Ministry of Education and Science of Ukraine

V. N. Karazin Kharkiv National University

EDUCATIONAL AND PROFESSIONAL PROGRAM

(educational-professional / educational-scientific)

Theoretical Computer Science

(program name)

second (master's) higher education level

(first (bachelor's), second (master's), third (educational and scientific)

Area of expertise F Information technology

(code, industry name)

Specialization F3 Computer Science

(code, specialty name)

Approved
By the Academic Council
Kharkiv National University
V. N. Karazin "25" May 2026,
Protocol No. 9

Effective from 2026/2027.
by Order No. 044-1/236
of "26" May 2026
Vice-Rector for Scientific and Pedagogical Work
Oleksandr HOLOVKO

Kharkiv 2026

APPROVAL LETTER
educational and professional programs "Theoretical Computer Science"

Educational program reviewed and approved:
1. Scientific and Methodological Council of V. N. Karazin Kharkiv National University
protocol No. 10 of "21" May 2026.

Chairman of the Scientific and Methodological Council,
vice-rector with scientific and pedagogical work
_____ Oleksandr HOLOVKO

2. To the Academic Council of the Faculty of Mathematics and Informatics:
Protocol No. 5 of 28 April 2026.

Acting Chairman of the Academic Council
Faculty of Mathematics and Computer Science
_____ Victoriya KUZNIETCOVA

3. Scientific and Methodological Department of Mathematics and Informatics:
Protocol No. 9 of 20 April 2026.

Chairman of the Scientific and Methodological Commission
Faculty of Mathematics and Computer Science
_____ Ievgen MENIAILOV

4. Department of Theoretical and Applied Informatics:
Protocol No. 10 of 20 April 2026.

Head of the Department _____ Anastasiia MOROZOVA

PREAMBLE

Developed by a working group consisting of:

Last name, first name, patronymic	Name of the position (for part-timers-place of main work, position)	Scientific degree, academic title, according to which the department (specialty) was awarded
Head of the working group, guarantor of the educational program		
FROLOV Vyacheslav Viktorovich (guarantor of the educational program)	Professor of the Department of Theoretical and Applied Informatics	Doctor of Technical Sciences 05.13.12-design automation systems, Associate Professor at the Department of Mechanical Engineering Technology and Metal-cutting Machines
Members of the working group		
RUKKAS Kyrylo Markovych	professor of the Department. theoretical and applied computer science	Doctor of Technical Sciences 05.13.06-Information Technologies, Professor at the Department of Theoretical and Applied Informatics
MOROZOVA Anastasiia Hennadiivna	associate Professor of the Department of Theoretical and Applied Informatics	PhD in Technical Sciences, 01.05.02-mathematical modeling and computational methods, Associate Professor at the Department of Theoretical and Applied Informatics
ZARETSKA Iryna Tymofiivna	associate Professor of the Department of Theoretical and Applied Informatics	PhD in Physical and Mathematical Sciences, 01.01.01-Mathematical analysis, Associate Professor at the Department of Higher Mathematics and Computer Science
ZHOLTKEVYCH Grygoriy Mykolaiovych	Professor of the Department of Information Systems, Faculty of Applied Mathematics and Informatics, Ivan Franko National University of Lviv	Doctor of Technical Sciences 05.02.08-Mechanical Engineering Technology, Professor at the Department of Theoretical and Applied Informatics
Employers are included in the working group		
VATULIA Hlib Leonidovych	director of the representative office of INTEGO GROUP LLC	Doctor of Technical Sciences, 05.23.01 – construction structures, buildings and structures.
KULANKHINA Oleksandra Oleksandrivna	Software Engineer of Google LLC	
The members of the working group include the following higher education graduates:		
Briukhovetskyi Yaroslav Olehovych	Core Developer ClickHouse, 1st year student of the second (master's) level in the specialty F3 Computer Science	

When developing the Program project, the following requirements are taken into account:

1. Standard of higher education in the specialty 122 computer science branches of knowledge 12 Information technologies for the second (master's) level of higher education, approved by Order No. 393 of the Ministry of Education and Science of Ukraine dated 28.04.2022 with changes;
2. Recommendations of leading experts in software development companies and Intego Group LLC.

1. Profile of the educational program

1 –General information	
Full name of the institution of higher education and its structural division	V. N. Karazin Kharkiv National University Faculty of Mathematics and Computer Science
Official name of the program	Theoretical Computer Science
Higher education degree	second (master's) level
Qualifications to be awarded	Master of Computer Science, Theoretical Computer Science
Type of diploma and scope of the educational program	Master's degree, single, 90 ECTS credits, the form of higher education - full-time duration of study - 1 year 4 months
Availability of accreditation	Accreditation Commission. Ukraine. Certificate-SUN # 2189568 Validity period-01.07.2027.
Background	Availability of first-level (bachelor's) or second (master's) level higher education
Language of instruction	Ukrainian
Duration of the educational program	1 year 4 months
Internet address of permanent placement of the educational program description	https://sites.google.com/karazin.ua/tacs-ua/education
2 –Purpose of the educational program	
Program goal	Training of professionals capable of conducting scientific research in the development of software projects in the field of information technology.
3– Characteristics of the educational program	
Subject area (field of knowledge, specialty, specialization (if available)**)**	F Information technology, F3 Computer Science **Objects of Study:** Applied software systems and intelligent data processing services. Processes of design, integration, and deployment of complex software. Modern architectural solutions, cloud services, and distributed IT infrastructure. Artificial intelligence algorithms and machine learning models in applied tasks. Technologies for the

	organization, storage, and protection of corporate data. **Objectives of the Educational Program:** Training of highly qualified specialists capable of solving complex practical problems in the development, modernization, and maintenance of modern computer systems within the dynamic environment of the IT industry. Formation of leadership and engineering competencies for designing software architecture and managing the development processes of applied intelligent systems. Ensuring graduates' readiness for rapid professional adaptation, implementation of innovative technological solutions, and holding leadership positions (Team Lead, Tech Lead, Solution Architect) in the commercial and public sectors. **Theoretical Content of the Subject Area:** Concepts and design patterns for complex software system architectures. Mathematical and algorithmic foundations of data analysis and intelligent computing. Methodologies for managing the software lifecycle and enterprise IT infrastructure. Applied aspects of machine learning (Applied Machine Learning) and processing large volumes of data. Methods of optimizing computational processes and protecting information in networks. **Methods, Methodologies, and Technologies:** Methods: Software engineering design; applied statistical analysis; intelligent information retrieval and data classification methods; code optimization and system testing. Methodologies: Modern industrial methodologies for agile project and development team management (Agile, Scrum, SAFe); methodologies for assessing the quality, reliability, and security of software products; system integration methodologies. Technologies: Technologies for developing intelligent web and mobile services; cloud computing and virtualization; data

	engineering. **Tools and Equipment:** Development Tools: Production programming languages (Python, Java, C#, Go, TypeScript, etc.), modern development frameworks (Spring, .NET, Django), and professional IDEs. Data Platforms: Relational and non-relational DBMS (PostgreSQL, MongoDB, Redis), analysis and visualization tools (PowerBI). Infrastructure Solutions: Containerization tools (Docker), cloud provider services (AWS, Azure), version control and automation tools (Git, GitHub, Jenkins). Equipment: Developer workstations, server equipment for software hosting and testing, cloud computing capacities (including virtual machines with GPUs for training applied models).
Orientation of the educational program	Educational and professional, professional. Provides mastery of a set of competencies required for specialists when performing research in the development of complex software projects in the field of information technology. Professional accents- specialist in information technology
Main focus of the educational program and specialization	Special education in the subject area that includes concepts and principles of higher and applied mathematics, programming, computer and mathematical modeling, intelligent data processing, system analysis and design, IT project management, enterprise architecture and IT infrastructure as such, ensuring the acquisition of relevant competencies by the graduate. Keywords: programmer, computer science, mathematical models
App Features	Widespread mathematical training is necessary for the implementation of innovative projects in the field of IT technologies. The practice of developing modern information systems shows the universality and usefulness of using algebraic tools. The same concepts and approaches are used in modeling of data types, relational databases and algorithms. At the same time, the

	interpretation of algebraic concepts in computer science makes general abstract concepts clear, which allows specialists to use the powerful apparatus of modern abstract algebra in this field of knowledge. For example, the most promising approach to proving the accuracy or developing an exact algorithm is that from the point of view of set-theoretic transformations of input data, the execution of the algorithm consists in a step-by-step transformation of the graph. In this regard, there is a growing need for specialists in this field to emphasize the study of discrete structures and other sections of modern mathematics, which are present in the educational program in normative (relational algebra, multivariate statistical analysis, etc.) and selective components (category theory, automata, etc.).
4– Suitability of graduates for employmentand further education	
Suitability for employment	Professional activity as a specialist in the development of mathematical, information and software for information systems, in the field of information technology, as well as an administrator of databases and systems. Graduates can work in the following professions: National classifier of professions DC 003: 2010: 2131.1 research assistants (computing systems) 2131.2 computer system developers 2132.1 research assistants (Programming) 2132.2 computer software developers This list is not exhaustive.
Further training	The possibility of studying for a third cycle program in this field of knowledge (which is consistent with the master's degree obtained). Obtaining additional qualifications in the postgraduate education system.
5 – Teaching and evaluation	
Teaching and learning	The main approaches to learning are competence-based, student-centered, and problem-oriented. The leading teaching methods are problem-based, partially exploratory, and exploratory. Teaching and learning is conducted in the form of lectures, including interactive and multimedia lectures,

	practical classes, self-study, and course research. Project-based, educational-game, graphic educational modeling, and interactive-communicative learning technologies are used.
Rating process	Four-level and two-level, 100-point assessment system through such types of control with the accumulation of points received: *current* (oral and written survey) control, intermediate (protection of practical, independent works), *final report* (written exams, test papers, defense of practice reports), self-monitoring, *certification process* (preparation and public defense of the master's thesis).
6 – Program competencies	
Integral competence	IC01 – Ability to solve research and / or innovation problems in the field of computer science.
General competencies	GC01 – ability to think abstractly, analyze and synthesize. GC02 – ability to apply knowledge in practical situations. GC03 – ability to communicate in the state language both orally and in writing. GC04 – ability to communicate in a foreign language. GC05 – the ability to learn and master modern knowledge. GC06 – ability to be critical and self-critical. GC07 – ability to generate new ideas (creativity).
Professional competencies	PC01 – awareness of the theoretical foundations of computer science. PC02 – the ability to formalize the subject area of a particular project in the form of an appropriate information model. PC03 – ability to use mathematical methods to analyze formalized domain models. PC04 – the ability to collect and analyze data (including large ones) to ensure the quality of project decision-making. PC05 – the ability to develop, describe, analyze and optimize architectural solutions of information and computer systems for various purposes. PC06 – the ability to apply existing and develop new algorithms for solving problems in the field of computer science. PC07 – the ability to develop software in

	accordance with the formulated requirements, taking into account available resources and limitations. PC08 – the ability to develop and implement software development projects, including in unpredictable conditions, with unclear requirements and the need to apply new strategic approaches, use software tools to organize team work on the project. PC09 – ability to develop and administer databases and knowledge. PC10 – ability to evaluate and ensure the quality of IT projects, information and computer systems for various purposes, apply international standards for evaluating the quality of software for information and computer systems, models for assessing the maturity of information and computer system development processes. PC11 – the ability to initiate, plan and implement the development processes of information and computer systems and software, including its development, analysis, testing, system integration, implementation and maintenance. PC12 – Ability to use the theoretical principles of modern algebra in the implementation of information and computer systems for various purposes.
7 – Program learning outcomes	
Programmatic learning outcomes	PLO1 – have specialized conceptual knowledge that includes modern scientific achievements in the field of computer science and is the basis for original thinking and research, critical understanding of problems in the field of computer science and on the edge of knowledge branches PLO2 – have specialized computer science problem-solving skills that are necessary for conducting research and / or implementing innovative activities in order to develop new knowledge and procedures. PLO3 – clearly and unambiguously communicate your own knowledge, conclusions and arguments in the field of computer science to specialists and non-professionals, in particular to people who are studying. PLO4 – manage information technology workflows that are complex, unpredictable, and require new strategic approaches.

	PLO5 – evaluate the performance of teams and teams in the field of information technology, ensure the effectiveness of their activities. PLO6 – develop a conceptual model of an information or computer system. PLO7 – develop and apply mathematical methods for analyzing information models. PLO8 – develop mathematical models and data analysis methods (including large ones). PLO9 – develop algorithmic and software solutions for data analysis (including large ones). PLO10 – design architectural solutions for information and computer systems for various purposes PLO11 – create new algorithms for solving problems in the field of computer science, evaluate their effectiveness and limitations on their application PLO12 – design and maintain databases and knowledge. PLO13 – evaluate and ensure the quality of information and computer systems for various purposes. PLO14 – test the software. PLO15 – identify the needs of potential customers for automating information processing. PLO16 – perform research in the field of computer science. PLO17 – identify and eliminate problem situations in the process of software operation, formulate tasks for its modification or reengineering. PLO18 – collect, formalize, systematize and analyze the needs and requirements for an information or computer system that is being developed, operated or maintained PLO19 – analyze the current state and global trends in the development of computer science and information technology PLO20 – Apply the apparatus of abstract algebra in the development of information systems
8 – Resource support for program implementation	
Specific characteristics of human resources support	Complies with the license conditions for educational activities. All teachers are full-time university teachers, have a scientific degree and / or academic title corresponding

	to the main profile of the discipline taught. All teachers undergo advanced training once every five years.
Specific characteristics of logistics support	Equipment and equipment, technical training facilities (whiteboards, multimedia projectors, laptops, printers, scanners, personal computers with software) for the formation of subject competencies in the course of training of the applicant. There are classrooms, computer labs, dormitories, food outlets, wireless Internet access points, gyms, and the like.
Specific characteristics of information and educational support	Official website of the University, unlimited access to the Internet, printed materials (collections of the V. N. Karazin Central National Library, repository, own libraries of educational laboratories) and Internet sources (incl. e-learning Center of the University) information; training and work plans (with explanatory notes to them), educational programs, working programs of disciplines and practices, educational and methodological complexes of disciplines, including lecture material, practical work tasks, questions of seminars, tasks of independent work, questions, tasks, tasks for the current and final stage of the project. control system. In the case of online learning, information and educational and methodological support has a number of specific characteristics: all materials must be presented in electronic form; access must be provided through platforms (LMS - Moodle, GoogleClassroom, Teams, etc.); materials must support both live participation of students in the educational process and asynchronous access (recorded lectures, methodological recommendations, etc.); integration with analytical modules (for example, progress tracking, built-in knowledge testing mechanisms: tests, auto-testing, online surveys, etc.). Meets the license conditions, 100%
9 – Academic mobility	
National credit mobility	In accordance with the law
International credit mobility	Academic cooperation under the double degree program: MoldovaState University, Moldova Erasmus + KA1 Academic Mobility Programs: Technical University of Lodz, Poland Nicolaus Copernicus University, Torun,

	Poland University of Murcia, Spain University of the Cote d'Azur, Nice, France.
Training of foreign applicants for higher education	Citizens of other countries are accepted for training on the basis of international agreements on the conditions defined by these agreements, as well as agreements concluded by an educational institution with foreign educational institutions, organizations, or individual agreements or contracts.

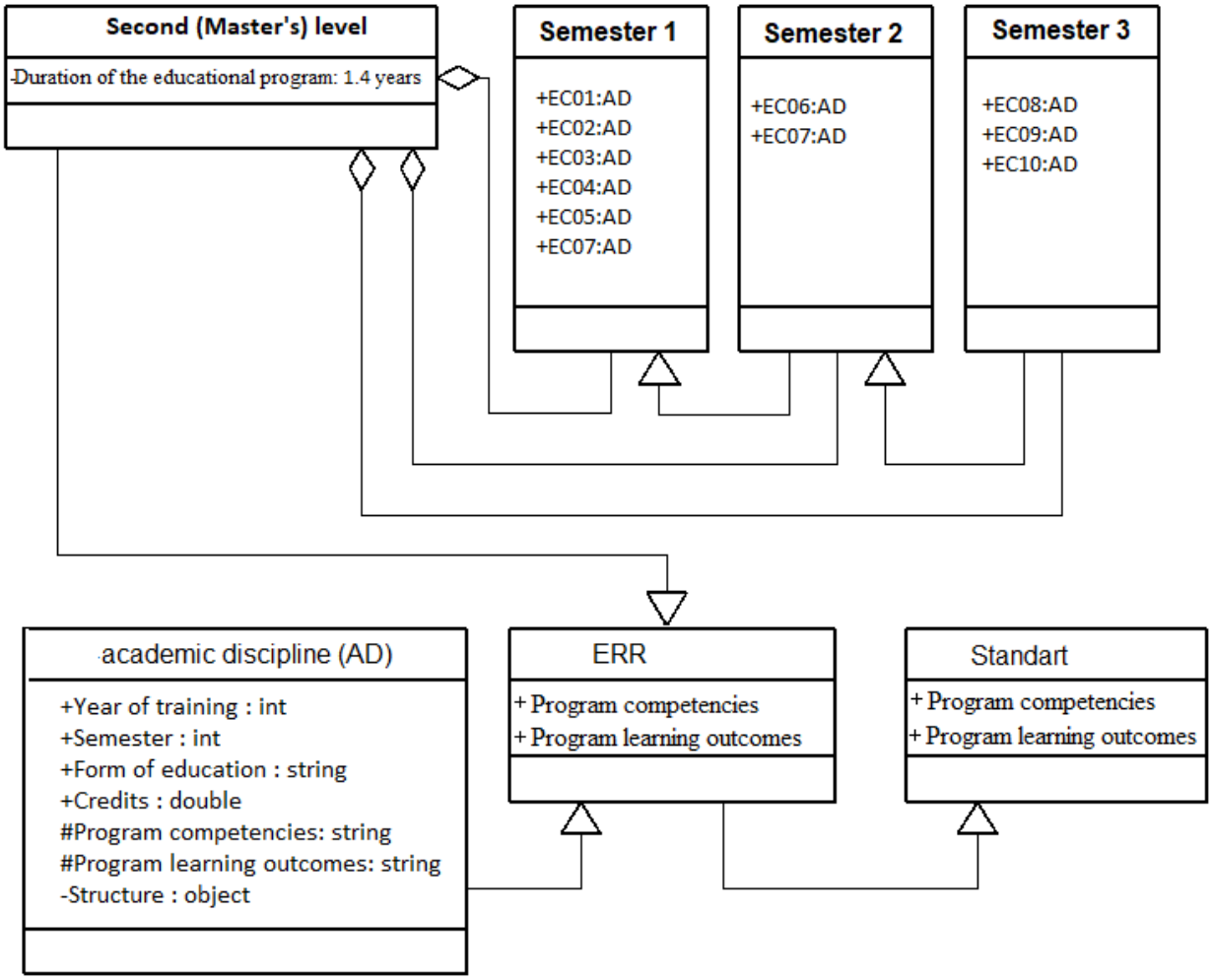
2. List of components of the educational and professional program and their logical Sequence

2.1. List of OP components

N / A code	Components of the educational program (academic disciplines, course projects (works), internships, qualification work)	Quantity credits	Final control form
1	2	3	4
1. Required OP components			
EC01	Global problems of our time	3	test
EC02	Statistical methods in computer science	5	exam
EC03	Theory of programming	6	exam
EC04	Database and data warehouse technologies	5	exam
EC05	Software engineering	5	exam
EC06	Data protection	3	test
EC07	Research coursework	6	test
EC08	Research and production practice	20	exam
EC09	Pre-graduate practice	6	test
EC10	Preparation of the qualification work	4	exam
Total amount of required components		**63**	
2. Selected OP components			
	2.2. Cycle of professional (professional) training		
	(5 disciplines are selected according to the catalog of professional selective disciplines of the faculty with a total volume of 27 ECTS) https://sites.google.com/karazin.ua/tacs-ua/education/syllabus-master-prof?#h.m6b3ta5fprbe		
SC2. 2. 1	Discipline P-1	3	test
SC2. 2. 2	Discipline P-2	6	exam
SC2. 2. 3	Discipline P-3	6	exam
SC2. 2. 4	Discipline P-4	6	exam
SC2. 2. 5	Discipline P-5	6	exam

Total volume of sample components	**27**	
TOTAL SCOPE OF THE EDUCATIONAL PROGRAM	**90**	

2.2. Structural and logical scheme of the OP



3. Form of certification of applicants for higher education

Certification of graduates of the educational program "informatics" in the specialty F3 Computer science is carried out openly and publicly, is carried out in the form of defense of a qualifying master's thesis and ends with the issuance of a standard document on awarding them a master's degree with the qualification: master of Computer Science, Theoretical Computer Science.

Requirements for a qualified Master's thesis:

During the preparation and defense of the qualification work, the graduate must demonstrate knowledge and ability to analyze the properties of the design object, justify the choice of technical and software, perform design work, develop application software, and use modern information technologies at all stages of development.

The master's thesis must not contain academic plagiarism, falsification, fabrication. master's thesis must be placed in a public repository of a higher education institution. The publication of master's thesis containing information with restricted access should be carried out in accordance with the requirements of the law.

Public defense (demonstration) of a qualifying work provides for::

– presentation of the main points of the work in the form of a multimedia presentation and an explanatory note;

– preliminary announcement on the official website of the higher education institution;

– open form of the commission meeting;

– announcement on the same day after the end of the defense evaluation of the qualification work and registration of the minutes of the commission meeting;

– decision-making by the commission on awarding the qualification.

Certification is carried out openly and publicly before the examination committee, which is approved by the order of the Rector of V. N. Karazin Kharkiv National University. The applicant's report must be accompanied by a presentation using multimedia technology in order to be convincing and confirm the conclusions and suggestions.

4. Compliance matrix of program competenciescomponents of the educational program

	EC01	EC02	EC03	EC04	EC05	EC06	EC07	EC08	EC09	EC10
IC01		+	+	+	+	+	+	+	+	+
GC01	+	+	+	+	+	+	+	+	+	+
GC02	+	+	+	+	+	+	+	+	+	+
GC03	+	+	+	+	+	+	+	+	+	+
GC04							+	+	+	+
GC05	+	+	+	+	+	+	+	+	+	+
GC06	+						+	+	+	+
GC07	+	+	+	+	+	+	+	+	+	+
PC01		+			+		+	+	+	+
PC02		+		+			+	+	+	+
PC03		+		+			+	+	+	+
PC04				+			+	+	+	+
PC05			+		+	+	+	+	+	+
PC06			+			+	+	+	+	+
PC07			+		+	+	+	+	+	+
PC08					+		+	+	+	+
PC09				+			+	+	+	+
PC10					+		+	+	+	+
PC11					+		+	+	+	+
PC12							+	+	+	+

5. Matrix for ensuring programmatic learning Outcomes (PRN)relevant components of the educational program

	EC01	EC02	EC03	EC04	EC05	EC06	EC07	EC08	EC09	EC10
PLO01		+			+		+	+	+	+
PLO02		+		+			+	+	+	+
PLO03		+		+			+	+	+	+
PLO04				+			+	+	+	+
PLO05			+		+	+	+	+	+	+
PLO06			+			+	+	+	+	+
PLO07			+		+	+	+	+	+	+
PLO08					+		+	+	+	+
PLO09				+			+	+	+	+
PLO10					+		+	+	+	+
PLO11					+		+	+	+	+
PLO12							+	+	+	+