processes and their transformations in the so-called Inverse Log-Gamma-G process. Thus, in [12], along with theoretical methods (for example, Theorem 2.1), some statistical procedures and also simulation studies (also illustrated with 10 graphs) are presented. In [14], a number of properties of the inverse Log-Gamma-G process, in particular its finite-dimensional distributions, are investigated. In article [2] (J.Appl.Stat., 32 pages) volatility in the so-called ARCH models using a new skewness test. The main results are presented in 8 theorems and methods for simulations and evaluations on real data are developed, presented through 32 figures and 3 tables.

In the fourth group D [10, 13, 16, 18, 20] various classes of random processes are studied, which are used as complicated insurance risk models. For example, in [20] a Poisson process with Pareto randomization (mixed Poisson–Pareto process) is studied and thus generalizes the classical Cramer-Lundberg risk process. The results are presented in five Propositions and one Theorem. In [16], the inter-claim times in a risk process have a randomized exponential distribution, which results in the counting claim process being mixed (randomized) Poisson. An adequate diffusion approximation is found and the probability of bankruptcy is estimated. In [13], multidimensional generalizations of the classical Kramer-Lundberg risk model are considered, claims can be grouped and have different types, allowing empty groups. An integro-differential equation of bankruptcy probabilities is found. A number of private cases were also considered. Sums of a random number of random vectors are studied in [18]. Theorem 2.1 describes a number of general properties. Some specific cases of the summation random variable are also presented, as well as simulations. In [10] recovery processes are considered, where the times between recoveries are Gamma distributed and "thinning" is allowed with probability p , $0 < p < 1$. A number of characterization and simulation studies have been found. Finally, in general, it can be noted that the works of this group in a certain sense continue the direction of P. Yordanova's doctoral dissertation.

The last fifth group D [5, 6, 15] is related to real applications of various regression models. Thus, in articles [5] and [10], specific environmental problems related to the assessment of water and air pollution status are considered, and in [15], glacier and snowfall data are evaluated. The obtained results are well illustrated with many graphs and tables.

An innovative textbook "Statistical Modeling of Probability Distributions with Excel", University Publishing House "Episcopo Konstantin Preslavski, 2017, 261 pages (co-authored with E. Veleva)" is proposed, which well presents classic problems from TV and MS, modernized by using of software. The presented "Probability Theory Problem Solving Guide", Konstantin Preslavski University Publishing House, 2022, 316 pages, is actually the second

revised and supplemented edition, which covers a standard classic TV program in 14 chapters. Each chapter begins with a brief theoretical background and is then divided into two parts: Sample Problems and Solutions and Self-Study Problems.

Everything presented in this section of the review gives me reason to conclude that the scientific output and scientific-metric indicators of the candidate P. Yordanova are at a high level and, without a doubt, fully meet all the conditions for occupying the requested academic position "professor".

III. Opinions, recommendations and notes

I have been following the scientific development of P. Yordanova for a long time and I have excellent impressions of her reports at seminars and at international conferences.

I would recommend P. Yordanova to maintain her high pace in scientific development by trying to attract graduate students and postgraduate students in the interesting subject she considers. I would also recommend that she try to deepen and to supplement the monograph (by including some more results and also those of other authors) and try to publish it in some prestigious international publishing house.

I would also recommend that he present a paper at the National Workshop on Stochastics on recent results in this area.


IV. Conclusion

As already emphasized in the previous sections, Pavlina Yordanova's scientific output is at a high scientific level, as well as her scientific-metric indicators, which far exceed the minimum requirements. She is a "doctor" in the direction of the competition and has appeared as a participant and leader of scientific and scientific-applied projects, both in our country and internationally. Her teaching activity at FMI of Shumen University "Episcopo Konstantin Preslavski" deserves without a doubt admiration and without a doubt exceeds the horary of a professor. She is the author of a monograph, as well as textbooks and collections. P. Yordanova is an internationally recognized specialist in the field of Stochastics with publications in a number of renowned journals with a high impact factor and anthologies with an impact rank, which also have serious citations. In general, we can conclude that the presented scientific output covers a wide range of stochastic processes, which also have serious applications.

Everything presented so far gives me a definite reason to conclude that the only candidate associate professor Dr. **Pavlina Kalcheva Yordanova** without a doubt satisfies all the conditions of the thus announced competition for the academic position of "professor" at the FMI of the "Episcopo Konstantin Preslavski" SHU, and I call upon the scientific jury and the faculty council to vote positively for her selection.

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REVIEWER:



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