MINISTRY OF SCIENCE AND HIGHER EDUCATION OF THE REPUBLIC OF KAZAKHSTAN

GRADUATE PROFILE (BACHELOR)
Of Educational Program
6B06102 – Computer Science
(B057 «Information Technologies»)

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CONTENTS

INTRODUCTION

The model of a Computer Science specialist must be systemic, reflecting the advantages of both qualification-based and competency-based approaches. In the competency framework of the specialist model, educational goals are linked not only to the execution of specific functions but also to the integrated requirements of the educational process outcomes. The competency-based approach encompasses not only specific knowledge and skills but also categories such as the ability and readiness for learning, social skills, and more.

Modern developments in information technology and software engineering impose new requirements on graduates, prioritizing the need for systematically organized, intellectual, communicative, and self-organizing skills.

The undergraduate program focuses on the comprehensive training of specialists in Computer Science, emphasizing software development technologies, data analysis, and information systems management. The program aims to prepare qualified IT specialists capable of effectively addressing tasks in software development, data analysis, and information security. Graduates of the program will be equipped to work in industries, businesses, or governmental institutions, possessing teamwork abilities and critical thinking skills.

The educational program is designed in alignment with the current demands of the IT industry and trends in software engineering and data science. It is based on practice-oriented learning, closely tied to employer requirements and modern standards in information and communication technologies.

The quality of professional training for a bachelor’s degree in Computer Science depends on the substantiation of three key aspects:

- The goals and objectives of the educational program.
- The content of education.
- The principles of organizing the learning process.

Considering the feedback from potential employers and the alumni association of Satbayev University, along with the mission of the university and the requirements of the State Compulsory Educational Standard of the Republic of Kazakhstan, the goals and objectives of the 6B06102 – Computer Science educational program were formulated.

The curriculum content must meet the demands of the current state of information technology and programming, which the bachelor will master throughout the duration of the program.

The competency matrix is a tool designed to define the minimum capabilities required of a bachelor’s degree graduate in the 6B06102 – Computer Science program. The structure of the matrix allows for the assessment of the minimal competencies necessary for career growth. This matrix is essential for establishing

future industry standards and can be utilized by companies to evaluate their personnel requirements.

The specialist model in the field of information and communication technologies (ICT) and software development includes:

– Competencies driven by advancements in modern science and technology.

– Competencies dictated by the requirements of the profession and specialization.

– Competencies shaped by the sociopolitical structure of the country and its spiritual and moral system.

– Competencies aimed at implementing the Sustainable Development Goals (SDGs) and ESG principles (environmental, social, and corporate governance), fostering sustainable thinking in students and the ability to integrate environmental and social aspects into the development of digital solutions;

– Developing students' understanding of inclusive culture and the principles of equal access in the context of digital transformation, ensuring technology accessibility for diverse social groups, and creating ethical IT products.

The Computer Science specialist model has historically been represented in various forms, ranging from qualification characteristics to professional profiles.

To acquire a comprehensive set of professional, intercultural, and communication competencies, graduates of the 6B06102 – Computer Science educational program must master the knowledge of a combination of general education (GE), fundamental (FE), and specialized (SE) disciplines. These should encompass both mandatory and elective components in full compliance with state standards.

In the modern world, the ability to navigate the information flow is of critical importance. This includes the skills to identify and systematize diverse sources of information based on specific criteria; apply effective methods for obtaining, transforming, organizing, and storing information; and activate it when needed in intellectual and cognitive activities.

Key skills also include computer literacy, proficiency in modern information and multimedia technologies, and the ability to critically evaluate information.

1 Goals and Objectives of the Educational Program 6B06102 – «Computer Science»

Goal: The goal of the educational program is to provide comprehensive training for IT professionals in the field of computer science to work in industry, business, and government, combined with a solid foundation in machine learning, data science, software development, and principles of sustainable development in the digital environment.

A graduate in Computer Science is expected to be prepared for the following:

– Organizational activities that focus on fostering a professional environment free from negative practices, demonstrating a high level of professional culture, ethical standards, and civic responsibility. Graduates should be capable of applying organizational and managerial skills to optimize workflows and improve the quality of IT-related services and products.

– Continuous self-improvement and lifelong learning, enabling them to acquire and apply new knowledge, skills, and competencies in advanced technologies, innovative methods, and emerging trends. This includes staying updated with global advancements in computer science and integrating them into professional practice.

– Developing advanced competencies for carrying out complex project-based and research-oriented tasks. This involves designing, developing, and implementing software solutions, analyzing large datasets, and creating and maintaining robust information systems and technologies to address real-world challenges.

– Achieving and maintaining competitiveness in the rapidly evolving field of computer science by pursuing professional development, enhancing their qualifications, and mastering cutting-edge tools, technologies, and methodologies. Graduates should be able to adapt to dynamic industry changes and contribute to technological innovation.

– Integration of the principles of sustainable development, ESG (environmental, social, and corporate governance), and digital ethics into the design and implementation of IT solutions, including an awareness of social and environmental responsibility during the digital transformation of industries.

This educational program aims to produce highly skilled, adaptable, and socially responsible IT specialists who can excel in diverse professional settings and drive innovation within the field of computer science.

2 List of Qualifications and Positions

Graduates of the bachelor's degree program in 6B06102 – Computer Science are awarded the academic degree of Bachelor in Information and Communication Technologies. The qualifications and job positions are determined in accordance with the National Qualifications Framework (NQF), approved by the protocol of the Republican Tripartite Commission on Social Partnership and Regulation of Social and Labor Relations on March 16, 2016.

A graduate who has successfully mastered the program is prepared to solve the following professional tasks in accordance with the types of professional activities:

– *Software Development:* Design, develop, and test software applications, systems, and components using modern programming languages and technologies. This includes applying software engineering principles to create scalable, efficient, and reliable solutions.

– *Data Analysis:* Collect, process, and analyze data using statistical and machine learning methods to extract insights and enable data-driven decision-making. This involves applying tools and techniques for big data analysis, visualization, and interpretation.

– *System Administration:* Manage and maintain the functionality of computer systems and networks, ensuring their security, reliability, and optimal performance. This includes configuring hardware, troubleshooting issues, and implementing data protection measures.

– *Web Application Development:* Design and develop interactive web applications and websites using modern web technologies and frameworks. This includes creating user-friendly interfaces and ensuring responsive design.

– *Database Development:* Design and manage relational and non-relational databases, ensuring their integrity, availability, and security. This involves creating efficient data storage solutions and optimizing database performance.

– *Participation in Information Systems Design:* Contribute to the analysis of requirements, design, implementation, integration, and testing of information systems. This includes working on system architecture, ensuring compliance with standards, and supporting system lifecycle processes.

Graduates are equipped to perform these tasks across diverse professional settings, including industrial enterprises, technology companies, research institutions, and government organizations. Their comprehensive training prepares them for roles that require analytical thinking, problem-solving, and effective use of advanced IT tools and methodologies.

Types of Professional Activities

Graduates of the 6B06102 – Computer Science program are qualified to perform the following types of professional activities:

– *Programming and Development:* Engaging in the design, coding, testing, and deployment of software applications and systems using modern programming languages and tools.

– *Analytical Activities:* Conducting data analysis, interpreting results, and providing actionable insights to support decision-making in various domains.

– *System Administration:* Managing, configuring, and maintaining computer systems and networks to ensure their functionality, security, and reliability.

– *Consulting and User Support:* Offering expert advice and technical support to users, addressing software, hardware, and system-related issues.

– *Project Management in Information Technology:* Planning, executing, and overseeing IT projects to ensure they meet objectives within time and budget constraints.

– *Software and Hardware Systems:* Designing, integrating, and maintaining software and hardware solutions for specific applications.

– *Computer Networks and Systems:* Developing, configuring, and managing local and wide-area networks and ensuring their seamless operation.

– *Databases and Data Management Systems:* Designing, implementing, and optimizing database systems, ensuring data integrity, accessibility, and security.

– *Web and Mobile Applications:* Creating and maintaining interactive web and mobile applications, using modern frameworks and technologies.

– *Artificial Intelligence and Machine Learning Systems:* Developing intelligent systems and applying machine learning techniques for predictive modeling, automation, and problem-solving.

These professional activities equip graduates to succeed in diverse roles across industries, leveraging their skills in both theoretical and practical aspects of computer science.

3 Descriptors

Scope of Professional Activities: The professional scope encompasses all sectors of the economy where the development and implementation of information technologies are integral. This includes software development, system administration, data management, network security, web development, data analysis, and machine learning. Graduates can pursue careers in diverse industries such as finance, healthcare, education, manufacturing, telecommunications, and many others where information technologies play a pivotal role.

Objects of Professional Activities: The objects of professional activities include information systems and technologies, such as computer networks, databases, software applications, content management systems, websites, and platforms for software development. Additional objects include devices and technologies for data processing and storage, as well as methods and tools for data analysis and visualization.

Subjects of Professional Activities:

– Software Development and Testing: Designing, coding, and ensuring the quality of software solutions.

– Database Design and Administration: Structuring, managing, and maintaining database systems for efficiency and reliability.

– Web Applications and User Interface Creation: Building interactive web applications and intuitive user interfaces using modern technologies.

– Big Data Analysis and Processing: Employing machine learning methods to analyze and process large datasets for insights and predictive modeling.

– Information Security and Protection: Implementing measures to safeguard data and ensure the security of computer systems.

– Project Management and Software Development Systems: Adopting and integrating systems for efficient project management and software engineering.

– Research and Application of Emerging Technologies: Exploring innovations such as artificial intelligence and cloud computing for practical implementation.

– Computer Network Organization and Support: Setting up, managing, and maintaining robust computer network systems.

– IT Consulting: Providing expert guidance on the effective use of information technologies in various contexts.

This comprehensive scope of activities and objects equips graduates to contribute significantly to advancing technological solutions in their respective fields.

Structure of Bachelor's Degree Program

4 General Competencies

4.1 Socio-Humanitarian Competencies

A graduate of the 6B06102 – Computer Science program must possess a profound understanding of the fundamentals of socio-economic development, including the historical context of Kazakhstan and the foundations of the state language and foreign languages such as Russian, which serve as tools for interethnic communication. It is crucial for graduates to understand their role as citizens, demonstrating a positive attitude toward societal responsibilities, being familiar with national symbols (emblem, flag, anthem), and human rights, and applying this knowledge effectively in various life situations.

Humanism and democracy should form the foundation of their approach to societal development. Graduates must have experience in socially useful activities, maintain an active civic position, strive to enhance democratic institutions, and accept responsibility for their actions. They should appreciate the importance of a healthy lifestyle and physical culture and consciously choose their life path.

A key aspect of their competency is the ability to think critically and articulate the outcomes of their activities clearly in both written and oral forms. Knowledge of etiquette, traditions, and rituals will help graduates interact effectively with others. They should be able to engage in constructive dialogue, resolve conflicts, critically assess themselves and others, and possess skills for public speaking and collaboration with diverse individuals.

Lastly, understanding ethical and legal norms governing relationships between individuals, society, and the environment is an essential part of their professional activities. Graduates must observe and apply these norms in their practice.

4.2 Economic and Organizational-Managerial Competencies

Graduates must have a foundational understanding of industrial relations and management principles, considering technical, financial, and human factors. Familiarity with economic analysis basics and readiness to perform organizational and managerial functions within a team are critical components of their professional readiness.

4.3 General Scientific Competencies

A strong foundation in natural and technical sciences, as the basis for professional education, is achieved through courses such as mathematics, physics, and engineering graphics. General scientific competencies also include information literacy, encompassing the use of modern informational and multimedia technologies. Graduates should be adept at working with large data volumes and utilizing analytical and programming tools like Python and C++.

The ability to navigate information flows entails finding and systematizing sources, as well as employing efficient methods of processing and storing data to solve practical problems.

4.4 General Technical Competencies

In addition, graduates must be proficient in all matters related to land management stages and the creation of land cadastres. These competencies are reinforced through courses such as Information and Communication Technologies, Ecology and Sustainable Development, Life Safety, and Engineering Graphics.

Graduates' professional capabilities must align with the demands of the global labor market. They should be prepared for changes in social, economic, and professional roles and possess geographic and social mobility to adapt to the increasing dynamism and uncertainty of modern environments.

5 Professional Competencies

The goal of the specialized subjects (SS) for the Computer Science program is to master key theoretical aspects of methodologies, techniques, and technologies in software programming and development to address professional challenges in the areas of production-technical, organizational-managerial, and project-research activities.

5.1 Research Activity

Graduates should be capable of conducting research in the field of software development using modern data analysis methods and tools, such as Python and C++. They must be able to diagnose software issues, evaluate the performance of various algorithms, and conduct testing using automated tests. Additionally, graduates need to master working with modern libraries and frameworks to create software solutions, applying methods of machine learning and big data analysis.

5.2 Production-Technical Activity

In their professional activities, graduates must apply project management methods in software development, including the use of Agile and DevOps practices. They should be able to organize and conduct software product testing, including integration and deployment, using modern automation tools. Graduates must be able to process and utilize data using Data Science methods, apply algorithms for analyzing large volumes of information, and use data visualization tools to present the results of their work.

5.3 Organizational-Managerial Activity

Within the scope of organizational and managerial activities, graduates must be able to organize software development processes, manage development teams, and set and monitor workflows in accordance with current and forecasted project tasks. They should be able to prioritize team work, manage risks, and ensure the adherence to quality standards in software development.

5.4 Project-Research Activity

Graduates should be ready to develop project documentation for creating software products, including technical specifications, project diagrams, and testing documentation. They must be able to analyze user requirements, formulate tasks for the development team, and monitor project deadlines.

5.5 Professional Activity Functions

Graduates will perform the following functions in their professional activities: developing and testing software, creating technical documentation and project reports, conducting training and instruction on new technologies and development tools, as well as ensuring compliance with software product quality requirements.

5.6 Typical Tasks of Professional Activity

Graduates should be capable of solving the following typical tasks: developing software solutions in Python and C++, using modern DevOps technologies to automate development and deployment processes, analyzing data using machine learning methods, and ensuring adherence to programming and software development standards.

5.7 Areas of Professional Activity

Professional activity areas include, but are not limited to, software development for various sectors of the economy, project management in IT companies, work in research and educational institutions, and consulting companies specializing in information systems development.

5.8 Content of Professional Activity

The professional activity of a Computer Science graduate is determined by a set of specialized theoretical knowledge and practical skills acquired through training. Graduates should possess in-depth knowledge of algorithms and data structures, programming in Python and C++, and the basics of DevOps. They should be capable of applying methods and tools for data analysis and processing, software solution development, and project management.

Additionally, graduates must be ready to collaborate with teams, demonstrating responsibility and ethical awareness during development. They should possess self-learning skills and a commitment to professional growth, stay up-to-date with modern trends in information technology, and be highly motivated to continuously improve their knowledge and skills.

Thus, the Computer Science program forms highly qualified specialists, ready for successful activities in the rapidly developing field of information technology.

5.9 Requirements for Key Competencies of Bachelor's Graduates in Information and Communication Technologies

1) Have an understanding of:

– Modern trends in information technology and software.
– The principles of operating systems, computer networks, and databases.
– Methods and algorithms for data analysis and machine learning.

– Key concepts of information security and data protection.

– The role of information technology in solving applied tasks across various industries.

2) Know:

– Programming languages (Python, Java, C++) and their application in software development.

– Fundamentals of algorithms, data structures, and object-oriented programming.

– Principles of database design and administration.

– Methods for developing web and mobile applications.

– Basics of information security, including data protection methods.

– Models and methods for big data analysis and machine learning.

3) Be able to:

– Develop and test software products for various platforms.

– Design and manage databases using SQL and other languages.

– Apply data analysis and machine learning methods to solve applied tasks.

– Develop web and mobile applications using modern frameworks.

– Configure and administer operating systems and computer networks.

– Ensure information system security and prevent cyberattacks.

– Work effectively in teams, solve problems, and interact with clients.

4) Have skills in:

– Programming in modern languages and developing algorithms.

– Analyzing and interpreting large datasets using appropriate tools.

– Designing application architecture and developing interfaces.

– Administering computer systems and networks, including security configuration.

– Evaluating software performance and conducting testing.

– Managing IT projects and maintaining software products.

5.10 National Educational Goals and Hierarchy of Goals (by Subject Cycles)

The goal of the Bachelor's program in 6B06102 – Computer Science is to:

– Implement democratic principles in managing the educational process, expanding academic freedom, and enhancing the capabilities of higher education institutions.

– Ensure the adaptation of higher education and research to the evolving needs of society and advancements in scientific thought.

– Ensure the recognition of specialist qualification levels internationally, providing graduates with additional opportunities in the global labor market.

– Ensure higher mobility for graduates in changing labor market conditions, allowing them to adapt to various professional roles and tasks.

The goal of the general education cycle is to provide a social-humanitarian education based on an understanding of the laws of socio-economic development,

the history of Kazakhstan, modern information technologies, state and foreign languages, and Russian as a means of interethnic communication.

The goal of the basic disciplines cycle is to provide in-depth knowledge in natural sciences and general engineering, serving as the foundation for professional education, enabling students to effectively master more complex specialized subjects.

The goal of the specialized disciplines cycle is to study key theoretical aspects of techniques and technologies in the field of computer science to solve professional tasks in the following areas:

– Research activity.
– Production-technical activity.
– Organizational-managerial activity.
– Project-research activity.

5.11 Requirements for Graduate's Level of Education

5.11.1 Requirements for General Education

The main requirement for general education is a comprehensive and high-quality professional education, confirmed by knowledge, skills, competencies, and qualifications in line with the state’s obligatory standards for content and volume.

5.11.2 Requirements for Socio-Ethical Competence

Graduates must possess a humanitarian culture, ethical and legal norms of relations with individuals, society, and the environment, and also develop their critical thinking skills.

5.11.3 Requirements for Economic and Organizational-Managerial Competencies

Graduates must master the basic laws of economic development and factors affecting technical and economic efficiency, as well as knowledge of sociology and psychology in enterprise management, being able to substantiate management decisions both qualitatively and quantitatively.

5.11.4 Requirements for Professional Competence

Graduates must professionally master the knowledge in their field, understand the basics of production relations and management principles considering technical, financial, and human factors. They should also have a system of knowledge in creating and applying modern technologies in their field and related areas, aligned with the chosen educational path and professional activity, to solve programming and software development tasks effectively.

5.11.5 Requirements for Readiness to Adapt to Changes in Social, Economic, and Professional Roles, Geographic and Social Mobility

The professional opportunities of a Bachelor's specialist in modern conditions should meet the demands of the global labor market. The specialist should be ready to adapt to changing social, economic, and professional roles, be geographically and socially mobile in an environment of increasing dynamism and uncertainty.

5.11.6 Requirements for Education in Core Subject Cycles

The educational requirements for core subject cycles are determined by the specific content of the educational program’s curricula. To acquire a full set of professional, intercultural, and communication competencies, the graduate must master the knowledge of general education (GE), basic (BD), and specialized (SD) disciplines as mandatory and elective components, in accordance with their chosen educational trajectory, for a total of at least 240 credits, as established by the current state standard.

6 Expected Learning Outcomes by Year of Study

1st Year of Study

During the first year, the focus is on the formation of personality, ethical standards, and legal foundations of behavior. Students consolidate their understanding of the social and economic development laws of society and the history of Kazakhstan. Proficiency in the state language, foreign languages, and Russian is refined and deepened. Students advance their knowledge of mathematical analysis and natural sciences, while also learning the basics of computer graphics and the logical framework of descriptive geometry, preparing them for more in-depth study of general scientific and technical disciplines.

2nd Year of Study

In the second year, students continue to build the fundamental technical knowledge required for their profession. Information literacy is strengthened, including computer skills and familiarity with modern information and multimedia technologies. Students learn the basics of industrial relations, principles of management, and fundamentals of economic analysis. Skills in programming and software development acquired during this year serve as a foundation for mastering specialized disciplines and advanced development methods. Practical training in workplace settings helps students acquire essential production skills.

3rd Year of Study

The third year focuses on providing in-depth theoretical knowledge of core and specialized disciplines, forming a critical step in professional training. Specialized courses enable students to master modern methods and techniques of software development using advanced technologies and cutting-edge software tools. Practical experience gained during this period helps students understand key production processes and involves collecting and analyzing materials under the supervision of their mentors.

4th Year of Study

The fourth year serves as the culmination of professional training, ensuring graduates meet the demands of modern industries. Through the completion of specialized courses, students are equipped both theoretically and practically to tackle tasks related to software development across various sectors. The year concludes with the preparation and defense of a diploma project, showcasing the knowledge and skills acquired throughout their studies.

CONCLUSION

Thus, in the competency model of a specialist under the Computer Science educational program, the goals of education are linked not only to the acquisition of specific knowledge and skills but also to the formation of integrated requirements for the outcomes of the educational process. This approach encompasses not only technical competencies but also essential attributes such as critical thinking, readiness for self-directed learning, social skills, and teamwork.

In the context of the rapid development of information technologies and their integration into various fields of activity, graduates of the Computer Science program must demonstrate flexibility and adaptability. The competencies of a modern specialist can be viewed through the lens of digital transformation, where they become a key resource for successful professional activity. Market conditions impose new demands on graduates, emphasizing the importance of a systems approach, creativity, teamwork, and self-organization.

Alongside this, special attention is given to the development of sustainable thinking based on ESG principles (environmental, social, and corporate governance), as well as an understanding of the Sustainable Development Goals (SDGs), digital ethics, and inclusive culture. These elements become an integral part of training professionals capable of creating technologies aimed at public good, sustainability, and digital equity.

Therefore, the training of bachelor's degree students in Computer Science not only advances their technical knowledge but also shapes professionals who are prepared to meet the challenges of the modern world, capable of effective collaboration and adaptation in a rapidly changing environment.

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