"KROK" UNIVERSITY

EDUCATIONAL-PROFESSIONAL PROGRAM "COMPUTER SCIENCE"

LEVEL OF HIGHER EDUCATION	FIRST
DEGREE OF HIGHER EDUCATION	BACHELOR
FIELD OF KNOWLEDGE	12 INFORMATION TECHNOLOGIES
SPECIALTY	122 COMPUTER SCIENCES

APPROVED
Scientific Council
of "KROK" University
Chairman of the Academic Council
_____ S.M. Laptiev
(protocol № 2 of October 29, 2020)

Kyiv – 2020

WORKGROUP:

Guarantor:

Zaytseva EE, Ph.D.
Associate Professor of the Department of Computer Science

Group members:

Tymchuk OS, Ph.D., Associate Professor,
Head of the Department of Computer Science
Pilipenko AI, Ph.D., Associate Professor,
Head of the Department of Mathematical Methods and Statistics
Polishchuk OA, Ph.D.
Associate Professor of the Department of Computer Science

1 PROFILE OF THE EDUCATIONAL PROGRAM "COMPUTER SCIENCES" BY SPECIALTY 112 COMPUTER SCIENCES

1 - General information	
Institution of higher education	"KROK" University **Educational and Scientific Institute of Information and Communication Technologies** Department of Computer Science
Level of higher education	The first (bachelor's) level
Degree of higher education	Bachelor
Branch of knowledge	12 "Information Technology"
Specialty	122 "Computer Science"
Form of study	Full-time, part-time (remote)
Educational qualification	Bachelor of Computer Science
Qualification in the diploma	Degree of higher education – Bachelor Specialty – 122 Computer Science Educational program – Computer Science
The scope of the educational program	240 ECTS credits
Availability of accreditation	Certificate of accreditation series НД-ІІ № 1194472 in accordance with the decision of the Accreditation Commission of July 5, 2016, protocol № 122 (order of the Ministry of Education and Science of Ukraine of 06.07.2016 № 806) in the field of knowledge 12 Information technology specialty 122 Computer Science by level bachelor. The certificate is valid until July 1, 2021.
Program cycle/level	NRC of Ukraine – level 6 FQ-EHEA – the first cycle EQF-LLL – level 6
Prerequisites	Basis on complete general secondary education / basis on educational and qualification level "junior specialist" (bachelor's degree) / basis on a bachelor's degree
Language of instruction	English
2 - The purpose of the educational program	
Training of specialists who can solve complex specialized problems and practical problems in the subject area of Computer Science, which are characterized by complexity and uncertainty of conditions, and involve the application of theory and methods of information technology	
3 - Characteristics of the educational program	
Subject area	*Objects of study and/or activity:* – mathematical, informational, simulation models of real phenomena, objects, systems and processes, subject areas, presentation of data and knowledge; – methods and technologies for obtaining, storing, processing, transmitting and using information, data mining and decision making; – theory, analysis, development, performance evaluation, implementation of algorithms, high-performance computing, including parallel computing and big data. *Learning objectives:*

	– to train the specialists capable to conduct theoretical and experimental research in the field of Computer Science; – to apply mathematical methods and algorithmic principles in modeling, design, development and maintenance of information technology; – to develop, implement and maintain intelligent systems for analysis and data processing of organizational, technical, natural and socio-economic systems. *Theoretical content of the subject area:* modern models, methods, algorithms, technologies, processes and methods of obtaining, presenting, processing, analyzing, transmitting, storage of data in information systems. *Methods, techniques and technologies:* – mathematical models, methods and algorithms for solving theoretical and applied problems that arise in the development of IT; – modern technologies and programming platforms; methods of collecting, analyzing and consolidating distributed information; – technologies and methods of design, development and quality assurance of IT components; – computer graphics methods and data visualization technologies; – knowledge engineering technologies, CASE-technologies of IT modeling and design. *Tools and equipment:* – distributed computing systems; – computer networks; – mobile and cloud technologies; – database management systems; – Operating Systems.
Orientation of the educational program	Educational and professional
The focus of the educational program	General training in the specialty 122 Computer Science in the field of Information Technology
Features of the program	Practical-oriented training, which focuses on the development and public presentation of IT projects.
4 - Suitability of graduates for employment and further study	
Suitability for employment	Graduates can work in professions according to the National Classification of Ukraine (ДК 003: 2010): 3121 Information Technology Specialist 3121 Software Development and Testing Specialist 3121 Specialist in computer program development
Academic and professional rights of graduates	They have the right to continue their studies at the second (master's) level of higher education. Acquisition of additional qualifications in the system of graduate education.
5 - Teaching and assessment	
Teaching and learning	Forms of teaching: lectures, practical classes, laboratory work, independent work, consultations with teachers, trainings (workshops), project implementation, qualification work preparation. Approaches and learning technologies: student-centered learning, self-study, problem-oriented learning, level differentiation, project-based learning.

Evaluation	Forms of control: verbal and written questioning, tests, case studies, reports on practical and laboratory work, defense of laboratory and practical work, tests, exams, project defense, defense of qualifying work. Assessment of students' academic achievements is carried out on a 4-point scale (excellent, good, satisfactory, unsatisfactory) and a 100-point scale.
6 - Program competencies	
defined by the standard in the specialty	
Integral competence	Ability to solve complex specialized problems and practical problems in the field of Computer Science or in the learning process, which involves the application of theories and methods of information technology and is characterized by complexity and uncertainty of conditions.
General Competences (GC)	GC1 Ability to abstract thinking, analysis, and synthesis. GC2 Ability to apply knowledge in practical situations. GC3 Knowledge and understanding of the subject area and understanding of professional activity. GC4 Ability to communicate in the state language both orally and in writing. GC5 Ability to communicate in a foreign language. GC6 Ability to learn and master modern knowledge. GC7 Ability to search, process and analyze information from various sources. GC8 Ability to generate new ideas (creativity). GC9 Ability to work in a team. GC10 The ability to be critical and self-critical. GC11 Ability to make informed decisions. GC12 Ability to evaluate and ensure the quality of work performed. GC13 Ability to act on ethical considerations. GC14 The ability to exercise their rights and responsibilities as a member of society, to realize the values of civil (free democratic) society and the need for its sustainable development, the rule of law, human and civil rights, and freedoms in Ukraine. GC15 Ability to preserve and increase moral, cultural, scientific values and achievements of society based on understanding the history and patterns of development of the subject area, its place in the general system of knowledge about nature and society and in the development of society, techniques, and technologies. active recreation and a healthy lifestyle.
Special (professional, subject) competencies (SC)	SC1 Ability to mathematical formulation and research of continuous and discrete mathematical models, justification of the choice of methods and approaches for solving theoretical and applied problems in the field of Computer Science, analysis, and interpretation SC2 Ability to detect statistical patterns of nondeterministic phenomena, the use of methods of computational intelligence, including statistical, neural network and fuzzy data processing, methods of machine learning and genetic programming, etc. SC3 Ability to think logically, build logical conclusions, use formal languages and models of algorithmic calculations, design, development, and analysis of algorithms, evaluate their efficiency and complexity, solvability and insolvability of algorithmic problems for adequate modeling of subject areas and creation of software and information systems.

	SC4 Ability to use modern methods of mathematical modeling of objects, processes, and phenomena, to develop models and algorithms for numerical solution of mathematical modeling problems, to consider the errors of approximate numerical solution of professional problems. SC5 Ability to provide a formalized description of operations research tasks in organizational, technical, and socio-economic systems for different purposes, to determine their optimal solutions, to build models of optimal management considering changes in the economic situation, to optimize management processes in different systems and hierarchies. SC6 Ability to systems thinking, application of systems analysis methodology to study complex problems of different nature, methods of formalization and solution of system problems with conflicting goals, uncertainties, and risks. SC7 Ability to apply the theoretical and practical foundations of methodology and modeling technology to study the characteristics and behavior of complex objects and systems, to conduct computational experiments with processing and analysis of results. SC8 Ability to design and develop software using different programming paradigms: generalized, object-oriented, functional, logical, with appropriate models, methods and algorithms of calculations, data structures and control mechanisms. SC9 Ability to implement a multi-level computational model based on client-server architecture, including databases, knowledge, and data warehouses, perform distributed processing of large data sets on clusters of standard servers to meet the computing needs of users, including cloud services. SC10 Ability to apply methodologies, technologies, and tools to manage the life cycle processes of information and software systems, information technology products and services in accordance with customer requirements. SC11 Ability to data mining based on methods of computational intelligence, including large and poorly structured data, their operational processing and visualization of analysis results in the process of solving applied problems. SC12 Ability to ensure the organization of computational processes in information systems for various purposes, considering the architecture, configuration, performance indicators of operating systems and system software. SC13 Ability to develop network software that operates based on different topologies of structured cabling systems, uses computer systems and data networks, and analyzes the quality of computer networks. SC14 Ability to apply methods and means of information security, to develop and operate special software for protection of information resources of critical information infrastructure. SC15 Ability to analyze and functional modeling of business processes, construction, and practical application of functional models of organizational, economic and production and technical systems, methods of risk assessment of their design. SC16 Ability to implement high-performance computing based on cloud services and technologies, parallel and distributed computing in the development and operation of distributed parallel information processing systems.

7 - Program learning results
defined by the standard in the specialty
PR1 Apply knowledge of the basic forms and laws of abstract-logical thinking, the basics of the methodology of scientific knowledge, forms and methods of extraction, analysis, processing, and synthesis of information in the subject area of Computer Science. PR2 Use a modern mathematical apparatus of continuous and discrete analysis, linear algebra, analytical geometry, in professional activities to solve problems of theoretical and applied nature in the design and implementation of informatization objects. PR3 Use knowledge of the laws of random phenomena, their properties and operations on them, models of random processes and modern software environments to solve problems of statistical data processing and construction of predictive models. PR4 Use methods of computational intelligence, machine learning, neural network and fuzzy data processing, genetic and evolutionary programming to solve problems of recognition, prediction, classification, identification of control objects, etc. PR5 Design, develop and analyze algorithms for solving computational and logical problems, evaluate the efficiency and complexity of algorithms based on the use of formal models of algorithms and computational functions. PR6 Use methods of numerical differentiation and integration of functions, solution of ordinary differential and integral equations, features of numerical methods and possibilities of their adaptation to engineering problems, have skills of software implementation of numerical methods. PR7 Understand the principles of modeling organizational and technical systems and operations; use methods of operations research, solving one- and multi-criteria optimization problems of linear, integer, nonlinear, stochastic programming. PR8 Use the methodology of system analysis of objects, processes, and systems for the tasks of analysis, forecasting, management, and design of dynamic processes in macroeconomic, technical, technological, and financial objects. PR9 Develop software models of subject environments, choose a programming paradigm from the standpoint of convenience and quality of application for the implementation of methods and algorithms for solving problems in the field of Computer Science. PR10 Use tools for developing client-server applications, design conceptual, logical, and physical models of databases, develop and optimize queries to them, create distributed databases, repositories and showcases of databases, knowledge bases, including on cloud services, using web languages - programming. PR11 Have the skills to manage the life cycle of software, products, and services of information technology in accordance with the requirements and restrictions of the customer, be able to develop project documentation (feasibility study, terms of reference, business plan, agreement, contract, contract). PR12 Apply methods and algorithms of computational intelligence and data mining in the problems of classification, forecasting, cluster analysis, search for associative rules using software tools to support multidimensional data analysis based on technologies DataMining, TextMining, WebMining. PR13 To know the languages of system programming and methods of program development that interact with the components of computer systems, to know network technologies, computer network architectures, to have practical skills of computer network administration technology and their software. PR14 Apply knowledge of methodology and CASE-tools for designing complex systems, methods of structural analysis of systems, object-oriented design methodology in the development and study of functional models of organizational-economic and production-technical systems. PR15 Understand the concept of information security, the principles of secure software design, ensure the security of computer networks in conditions of incomplete and uncertain source data. PR16 Perform parallel and distributed calculations, apply numerical methods and algorithms for parallel structures, parallel programming languages in the development and operation of parallel and distributed software.
8 - Resource support for program implementation

Staff support	Full-time employees of the university, leading teachers of academic research institutions, other institutions of higher education, teachers-practitioners who meet the qualification requirements in accordance with the specialty are involved in teaching.
Material and technical support	Meets the license terms for the total area of premises, educational premises and other premises used in the educational process. The available equipment, hardware and software of specialized computer laboratories is sufficient to ensure the implementation of the curriculum and the formation of program learning outcomes of the educational program.
Information and educational and methodical support	Meets the license terms for conducting educational activities in the library, providing textbooks, manuals, references and other educational literature and professional periodicals. Educational and methodological support of disciplines is adapted to modern learning technologies using the platform "Moodle".
9 - Academic mobility	
National credit mobility	Implemented under academic mobility programs under programs and agreements between "KROK" University and higher education institutions of Ukraine.
International credit mobility	Implemented under academic mobility programs under programs and agreements between "KROK" University and foreign higher education institutions.
Training of foreign applicants for higher education	Carried out in accordance with the rules of the Ministry of Education and Science of Ukraine and the rules of admission to "KROK" University.

2 LIST OF COMPONENTS OF THE EDUCATIONAL PROGRAM AND THEIR LOGICAL SEQUENCE

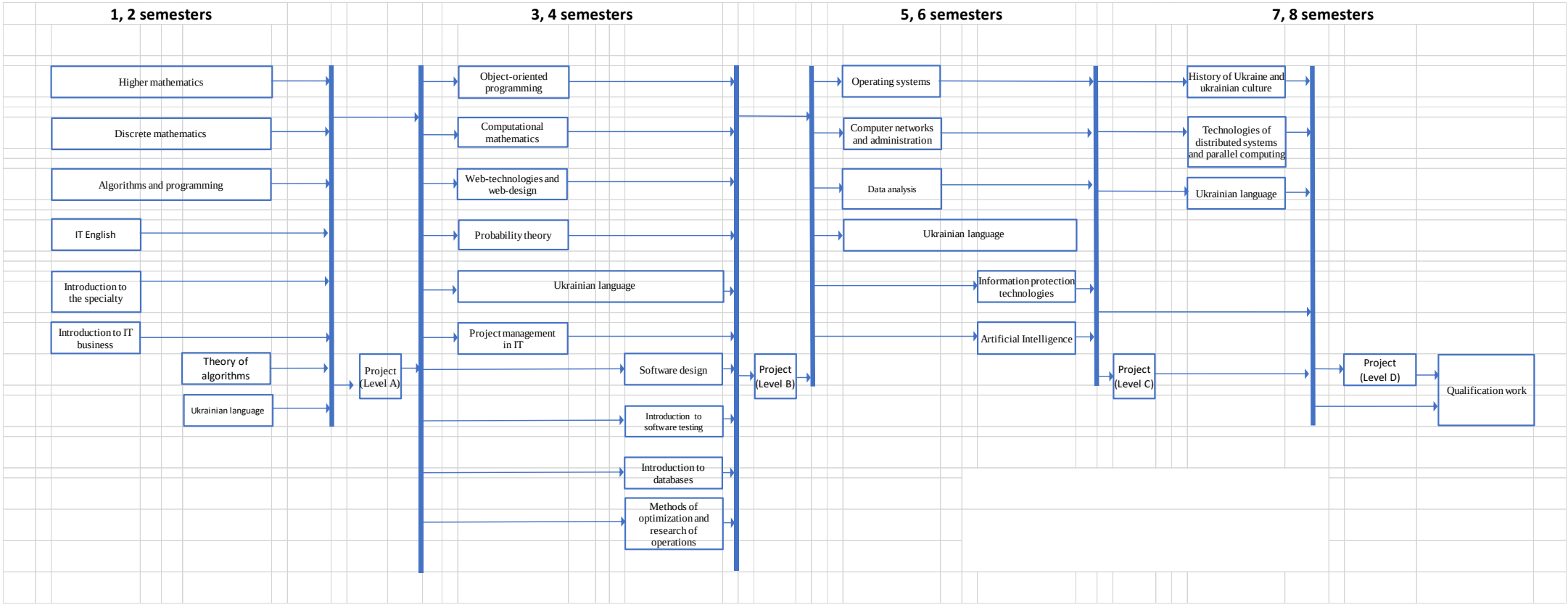
2.1 List of components of the educational program

Code	Components of the educational program (academic disciplines, projects, qualification work)	Number of credits	Form of final control
1	2	3	4
1st semester			
CSB001E	Higher mathematics	5	exam
CSB002E	Discrete mathematics	5	exam
CSB003E	Algorithms and programming	5	exam
CSB004E	Introduction to the specialty	3	diff. credit
CSB005E	Ukrainian language	4	diff. credit
CSB006E	Introduction to IT business	4	diff. credit
The total amount of components for 1 semester		26 credits	
2nd semester			
CSB001E	Higher mathematics	6	exam
CSB002E	Discrete mathematics	6	exam
CSB003E	Algorithms and programming	6	exam
CSB007E	Theory of algorithms	4	diff. credit
CSB005E	Ukrainian Language	4	diff. credit
CSB008E	Project (Level A)	8	project defense

1	2	3	4
The total amount of components for the 2nd semester		34 credits	
The total amount of components for 1 year		60 credits	
3rd semester			
CSB009E	Object-oriented programming	4	exam
CSB010E	Computational mathematics	4	exam
CSB011E	Web-technologies and web-design	4	exam
CSB012E	Probability theory	3	diff. credit
CSB005E	Ukrainian language	3	diff. credit
CSB013E	Project management in IT	3	diff. credit
CSBS01E	Discipline of free choice	5	diff. credit
The total amount of components for the 3rd semester		26 credits	
4th semester			
CSB014E	Software design	5	exam
CSB015E	Introduction to software testing	4	exam
CSB016E	Introduction to databases	5	exam
CSB005E	Ukrainian language	3	diff. credit
CSB017E	Methods of optimization and research of operations	4	diff. credit
CSB018E	Project (Level B)	8	project defense
CSBS02E	Discipline of free choice	5	diff. credit
The total amount of components for the 4th semester		34 credits	
The total amount of components for 2 years		60 credits	
5th semester			
CSB019E	Operating systems and system programming	5	exam
CSB020E	Computer networks and administration	4	exam
CSB021E	Data analysis	4	exam
CSB005	Ukrainian language	3	diff. credit
CSBS03E	Discipline of free choice	5	diff. credit
CSBS04E	Discipline of free choice	5	diff. credit
The total amount of components for the 5th semester		26 credits	
6th semester			
CSB022E	Information protection technologies	6	exam
CSB023E	Artificial Intelligence	6	exam
CSB005E	Ukrainian language	6	diff. credit
CSB024	Project (Level C)	8	project defense
CSBS05E	Discipline of free choice	5	diff. credit
CSBS06E	Discipline of free choice	5	diff. credit
The total amount of components for the 6th semester		34 credits	
The total amount of components for 3 years		60 credits	
7th semester			
CSB025E	Technologies of distributed systems and parallel computing	4	exam
CSB026E	History of Ukraine and Ukrainian culture	4	exam
CSB005E	Ukrainian language	3	diff. credit
CSBS07E	Discipline of free choice	5	diff. credit
CSBS08E	Discipline of free choice	5	diff. credit
CSBS09E	Discipline of free choice	5	diff. credit
The total amount of components for the 7th semester		26 credits	
8th semester			
CSB005E	Ukrainian language	3	diff. credit
CSBS10E	Discipline of free choice	5	diff. credit

1	2	3	4
CSBS11E	Discipline of free choice	5	diff. credit
CSBS12E	Discipline of free choice	5	diff. credit
CSB027	Project (fourth level)	4	defense
CSB028	Qualification work	12	defense
The total amount of components for the 8th semester		34 credits	
The total amount of components for 4 years		60 credits	
The total amount of mandatory components		180 credits	
The total amount of sample components		60 credits	
The total amount of components of the educational program		240 credits	

2.2 Structural logic scheme of the educational program



3 THE FORM OF CERTIFICATION OF HIGHER EDUCATION APPLICANTS

Forms of certification of applicants for higher education	Certification is carried out in the form of open and public defense of qualification work (thesis).
Requirements for qualification work	Qualification work should include theoretical, systems engineering or experimental research of a complex specialized task or practical problem in the field of Computer Science, which is characterized by complexity and uncertainty of conditions and requires the use of theories and methods of information technology. There should be no academic plagiarism, falsification or fabrication in the qualification work. Qualification work must be published on the official website of the university or its structural unit, or in the repository of the university.

Guarantor of educational and professional program E.E. Zaytseva