

**REVIEW**  
**in a competition for an academic position**  
**"Professor"**  
**in professional field 4.5 Mathematics (Probabilities and Statistics),**  
**for the needs of Shumen University "Ep. Konstantin Preslavski ",**  
**Faculty of Mathematics and Informatics (FMI),**  
**announced in SG no. 21 of 2020 and on the websites of FMI and Sofia University**

The review was prepared by: Assoc. Prof. Dr. Doncho Stefanov Donchev FMI, Sofia University "St. Kliment Ohridski ", in my capacity as a member of the scientific jury of the competition according to Order №RD.16.201/04.10.2022. of the Rector of Shumen University.

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

Assoc. Prof. Pavlina Kalcheva Jordanova, Shumen University

## **I. General description of the presented materials**

### **1. Details of the application**

The documents submitted for the competition by the candidate comply with the requirements of ZRASRB and PPZRASRB.

For participation in the competition the candidate Assoc. Prof. Pavlina Kalcheva Jordanova. has presented a list of a total of 20 titles, publications in foreign and bulgarian scientific journals. Also presented are published university textbooks, study aids and scientific monographs, as well as references for the minimum requirements met under Art. 26 of ZRASRB, for the scientometric indicators of the publications, for the citations, for participation in and management of national and international projects, as well as documents reflecting the teaching experience and the management of doctoral students.

I have no notes or comments on the documents.

## **2. Details of the candidate**

Pavlina Kalcheva Yordanova received a master's degree in Mathematics at the "Ep. Konstantin Preslavski" in 1996. In 2006, he defended his dissertation on the topic Multidimensional functional extremal criterion and received a doctorate in mathematics at the Institute of Mathematics and Informatics at the BAS under the supervision of Prof. E. Pancheva. From 1998 to 2014, she was successively an assistant, senior and head assistant at "Ep. Konstantin Preslavski", where since 2014 he holds the position of associate professor. In 2010 she participated in a workshop on "Some Contemporary Research Topics in Extreme Value Theory" at the Center for Statistics and Applications, Lisbon, Portugal. In 2013, she was a guest lecturer at Johannes Kepler University, Linz, Austria, where she taught a course on "Analysis of dynamic series" with master students. Her research interests cover the following areas: extreme value analysis, risk theory, probability theory, random processes, dynamic series analysis, mathematical, computer and applied statistics, financial mathematics. She was also a participant and PI of a number of national and international scientific projects.

## **3. General characteristics of the scientific works and achievements of the candidate**

In paper 1, the probabilities for right-hand outside values in the case of the Frechet exponential distribution were found. A version of the method of moments is proposed in order to express the unknown parameters in terms of the empirical relative frequencies of outside values. Since the corresponding system has no closed solution the authors apply numerical methods to solve it. The solution of the system is defined as IPO-KM scores. The properties of these estimates are studied as well.

In paper 3 is developed an original approach for estimation of the parameter that governs the tail behavior of the c.d.f. of a random variable. This approach can be applied to a wide class of probability distributions with regularly varying tails.

In paper 4, the authors introduce estimates of the index of a regular variation of the tail of the c.d.f. in terms of the central ordered statistics of the sample. These

estimates are distribution dependent. It is shown that the estimators are unbiased, robust, asymptotically normal and asymptotically efficient. The results relate to the log-logistic, Fréchet, and Error-Hill distributions and complement the author's recent results for Pareto's distribution.

In papers 7 and 8 are studied the theoretical and empirical outside values of distributions and their properties. In paper 7 are found the theoretical probabilities of the outside values for some special distributions, e.g. Pareto, Gamma, Logistic, Fréchet, as well as of some stable laws. In Paper 8 is developed a general approach which can be applied to a wide class of distributions. These results allow to study the tail behavior of the distribution outside of the sample range.

In paper 9, are obtained asymptotic results for the ratio of two central ordered statistics of the sample from a population with a regularly varying tail. In the case of Pareto's distribution the authors obtain a closed formula for the p.d.f. of the estimate and calculate both its mathematical expectation and variance.

In paper 12 is studied a stochastic interest rate model that takes into account the volatility of the financial market. The basic assumption is that the evolution of the interest rates is governed by a Gamma process. Then the return of the risk-free assets is described by a Log-Gamma process, for which a number of important results are obtained in Theorem 3.1.

The ideas of paper 12 are further developed and supplemented in article 14. Here, the authors study a wider range of processes related to the Gamma-Subordinator. They call them Inverse Log-Gamma, Inverse Log-G-Gamma, Inverse Log-Variance-Gamma, and Inverse Log-Variance-G-Gamma processes. The relevant generalizations of Theorem 3.1 of paper 12 concerning these processes can be found in Theorem 4.1.

Papers 16 and 20 are devoted to generalizations of the classical Kramer-Lundberg risk model. It is assumed that the distribution of the inter-arrival times is a mixture of an exponential distribution with some non-negative mixing variable. The authors study the asymptotic behavior of such models when the number of claims is large. It is shown that depending on the size of the claims, namely, the existence of finite second or first absolute moments, or the absence of such, there are three different types of limit behavior, which can be described in terms of a Brownian motion or a stable Lévy

subordinator. In Paper 20, the case of a Pareto distributed mixing variable is studied in details.

Paper 19 complements the author's research on obtaining estimates of the parameter of regular variation of the tail of the c.d.f. of the observed r.v. Two such estimates were studied. The first one is based on the harmonic mean and is called a t-Hill score. The other, the t-log-Hill score, relates to the Log-gamma distribution. It is shown that in case of moving average time series with infinite memory both estimates are weekly consistent. The asymptotic normality of the t-log-Hill score is proved as well.

**I can confidently assert that the scientific papers meet the minimum national requirements under Art. 2b, para. 2 and 3 of ZRASRB for holding the academic position “professor” in the scientific field and professional direction of the competition; that the scientific papers presented by the candidate do not repeat those of previous procedures for acquiring a scientific degree and an academic position, and that they present original and significant scientific achievements.**

### **3. Characteristics and assesment of the teaching activity of the candidate**

The textbook and the other s presented for participation in the competition are evidence of the high criteria and competence of the candidate in relation to the teaching activity.

### **4. Analysis of the scientific and scientific-applied achievements of the candidate according to the submitted papers for participation in the competition**

All articles of the candidate show the diversity and breadth of her scientific interests, as well as the rich mathematical toolkit she uses. They cover both areas related to classical directions in the theory of stochastic processes (papers 12, 14, 20) and those related to modern applications of this theory such as financial mathematics (paper 6), mathematical statistics (papers 1, 3, 4, 7, 8, 9, 11, 19), risk theory (papers 16, 20), etc. The style of the papers is distinguished by brevity and clarity in setting out the problems, highlighting the contributions

of each particular paper, and clarifying the relationship with the research of other authors.

5. **I have no critical remarks and recommendations** regarding the presented works.

**6. Personal impressions of the candidate**

I have known Pavlina Kalcheva Yordanova from the time of her work on her Ph. D thesis, when I had the pleasure of being her reviewer. In 2014, I was a reviewer of her articles when she got the position of an associate professor at the Shumen University "Ep. Konstantin Preslavsky". Reading her articles for me is always very interesting because they contain new ideas and allow me to follow the latest trends in many different and interesting fields. Her character is characterized by modesty and responsiveness.

**7. Conclusion on the application**

After getting acquainted with the materials and scientific papers presented in the competition and on the basis of 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 and the Regulations for its application for holding the academic position of “ professor ” in the scientific field and professional direction of the competition. In particular, the candidate satisfies the minimum national requirements in the professional field and no plagiarism has been established in the scientific papers submitted at the competition.

I give my positive assessment of the candidacy.

**OVERALL CONCLUSION**

Based on the above, I recommend the scientific jury to propose to the competent authority of the Faculty of Mathematics and Informatics at Shumen University "Ep. Konstantin Preslavski ” to confirm that Pavlina Kalcheva Yordanova can get the academic

position of“ professor ”in the professional field 4.5 Mathematics (Probabilities and Statistics).

05.11. 2022

Prepared by

Assoc. Prof. Dr. Doncho Stefanov Donchev