The program of the entrance exam for applicants to the PhD
for the group of educational programs
D094 – «Information technologies»

1. General provisions.

1. The program was drawn up in accordance with the Order of the Minister of Education and Science of the Republic of Kazakhstan dated October 31, 2018 No. 600 "On Approval of the Model Rules for Admission to Education in Educational Organizations Implementing Educational Programs of Higher and Postgraduate Education" (hereinafter referred to as the Model Rules).

2. The entrance exam for doctoral studies consists of writing an essay, passing a test for readiness for doctoral studies (hereinafter referred to as TRDS), an exam in the profile of a group of educational programs and an interview.

Block	Points
1. Essay	10
2. Test for readiness for doctoral studies	30
3. Exam according to the profile of the group of the educational program	40
4. Interview	20
Total admission score	100/75

3. The duration of the entrance exam is 4 hours, during which the applicant writes an essay, passes a test for readiness for doctoral studies, and answers an electronic examination. The interview is conducted on the basis of the university before the entrance exam.

2. Procedure for the entrance examination.

1. Applicants for doctoral studies in the group of educational programs D094 - «Information technologies» write a problematic / thematic essay. The volume of the essay is at least 250-300 words.

2. The electronic examination card consists of 3 questions.

**Topics for exam preparation according to the profile of the group of
the educational program.**

Discipline «Advanced Algorithms and Data Structures»

Algorithms, their analysis and creation. Function growth rate. Addition and their properties. Divide and Conquer Algorithm. Evaluation of addition. Polynomials and their operations. Relations. Binary relations. Concept of function. Counts. Oriented and non-oriented trees. General description of trees. Binary tree. Combinatorics and probability. The rules of addition and multiplication. Binomial coefficients and their estimation. Probability and its axioms. Concepts of conditional probability and independence. Probability and Bayes formula. Discrete random variables. The mathematical expectation of a random variable. Dispersion and standard deviation. Geometric and binomial distribution. Sorting Algorithms. Quick sorting. The principle of the sorting algorithm. Linear programming and game theory.

Discipline «Technology of Software Development»

The process of software development. Overview of modern software development technologies. Organization of the software development process. Managing project. Identify and reduce risks. Development and support tools. Requirements and software architecture. Requirements analysis. A description of the requirements. Adding detailed requirements. Software architecture. Types of architectures and their models. The design of software systems. Fundamentals of software system design. Features of the software system synthesis process. Features of the design stage. Classical design methods. Testing of the software supply. Principles of software testing. Structural software testing. Functional testing of software. The organization of the process of software testing. Methodology for testing software systems. System testing. Object-oriented software systems. Development of the user interface of various software systems and requirements for interface design. Fundamentals of object-oriented representation of software systems. The basis of the visual modeling language. Static models of object-oriented software systems. Dynamic models of object-oriented software systems. Implementation models for object-oriented software systems. Metrics for object-oriented software systems. Unified development process for object-oriented software systems.

Discipline «Artificial Intelligence»

Neurons and artificial neural networks. Classification of neural networks. Neural network architecture. Types of multilayer neural networks. Feedback networks. Formal neuron. Neuron activation function and its functions. Neural network training. Deep learning methods. Algorithm for training a single-layer neural network. Multilayer neural network. Algorithm for training a multilayer neural network. Learning with and without a teacher. The concept of "Artificial intelligence". Modern research areas in artificial intelligence. Technology for working with expert systems. Control object of an intelligent system. Regression algorithms. Turing test. Basic classification methods.

Discipline «Design and modeling of information systems»

Build a use case diagram that simulates the operation of an ATM, build a state diagram and an activity diagram that simulates the operation of an ATM, build a usecase diagram and an activity diagram that simulate the functioning of an online auction, build a use case diagram and an activity diagram that simulate the operation online testing systems, building a contextual DFD diagram of the "Checkout" process, building a state diagram that simulates the functioning of a scientific social network, building a use case diagram and a state diagram that simulates the functioning of an online

store, building an activity diagram that simulates the functioning of an online store , construction of a use case diagram and a state diagram that simulate the operation of the technical support center information system.

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