- Software implementation of the web server for the content exchange system following the requirements using third-party services, the selected technology stack and ensuring the protection of the web server from cross-site request forgery.
- We tested the content exchange system by writing Unit tests for the web server and End-to-end tests for the web application. Testing ensures that the system works correctly and directly helps to detect errors if they occur when a certain time of the system changes.
- To expand the possibility of project support and due to the large code base, the source code of the content-sharing system is hosted on the GitHub repository service, the link is attached: https://github.com/zenia369/keqing-site.

A web-based system for content sharing is available on the Internet and can be accessed at the following link: https://keqing-site.onrender.com/.

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DEVELOPMENT OF A COMPUTER-BASED EDUCATIONAL PROGRAM ON THE SUBJECT "FUNDAMENTALS OF COMPUTER MODELING"

РОЗРОБКА КОМП'ЮТЕРНОЇ НАВЧАЛЬНОЇ ПРОГРАМИ З ДИСЦИПЛІНИ "ОСНОВИ КОМП'ЮТЕРНОГО МОДЕЛЮВАННЯ"

Kim Yekaterina[1], Alimbekova Ayaulym[2], Gavrilova Anastassiya[3], Kan Alexandr[4]
Кім Екатеріна[1], Алімбекова Аяулим[2], Гаврилова Анастасія[3], Кан Олександр[4]

[1,2,3,4] Туран University, Almaty city, Republic of Kazakhstan
ORCID: https://orcid.org/0000-0001-7441-524X[1], https://orcid.org/0009-0001-6092-8762[2],
https://orcid.org/0009-0000-5286-604X[3], https://orcid.org/0009-0001-6092-8762[4]
E-mail: e.kim@turan-edu.kz[1], 22230750@turan-edu.kz[2], 21220856@turan-edu.kz[3], 21222052@turan-edu.kz[4]

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Abstract. *In the conditions of technological progress and rapid development of information technologies, it is very challenging to prepare specialists in the field of information and communication technologies who would fully possess the knowledge and skills to work with the diverse range of instrumental and software tools and equipment used in the field. This is due to the continuous improvement and updating of programming languages, frameworks, software environments, shells, and hardware. One of the ways to address this issue is through computer-based educational programs, allowing the individualization of the learning process while preserving it's quality. Currently, there is a large*

number of computer-based educational programs used in the study of various disciplines. This paper presents the design of a computer-based educational program on the subject "Fundamentals of Computer Modeling," which enables the modeling of random patterns of various natures, ranging from random events to random streams. The educational program consists of three modules, which include a theoretical part on methods of modeling random patterns, testing after each topic, and a calculator for all modeling methods. In each modeling method, you can input any initial data, such as the number of trials, probabilities of events, functions, and parameters of distribution laws. The results of modeling random patterns can be saved as a file. The program interface is available in three languages: Russian, English, and Kazakh. The currently developing educational program aims to improve the learning process in the "Fundamentals of Computer Modeling" discipline and allows learners to study it independently without any interventions from a professor.

Анотація. *В умовах технічного прогресу та стрімкого розвитку інформаційних технологій дуже складно підготувати спеціалістів у галузі інформаційно-комунікаційних технологій, які б у повній мірі володіли знаннями та навичками роботи з різноманітним спектром використовуваних інструментальних та програмних засобів та обладнання. в польових умовах. Це пов'язано з безперервним удосконаленням і оновленням мов програмування, фреймворків, програмних середовищ, оболонок і апаратного забезпечення. Одним із шляхів вирішення цієї проблеми є комп'ютерні навчальні програми, що дозволяють індивідуалізувати процес навчання, зберігаючи його якість. В даний час існує велика кількість комп'ютерних навчальних програм, які використовуються при вивченні різних дисциплін. У цій роботі представлено дизайн комп'ютерної навчальної програми з дисципліни «Основи комп'ютерного моделювання», яка дозволяє моделювати випадкові закономірності різної природи, починаючи від випадкових подій і закінчуючи випадковими потоками. Навчальна програма складається з трьох модулів, які включають теоретичну частину з методів моделювання випадкових закономірностей, тестування після кожної теми та калькулятор для всіх методів моделювання. У кожному методі моделювання можна вводити будь-які вихідні дані, такі як кількість випробувань, ймовірності подій, функції та параметри законів розподілу. Результати моделювання випадкових закономірностей можна зберегти у вигляді файлу. Інтерфейс програми доступний трьома мовами: російською, англійською та казахською. Навчальна програма, що розробляється, спрямована на вдосконалення навчального процесу з дисципліни «Основи комп'ютерного моделювання» та дозволяє слухачам вивчати її самостійно без втручання викладача.*

Keywords: education informatization, educational process, computer-based educational program, instructional programs, simulation modeling, random patterns, continuous random variables, discrete random variables.

Ключові слова: інформатизація освіти, навчальний процес, комп'ютерна навчальна програма, навчальні програми, імітаційне моделювання, випадкові закономірності, неперервні випадкові величини, дискретні випадкові величини.

I. INTRODUCTION

In the era of information technology development, there is a wide variety of programming languages, frameworks, instrumental and software tools, shells, and equipment that students, enrolled in the educational programs "6B06101 - Information Systems" and "6B06103 - Intelligent Robotics," need to be familiar with. Typically, specialists in these fields must be able to use various types of instrumental and software environments and equipment.

The limited number of hours allocated to different disciplines and the constant evolution and updating of information technologies and equipment do not allow for structuring the educational process to cover all existing programming languages, instrumental and software tools, shells, and equipment.

For the quality and effective performance of tasks assigned to specialists in the field of information technology and robotics, they need to constantly improve their skills and explore new digital tools and equipment. This process should continue even after they have completed their education in this field.

One solution to this problem is computer-based educational programs aimed at self-learning, which, in turn, allow individuals to undergo training at a convenient (free) time for them.

II. LITERATURE ANALYSIS

More and more educators are utilizing various informational and interactive teaching methods and technologies [1-11]. The use of informational and interactive methods and technologies enables the activation of the cognitive activities of learners, optimizes the task execution process, and improves communication between the teacher and learners.

Currently, there are a multitude of digital tools that can be employed in teaching various disciplines. Among such tools are no-code tools, online compilers, integrated programming environments for software development, platforms for creating tests and quizzes, virtual trainers and simulators, educational platforms, etc.

Many researchers are involved in the development and use of computer-based educational programs for studying various disciplines. For instance, in [6], the authors develop educational and control programs, an electronic textbook "Forensic Studies of Narcotics and Psychotropic Substances" for students in the field of "Forensic Expertise," which includes two lecture presentations, two educational programs, six control tests, two instructional videos, and other educational materials covering all the topics studied.

In [7], the authors use an instructional (control and instructional) program in the study of the discipline "Digital Devices and Microprocessors," which is developed in the "Delphi" language.

When studying electronic devices and designing the structure of radio-electronic equipment, it is convenient to use various electronic laboratory practicals, as demonstrated in [8].

The authors of [9] developed five virtual laboratory works for studying the discipline "Heat Supply of Forest Industry Enterprises," which students can perform remotely. Thanks to the developed laboratory works, students reduce the time of their completion by accelerating simulated processes and can visually study and analyze processes under unlimited conditions. Virtual laboratories can also be used as an alternative to using outdated equipment during its repair or before purchasing new equipment.

In [10], the authors propose a computer-based educational program for studying the topic "Graphical Method for Solving Optimization Problems" in the mathematical section "Linear Programming." The developed program can be used by students from various training directions in universities and is intended to form deep theoretical knowledge and sustainable skills in solving specific problems. The program also includes testing to reinforce the covered material. It can be used in distance learning for part-time students and students combining work with education.

Thus, the development of computer-based educational programs is a relevant direction and is used by many authors in teaching various disciplines. The following section discusses issues related to creating computer-based educational programs and the requirements placed on them.

III. COMPUTER-BASED EDUCATIONAL PROGRAMS

Educational software is a term that refers to any computer software created for educational purposes. The scope of application for such software is not limited, as it is commonly used in the study of exact sciences as well as in linguistic analysis.

Computer-based educational programs, as software for educational purposes, can be conceptualized as a system consisting of two main components (subsystems): the informational (content) and the programmatic (implementation) [12].

The informational subsystem is responsible for the content of education, providing educational materials, concepts, and tasks. This part ensures the relevance, quality, and relevance of the instructional material.

The programmatic subsystem, in turn, is responsible for the technical implementation and presentation of the informational part. This includes interface development, task creation, management of the learning process, and other technological aspects.

When creating computer-based educational programs, there are two main approaches, represented by two polar points of view [12]. According to the first perspective, it is sufficient for the instructor to prepare educational materials correctly, and their computer adaptation will not present significant difficulties. According to the second perspective, a qualified programmer can take any textbook and, without the author's involvement, create an effective educational tool. The first approach emphasizes the importance of content, while the second emphasizes programmatic implementation.

These two aspects, informational and programmatic, are interrelated and require attention and efforts from both content experts and programmers to create comprehensive and effective educational software.

Computer programs used in education should primarily possess certain basic characteristics. Research on and identification of such characteristics for linguistic programs were undertaken by V.G. Sibirtseva and N.Kh. Frolova in their work [13]. The following characteristics were proposed for evaluating educational software:

- Presence of a large volume of data;
- Free availability;
- User-friendliness;
- Multilingualism;
- Multifunctionality.

The authors [13] compiled a series of educational programs possessing these properties, such as TextAnalyst SDK, LF Aligner, LEKTA, and AntConc. Within the research, a survey was conducted, asking respondents to mark the characteristics that were important to them (see table 1).

Thus, when it comes to computer-based educational programs, there are several key requirements that help ensure their effectiveness [14]:

- Goal-oriented educational work, assuming that after completing the course provided by the computer-based educational program, the user should achieve specific goals in terms of acquired knowledge, skills, and abilities.

- Proper selection and structuring of educational material, implying that a critical factor in education is the correct choice and presentation of educational material. The program should structure the material in such a way that the learner receives only the necessary information presented in an optimal form for assimilation.

- Additionally, it is important to consider that users may have different levels of experience in working with computers. Therefore, the program interface should be accessible and intuitively understandable even for those who do not have advanced computer skills.

- An orientation towards the average learner is also necessary. Except for narrowly specialized programs, educational material should be adapted to be understandable for those with basic knowledge in the field.

- The program should provide educational materials and an interface that allow the user to independently absorb information without the constant intervention of an instructor.

Table 1 – Characteristics of Investigated Programs in Comparison [13].

Program	Great text volume	Free access	User-friendliness	Multilingual	Multifunctioning
TextAnalyst SDK	+	+	-	-	-
LF Aligner	+	+	+	+	-
LEKTA	+	-	+	-	+
AntConc	+	+	-	+	+

IV. RESULTS

At the Department of Information Technologies at Turan University, a computer-based educational program is being developed for the course "Fundamentals of Computer Modeling." The program is intended for students enrolled in the educational programs "6B06101 - Information Systems" and "6B06103 - Intelligent Robotics," enabling them to model random patterns of any nature, ranging from random events to random flows.

The educational program consists of 6 laboratory works (fig. 1). The program interface is designed in three languages: Russian, Kazakh, and English (fig. 2).

Each laboratory work includes various methods for modeling random patterns and the most common laws of their distribution (fig. 2).

For example, in laboratory work No. 3, "Modeling Continuous Random Patterns," methods such as the inverse function method, Neumann's rejection method, limit theorem method, and composition method are discussed.

Among the frequently encountered distributions of continuous variables, normal, uniform, linear, gamma, and exponential distributions are highlighted, and these are also covered in laboratory work No. 3.

The results of laboratory works can be presented as numerical data (fig. 2) or as graphs (fig. 3). Numerical data can be saved in an Excel file format (fig. 4).

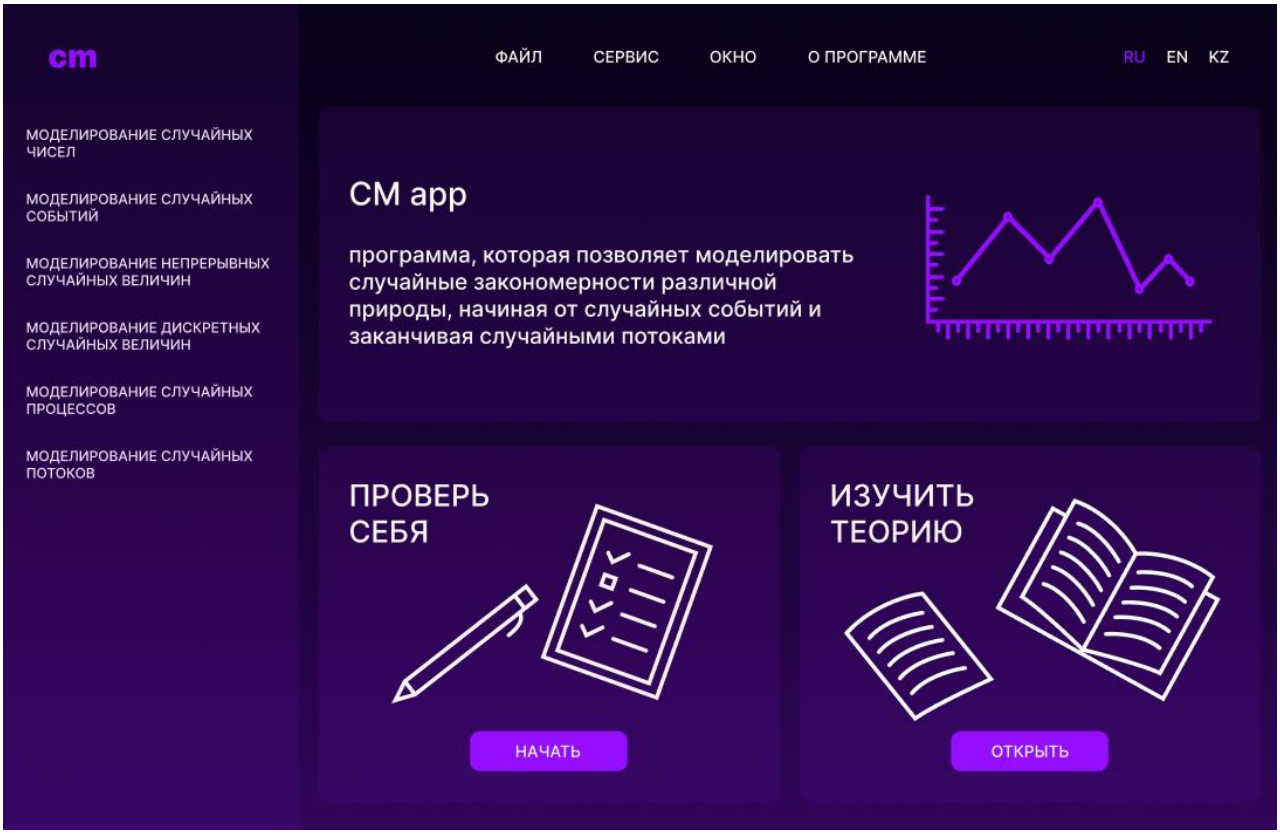

Fig 1 – Main Page of the Program

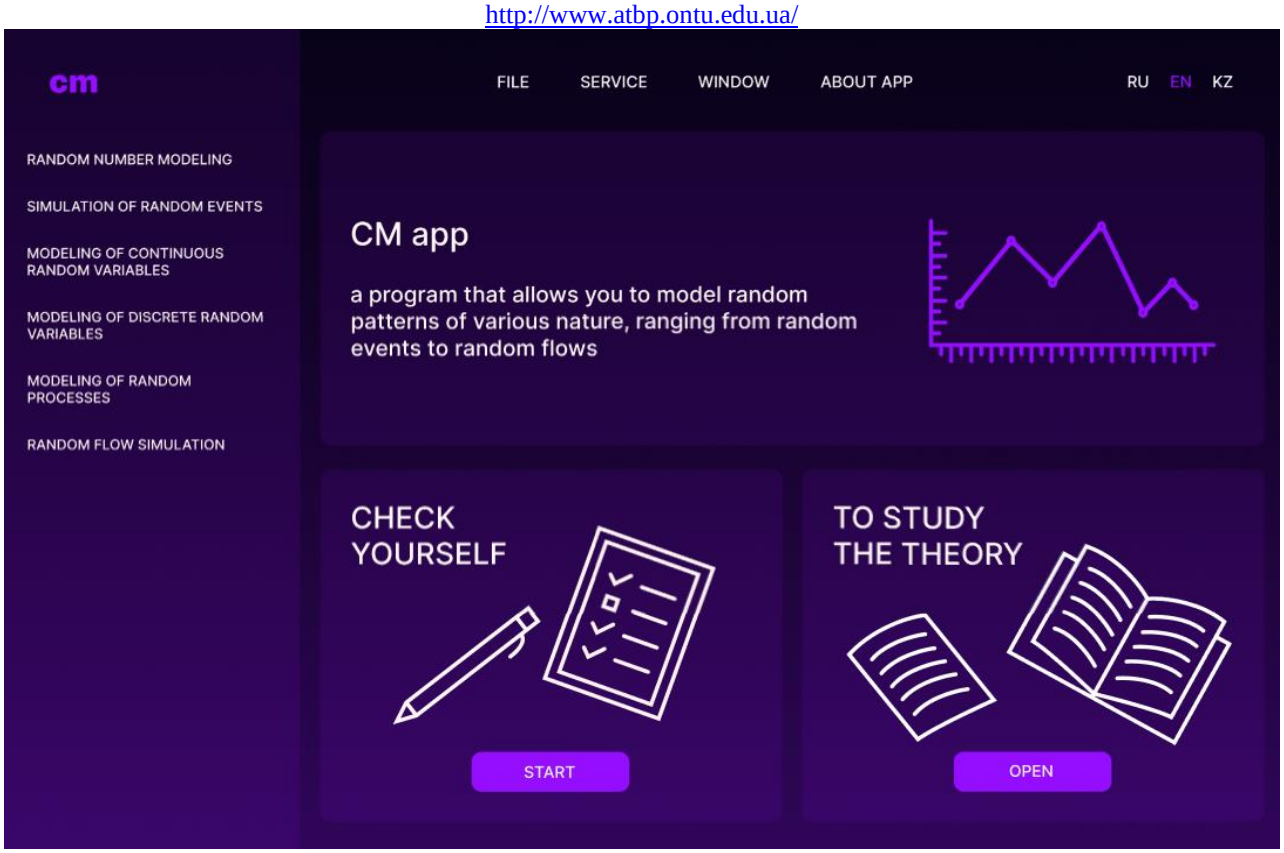

Fig 2 – The program interface is in English

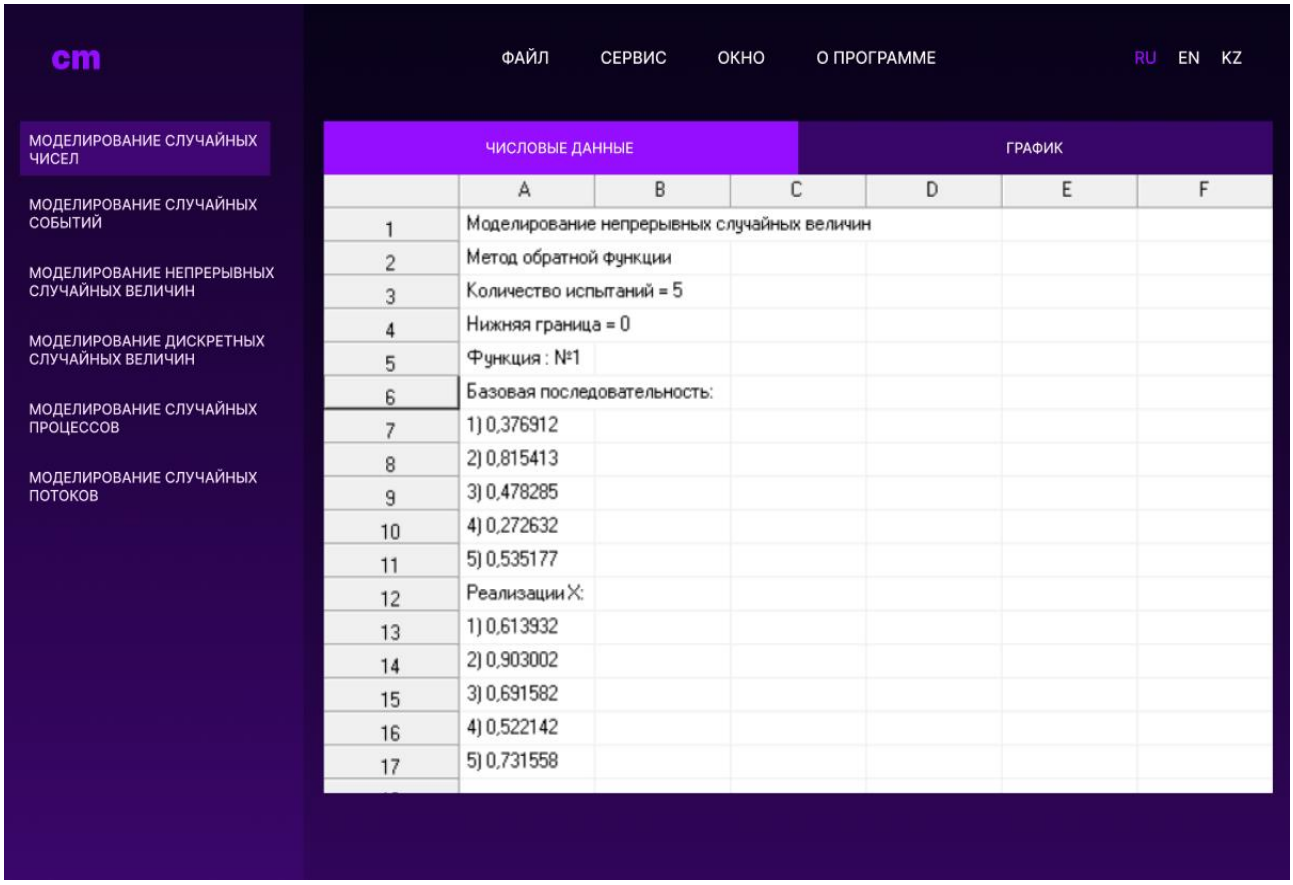

Fig. 3 – Modeling Continuous Random Variables

Fig.4 – Data output as a graph

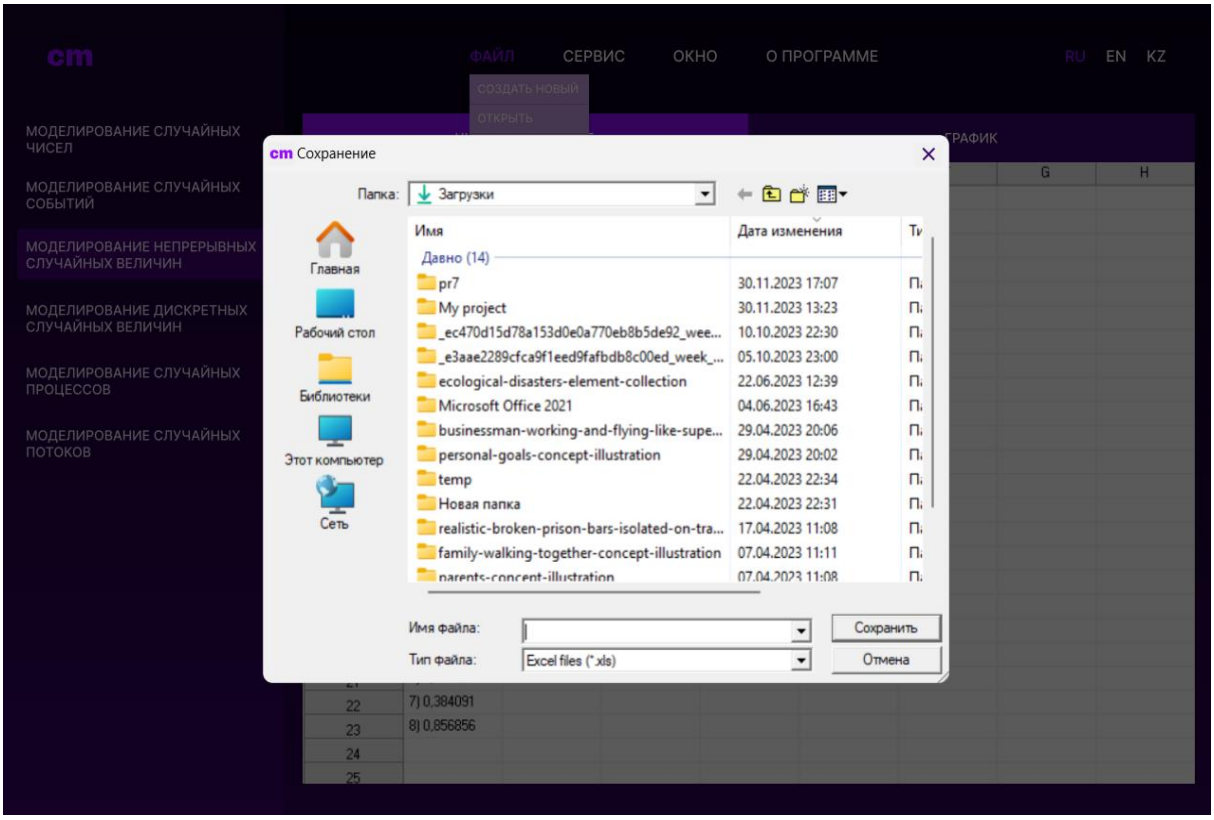

Fig.5 – Saving file as Excel format

Before completing each laboratory work, the learner can familiarize themselves with the theoretical part and numerical examples for each method and algorithm (fig. 6).

To reinforce the covered material, the learner can take a test on each topic and analyze their results (fig 7). In case of unsatisfactory results in a particular topic, the learner can review it again.

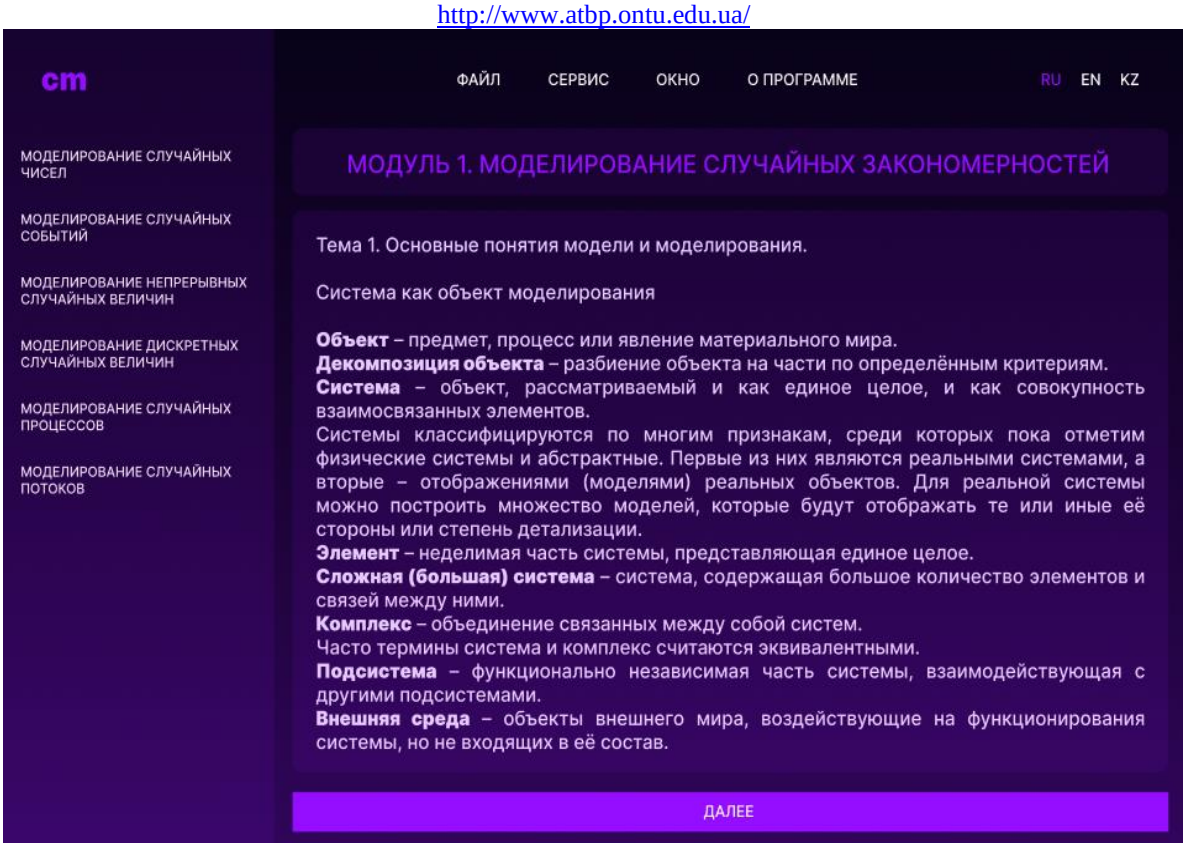

Fig. 6 – Theoretical part

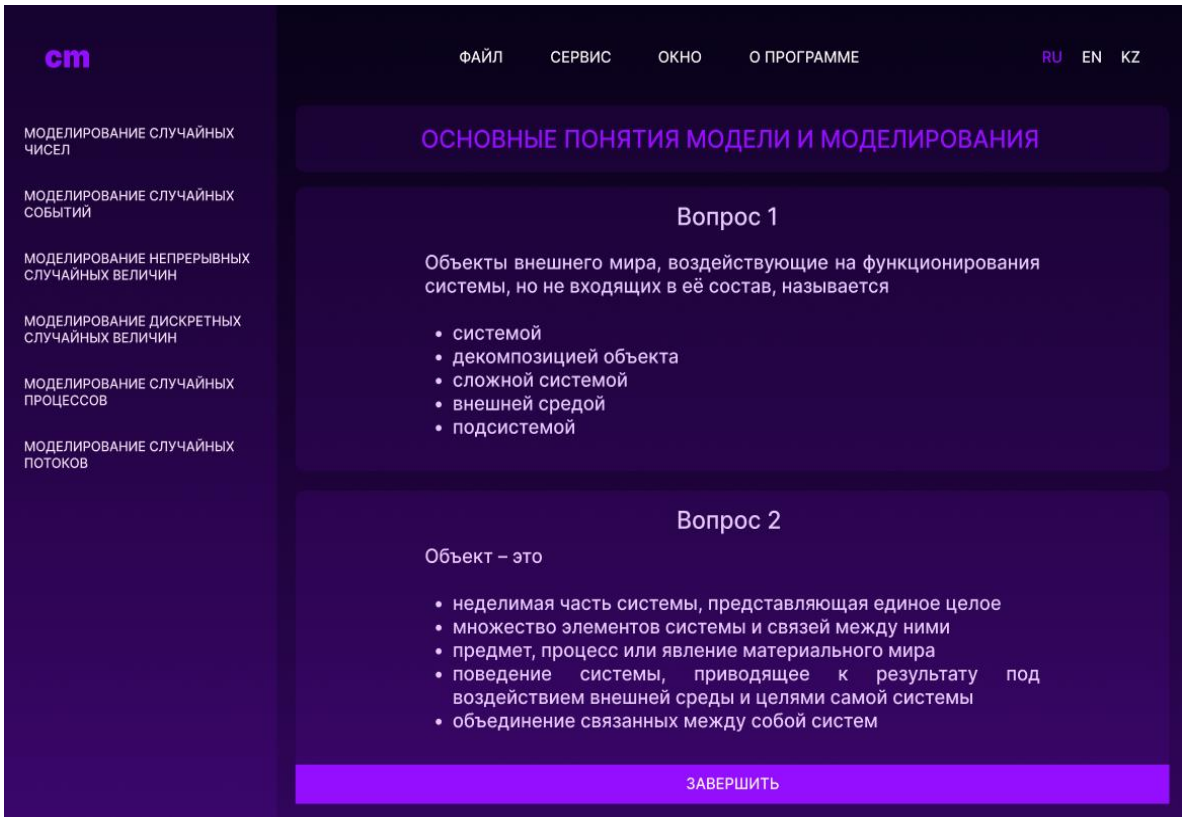

Fig. 7 – Taking the test

V. CONCLUSIONS

In the context of rapid developments in information technology, the development of computer-based educational programs becomes one of the promising directions for the educational environment of any university. With the aim of enhancing the educational process and increasing the effectiveness of learning, it is proposed to integrate digital technologies into education and develop computer-based educational programs.

In this research work, the authors present a computer-based educational program based on a complex of simulation

models for modeling random patterns, demonstrating high universality. The proposed simulation system incorporates methods and algorithms for modeling random patterns of various natures, ranging from random events to random flows. These methods and algorithms cover the most commonly used methods and encountered distributions.

The developed computer-based educational program covers the entire cycle of the learning process, starting from studying the theoretical part, reinforcing it through practical examples, and concluding with testing. This program is designed to improve the learning process for the discipline and provides learners with the opportunity to independently study the subject without the direct intervention of an educator.

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