



## ABSTRACTS

of scientific publications by Chief Assist. Prof. Deyan Mihaylov, PhD Department of Statistics and Applied Mathematics in a competition for “Associate Professor“, in the professional field 3.8. Economics, Scientific Field/Specialty: “Modelling of Production and Management Processes”, published in Darzhaven Vestnik, issue 46/2023, p. 56

### A. Scientific Publication on the Dissertation

General number	Number in the category	Title
1.	1.	Mihaylov. D. Yordanova, V. Some Math Quizzes for Presenting a Number by Using Equal Digits and Math Operations - Mathematics Informatics, Sofia : Az-Buki, 62, 2019, 3, 290-300, ISSN 1310-2230 (print); ISSN 1314-8532 (online)
<p>This paper gives a formalization of a problem for presenting a number by using particular set of equal digits and a range of math operators. Based on the formal definition, an example for presenting 7 in 2 ways by using 4 times the digit 2 is given. The first option is without any restrictions and the objective is to have the maximum possible number of solutions. For the second option there are some restrictions concerning the type and number of operations. The aim here is to achieve a result with minimum deviation from the constraints. Both options can be used as a type of math quiz for improving the cognitive way of thinking.</p>		

### B. Scientific Publication on the Competition for Associate Professor

#### I. Monograph

General number	Number in the category	Title
2.	1.	Mihaylov, D. Simulation Modelling of the Duration of Production and Management Processes. (Monographic Library “Prof. Tsani Kalyandzhiev“ № 74. Varna: Nauka i ikonomika, 2021, 140 стр. ISBN 978-954-21-1079-8.
<p>The process can be defined as a structured set of activities, combined in a logical sequence for the achievement of a specific objective. The shared resource which is used by all processes is time and – under conditions of a dynamically changing environment – it turns into a factor, which can be decisive for success. The complex structure of the systems in which those processes run reduces the possibility for them to be studied by means of deterministic models. This necessitates the use of probabilistic methods.</p> <p>Each system is set in an environment, in which there are manifested many and various factors that affect in a random manner the elements of the system and the processes running in it. Because of that it can be presumed that all actually running processes, particularly those in the economic systems, are nondeterministic. In the present monographic work there is a model of the duration of complex nondeterministic processes, and is obtained and analyzed the function of the time distribution for their execution. There are used models of two types – analytical models and simulation models. With processes of a simpler structure the distribution function</p>		



may be achieved at relatively easily using analytical methods. With complex processes it is appropriate to use simulation models, realized with the Monte Carlo method. In the conducted simulation experiments it is studied the effect of the changes in the structure of the process and of the length of the activities included in it on the time of its running.

## II. Other monographs and extended scientific articles

General number	Number in the category	Title

## III. Scientific articles

General number	Number in the category	Title
3.	1.	Mihaylov, D. A Way to Accelerate the Process of Gathering Information for Decision-Making. International Journal on Information Technologies and Security, Sofia : Union of Scientists in Bulgaria, 11, 2019, 4, 39 - 50. ISSN 1313-8251
<p>The decision-making is a delicate balance between competing subjects. The managers spend large part of time on gathering necessary information. If the process of data-collecting can be accelerated, the duration of decision-making will be reduced. A way to achieve that is to use not the whole possible information, but only sufficient part of it. This article explains how the duration of data gathering can be reduced if the decision-maker accepts this idea. The duration of actions of collecting information is modeled by time-measured random variables.</p>		
4.	2.	Mihaylov, D. Determining the Critical Activities in a Complex Project Using Simulations. International Journal on Information Technologies and Security, Sofia : Union of Scientists in Bulgaria, 12, 2020, 2, 3 - 14. ISSN 1313-8251
<p>The subject of this article is to represent a simulation model which can determine the activities, which can directly impact the duration of complex projects. It is assumed that the duration of every activity is a random variable. The model determines all the paths in the project diagram and the relative frequencies of occurrences of critical paths and activities. The critical activities could affect the duration of the whole project and require more attention. Variants in which the distributions are PERT-beta, triangular and uniform are played out. The experiment shows that the type of distribution has great impact on the relative frequencies.</p>		
5.	3.	Mihaylov, D. Cryptography and Cryptanalysis in MS Excel. Mathematics and Informatics, Sofia : Az Buki, 65, 2022, 1, 53-71., ISSN(print) 1310-2230, ISSN(online) 1314-8532
<p>This paper provides implementations of three well-known ciphers – Caesar Cipher, Vigenere Cipher and Hill Cipher in Microsoft Excel. It is shown how the ciphers can be broken by using Brute-force Attack, Frequency Analysis Attack and Known-plaintext Attack. For the purpose of the cryptanalysis the relative occurrence frequencies of the letters and the index of coincidence (<math>\kappa</math>) in Bulgarian language are determined. The classical Frequency Analysis</p>		



<p>Attack is modified using the cross-correlation between frequencies of letters in the natural language and the cipher text. Modular matrix operations in MS Excel are shown.</p>		
6.	4.	<p>Mihaylov, D. One simple model of small arms fire using the Monte Carlo method. Journal of Defense Modeling and Simulation, 14, 2017, 4, 465 - 470. ISSN: 1548-5129 (print); ISSN (online): 1557-380X</p>
<p>This article provides a simple model of small arms fire. To take account of the different factors affecting the hitting point and various sizes and shapes of the targets, the Monte Carlo method is used. The parameters of the model enable research of the effectiveness of fire for different types of weapons at various targets. As an example, the effectiveness of fire of the AK-47 in one type of target has been investigated for various distances and different firing positions.</p>		
7.	5.	<p>Mihaylov, D. Using Simulations Modelling in Learning the Game Theory Elements. Journal of Mining and Geological Sciences, Sofia : St. Ivan Rilski [University of Mining and Geology], 62, 2019, 4, 104 - 107. ISSN 2682-9525 (print) ISSN 2683-0027 (online)</p>
<p>The paper presents the author's attempt to use simulation modelling in the teaching of zero-sum matrix games. A matrix game with a 2×2 dimension is selected, which has a solution in mixed strategies. The conditions of the game are such that the solution obtained by applying the corresponding formulas seems paradoxical and questionable for the students. The correctness of the solution is confirmed by conducting a simulation experiment in the Microsoft Excel environment. At each stage of the teaching process, a survey is conducted. The statistical processing of survey data shows that the demonstration of simulation modelling results has the greatest impact on the learning of the curriculum.</p>		
8.	6.	<p>Mihaylov , D., Research of Probability of Hitting a Single Target with Small Arms Fire Using Monte-Carlo Method , Voenen Zhurnal, 123, 2016, 2, 104 - 110. ISSN 0861-7392 (print); 2534-8388 (online)</p>
<p>A number of parameters - the ballistic characteristics of the weapon, temperature and humidity, variations in characteristics of ammunition, individual characteristics and level of preparation of soldiers - affect the bullet's trajectory and point of impact. Most of these parameters are random. Therefore, the target hitting occurs with a probability. This probability is a measure allowing to assess the fire effectiveness. On the other hand there are many different types of targets. The calculation of probability may be difficult (or impossible) analytically. This paper presents a simple way to evaluate the hitting probability using Monte-Carlo method under Microsoft Excel.</p>		
9.	7.	<p>Mihaylov , D., A Possibility to Optimize the Strength of the Troops, Engaged in Operations, Voenen Zhurnal, 122, 2016, 4, 59-65 ISSN 0861-7392 (print); 2534-8388 (online)</p>
<p>The article presents a possible way to optimize the strength of troops. We suppose every mission may be decomposed into classes of elementary tasks. Classes of elementary units exist and every class of tasks corresponds to a class of units. Every elementary unit may perform an elementary task, belonging to the corresponding class and has no abilities to perform a task, belonging to other class. During the mission every elementary unit requires some kinds of support (protection, sustainment etc.). Every kind of support may be satisfied by other elementary unit. The strength of the troop has to be sufficient to fulfil the mission and support its own units. On another hand it is not desirable to have an excess of resources. This problem of optimizing the strength of the troop may be formalized and solved as an integer linear program.</p>		



10.	8.	Mihaylov, D. Possibility to Modelling of Emergency Repair of one-type Equipment using non-homogeneous Markov Chains, Yearbook of VA "G. S. Rakovski", Faculty of NSD. Sofia: VA "G.S. Rakovski", 2016, 174-184. ISSN 1312-2983 (print)
<p>In this paper we analyze the behavior of a set of identical devices which are used to ensure the performance of a specific task. The devices are damaged randomly and are repaired by use of spare parts (units). A possible method for process modeling using non-homogeneous Markov chains is proposed.</p>		
11.	9.	Mihaylov, D. Some approaches in creating tests for evaluating the achieved in distance learning results , Yearbook of VA "G. S. Rakovski", IPIO. Sofia: VA "GS Rakovski", 2008, 193-201. ISSN 1312-0816 (print)
<p>Approaches to creating tests suitable for implementation in interactive and distance learning systems are considered. A way to generate close-ended test questions and to reduce the probability of guessing the correct answers by chance is proposed. It is concluded that in this way the labor costs of creating tests can be reduced and the discriminating ability of the tests can be increased.</p>		

#### IV. Research papers

General number	Number in the category	Title
12.	1.	Mihaylov, D., Comparison Between Nonlinear Least Square Method and Linearizations of saturation Growth Model. The Role of Fundamental Programs in Higher Education: Conference Proceedings 21.10.2022 г. Varna: Nauka i ikonomika. 107-113 ISSN 2815-3863 (online)
<p>The determination of the regression parameters is one of the tasks of regression analysis. They are easily obtained in the case of linear dependence. The nonlinear models require applying more complicated methods. To avoid this it is often recommended to use linearization of the regression equation. This paper shows that this approach leads to increase in the bias of regression parameters. The example of saturation-growth model of Michaelis-Menten equation is used. The parameters of the linearization plots of Lineweaver-Burk, Eadie-Hofstee and Hanes-Wolf are biased from the parameters which are determined by nonlinear least square method.</p>		
13.	2.	Mihaylov, D., A Comparision Between Entry Level Test in Mathematics of The First-Year Students in University of Economics-Varna During Different Academic Years. The Role of Fundamental Programs in Higher Education: Conference Proceedings 21.10.2022 г. Varna: Nauka i ikonomika. 103-106 ISSN 2815-3863 (online)
<p>Mathematics is a fundamental subject at the University of Economics-Varna. It is supposed that the first-year students have skills in maths according to high school programs. Unfortunately there are gaps in their mathematical knowledge. It is necessary to check the entry level of the students. This paper presents a study of students' skills. In different academic years the first-year students make the same test. The results show improvement in average entry level test from 2014 to 2021. The Chi-Square test is used.</p>		



14.	3.	Mihaylov, D., Using Simulations in Excel to Evaluate the Estimators of the Expectation and the Variance. The Role of Fundamental Programs in Higher Education: Conference Proceedings 21.10.2022 г. Varna: Nauka i ikonomika. 97-102 ISSN 2815-3863 (online)
<p>Unbiased estimators of the expected value and the variance are well known in statistical theory. This paper presents an approach for experimental validation of the theoretical formulas. It is assumed that we have the entire population or a representative sample and the expected value and the variance are known. Re-samples are taken from the population and for each re-sample mean values, biased and unbiased estimates of variance are calculated. The experiment shows that the mean of sample variance is equal to the population variance. The re-samples are simulated in MS Excel.</p>		
15.	4.	Mihaylov, D. Modeling and Simulation of Some Functions of Two Independent Random Variables. Information and Communication Technologies in Business and Education: Proceedings of the International Conference, Dedicated to the 50th anniversary of the Department of Informatics. – Варна: Univ. Publ. House Science and Econ., 2019, 225 - 232. ISBN 978-954-21-1004-0 (print)
16.	5.	Mihaylov, D., Optimization of the Scheduling of Short-Time Construction Activities. Construction Entrepreneurship and Real Property: Proceedings of the 33-th International Scientific and Practical Conference, Varna: Science and Economics, 2018 г., 193-200. ISSN 1313-2369
<p>This report examines the possibility to optimize the scheduling of shorttime construction activities. For the purposes of the study, a “short” construction activity shall mean one whose execution time is shorter than the normal working day. Generally, different activities have different durations. It’s proposed to use the linear optimization model of one-dimensional cuttings when creating such schedules. The minimum number of working days needed for the execution of a large number of activities is accepted as a criterion of optimality. The proposed method allows to create more efficient schedules.</p>		
<p>This paper represents a way to analyze the duration of some processes, which have little complexity. They can be decomposed into limited number of elementary activities. It is supposed that the activity durations are random variables. Hence, the total duration can be represented as a function of random variables. The functions Sum, Maximum and Minimum of two independent random variables are discussed. One way to obtain the distribution functions of results is represented. The mathematical models are tested by simulations. The results, obtained by mathematical and simulation models are similar. The represented method can be used in analysis of processes or objects which have nondeterministic parameters.</p>		
17.	6.	Mihaylov, D. The Proximity to the Seashore and the Dwelling Construction in Bulgaria. Construction Entrepreneurship and Real Property: Proceedings of the 32-nd International Scientific and Practical Conference, Varna: Science and Economics, 2017, 382 - 392. ISSN 1313-2369
<p>In this paper the impact of several factors on dwelling construction in the Republic of Bulgaria is assessed. The population includes all the districts of this country. The number of inhabitants, the total income, the proximity to the seashore and the volume of dwelling construction are examined. It is clear that there are quantitative and categorical characteristics, so one method of correlation analysis and Fisher’s exact test are used. The obtained results</p>		





<p>show that the proximity to the seashore plays a positive role in the volume of dwelling construction. This impact is stable, so it may be expected that it will be observed in the future.</p>		
18.	7.	<p>Михайлов, Д. Application of the Cobb-Douglas Production Function for Estimating Factors Affecting the Volume of Building Production in the Republic of Bulgaria During 2000-2014. Construction Entrepreneurship and Real Property: Proceedings of the 31-nd International Scientific and Practical Conference, Varna: Science and Economics, 2016 г., 416-422. ISSN 1313-2369</p>
<p>This paper defines the parameters of the Cobb-Douglas production function in the building sector. The statistical data about investments, labor and production in this sector in the Republic of Bulgaria during 2000-2014 are used.</p>		
19.	8.	<p>Mihaylov, D. On modeling the duration of technological activities. Economy in a Changing World: National, Regional and Global Dimensions. Conference proceedings. Varna: Science and Economics, 4, 2015, 95 - 101. ISBN 978-954-21-0853-5 (т. 4)</p>
<p>It is generally accepted that the duration of technological activities is a random variable with a generalized Beta distribution. The report examines one possibility for determining the parameters of such a random distribution if the estimates of the minimal duration, the complexity and the difficulty of the activity are given. The method can be used in simulation modeling of complex production processes.</p>		
20.	9.	<p>Mihaylov, D. The Entry Skills in Mathematics of the First-Year Students of the Professional Field of Economics. Mathematics as a Fundamental and Applied Science. Proceedings of the International Scientific Conference. Varna: Science and Economics, 2015. - 391 - 399. ISBN 978-954-21-0860-3</p>
<p>This paper presents a research conducted on the preliminary preparation in the field of elementary mathematics of first-year students in the University of Economics-Varna. A discrepancy was found between the grades in the high school diplomas and the possessed knowledge and skills. Some measures are proposed to overcome student backlog.</p>		
21.	10.	<p>Mihaylov, D., R. Mihaylov. Possibility of Reducing the Amount of Memory Required for Data Processing Using the Method of Least Squares. Information Technologies in Business and Education : Proceedings of the International Scientific Conference. - Varna: Science and Economics, 2014, 438 - 444. ISBN 978-954-21-0780-4</p>
<p>The memory capacity required to run a particular class of applications could be reduced using the method of least squares. This paper proposes a representation of a one-dimensional array with a polynomial of sufficiently high degree.</p>		
22.	11.	<p>Mihaylov, D., Possibilities of using the PERT method in cost optimization in construction. Construction Entrepreneurship and Real Property: Proceedings of the 28-th International Scientific and Practical Conference, Varna: Science and Economics, 2015 г., 501-509. ISSN 1313-2369</p>
<p>A way to reduce the expenditure in construction, using PERT method, is suggested in this paper. The combining of the Queueing Theory and the Dynamic Optimization allows decrement the costs more than existing linear models.</p>		
23.	12.	<p>Mihaylov, D. Distance Learning – Technologies and Learners. Scientific Session 2010. Collection of Research Papers. NMI-,V.</p>



		Levski“, Faculty of AAD&CIS, Shumen: 2011, 110-115, ISSN 1313-7433
Technology is necessary but not sufficient condition for the success of distance learning. Significantly more important is the role of learners and in particular their abilities and desires. Learning and knowledge of these opportunities will allow to represent a content in various forms corresponding to the individual characteristics of each student.		
24.	13.	Mihaylov, D. The Concept of Distributed Learning and Learner Model Content. Scientific Session 2010. Collection of Research Papers. NMI-„V. Levski“, Faculty of AAD&CIS, Shumen: 2011, 115-120, ISSN 1313-7433
The conception of Distributed Learning requires an individual approach to meet the needs of learners. Under the circumstances the learning system have to keep Learner Model – information about the learners’ individual characteristics concerning learning process. This paper propound minimal required content of Learner Model.		
25.	14.	Mihaylov, D. Evaluation of the Criterion-Referenced Tests Precision in Learner Modeling. Scientific Session 2010. Collection of Research Papers. NMI-„V. Levski“, Faculty of AAD&CIS, Shumen: 2011., 120-127, ISSN 1313-7433
Reliable data about the gained knowledge and skills is the main part of Learner Model, so, it is important to have a precise tool to collect them. Such tool may be criterion-referenced test. In this paper is made an attempt to evaluate criterion-referenced test precision, using the combinatorial theory.		

#### Всичко по част IV:

#### V. Textbooks and Practical Textbooks

General number	Number in the category	Title
26.	1.	Nikolaev, R., J. Petkov, D. Mihaylov, Mathematics with Application in Economics. Electronic Textbook. Varna: Science and Economics, 2014, 222 p. ISBN 978-954-21-0797-2
<p>The textbook is intended for the students of the University of Economics - Varna, studying in bachelor's programs in distance learning.</p> <p>The content is structured in fifteen topics, one for each semester’s semester.</p> <p><b>The topics developed by D. Mihailov are:</b></p> <p>2. Inverse matrix. Matrix equations; 4. Straight line in the plane; 6. Limits and continuity of a function of one variable; 7. Derivative and differential of a function of one variable; 9. Function investigation; 11. Extremum of a function of two and more variables; 12. Indefinite integral; 13. Definite integral (without item 13.7. Applications of definite integral); 14. Elements of probability theory; 15. Random variables.</p> <p>The content is selected in such a way as to provide the necessary minimum of theoretical knowledge used in modeling economic processes.</p>		
27.	2.	Petkov, J., D. Mihaylov, Mathematics with Application in Economics. Electronic Practical Textbook. Varna: Science and Economics, 2015 p. 181. ISBN 978-954-21-0868-2



<p>The Practical Textbook is intended for the students of the University of Economics - Varna, studying in bachelor's programs in distance learning. The learning content is structured in fifteen exercises. Each exercise is on one topic from the e-textbook Mathematics with applications in economics by R. Nikolaev, D. Mihailov and J. Petkov, ed. Science and Economics, 2014. Each topic is designed to be studied within one academic week. At the beginning of each paragraph, solved typical problems are presented, followed by exercise problems. Examples of modeling economic processes using the presented mathematical apparatus are included</p> <p>The topics developed by D. Mihailov are:</p> <p>1. Determinants and matrices; 2. Inverse matrix. Matrix equations; 3. Systems of linear equations; 4. Straight line in the plane; 5. Second-order curves. Application of analytic geometry in economics; 6. Limits and continuity of the function of one variable; 7. Derivative and differential of a function of one variable; 9. Function Investigation; 11. Extremum of a function of two and more variables; 15. Random variables</p>		
28.	3.	Atanasov, B., D. Dochev, R. Nikolaev, R. Miryanov, J. Petkov, D. Mihaylov, V. Yordanova, Sample Tests for an Entrance examination in Mathematics. Varna: Science and Economics, 2014, p. 214. ISBN 978-954-21-0739-2
<p>The sample tests are intended for the preparation of applicants to the University of Economics-Varna. The tests contain tasks with a choice of several possible answers (one correct and 4 incorrect). The questions are divided into 28 thematic units, in accordance with the secondary school curriculum.</p> <p>The thematic units developed by D. Mihailov are:</p> <p>11. Calculation of trigonometric functions and expressions; 12. Trigonometric equations; 16. Limit and continuity of a function; 24. Circle.</p>		
29.	4.	Atanasov, B., R. Nikolaev, T. Milkova, D. Mihaylov, Operation Research. Textbook. Varna: Science and Economics, 2015, p. 488. ISBN 978-954-21-814-6
<p>The textbook is intended for students in Bachelor's and Master's courses at the University of Economics - Varna, studying the subject "Operations Research". It consists of topics in linear and nonlinear optimization, matrix games, assignment problem, replacement and maintenance models, routing problems, project management (CPM and PERT), queuing theory, inventory control models, portfolio theory.</p> <p>The chapters, developed by D. Mihailov are:</p> <p>9. Elements of queuing theory; 10. Inventory Management Models.</p>		
30.	5.	Milkova, T., D. Mihaylov, Operation Research. Practical Textbook. Varna: Science and Economics, 2016, p. 420. ISBN 978-954-21-814-6
<p>The practical textbook is intended for students in Bachelor's and Master's degree programs of the University of Economics - Varna, whose curricula include the subject "Operations Research".</p> <p>The chapters, developed by D. Mihailov are:</p> <p>2. Solving linear optimization problem methods; 7. Elements of queuing theory; 8. Inventory Management Models.</p>		
31.	6.	Yordanova, V., D. Mihaylov, J. Petkov. Applied Mathematics. Practical Textbook. Varna: Science and Economics, 2021, p. 181. ISBN 978-954-21-1097-3





The practical textbook is intended for students of the University of Economics - Varna, studying in bachelor's programs in professional fields 3.7 "Administration and management", 3.8 "Economics" and 3.9 "Tourism". The content is structured in 6 chapters, corresponding to the curriculum of the subject of "Applied Mathematics".

The main purpose of the book is to present a set of tasks that cover the entire study content. Some of them are presented with complete and detailed solutions, and the rest are intended for independent work. A large number of mathematical models which are applied in economics are given.

The chapters, developed by D. Mihailov are:

3. Function of one variable; 5. Combinatorics. Probabilities. Random variables

32.	7.	Nikolaev, R., R. Miryanov, J. Petkov, D. Mihaylov, V. Yordanova. Sample Tests for an Entrance examination in Mathematics. Varna: Science and Economics, 2021, p. 213. ISBN 978-954-21-1097-2
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The sample tests are intended for the preparation of applicants to the University of Economics-Varna. The tests contain 594 questions with a choice of several possible answers (one correct and 4 incorrect). The questions are divided into 27 thematic units, in accordance with the secondary school curriculum.

**The participation of the authors in the all topics is equal.**

Varna,  
.....2023 г.

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