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

### I. 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, an exam in the profile of a group of educational programs and an interview.

| Блок | Баллы |
|---|---|
| 1. Interview | 30 |
| 2. Essay | 20 |
| 3. Exam according to the profile of the group of the educational program | 50 |
| Total admission score | 100/75 |

3.The duration of the entrance exam is 3 hours 10 minutes, during which the applicant writes an essay and answers the electronic examination ticket. The interview is conducted at the university premises before the entrance exam.

### II. 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 250words.

The purpose of the essay is to determine the level of analytical and creative abilities, expressed in the ability to build one's own argumentation based on theoretical knowledge, social and personal experience.

Types of essays:
- motivational essay revealing the motivation for research activities;
- scientific-analytical essay justifying the relevance and methodology of the planned research;
- problem/thematic essay reflecting various aspects of scientific knowledge in the subject area.

2. The electronic examination card consists of 3 questions

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

1. Algorithms, their analysis, and creation
2. Function growth rate
3. Graphs
4. Oriented and non-oriented trees
5. General description of trees. Binary tree
6. Combinatorics and probability
7. Binomial coefficients and their estimation
8. Probability and its axioms
9. Concepts of conditional probability and independence
10. Geometric and binomial distribution
11. Sorting Algorithms
12. Linear programming and game theory
13. Neurons and artificial neural networks
14. Classification of neural networks
15. Neural network architecture
16. Types of multilayer neural networks
17. Feedback networks. Formal neuron.
18. Neuron activation function and its functions
19. Neural network training
20. Deep learning methods
21. Algorithm for training a single-layer neural network.
22. Multilayer neural network
23. Algorithm for training a multilayer neural network.
24. Learning with and without a teacher
25. The concept of «Artificial intelligence»
26. Modern research areas in artificial intelligence
27. Technology for working with expert systems.
28. Control object of an intelligent system
29. Regression algorithms
30. Basic classification methods
31. Intelligent control systems as a stage in the development of automated control systems.
32. Problems of intellectualization of IoT devices.
33. The use of IoT devices and artificial intelligence in the future.
34. Control systems in IoT devices: current state and prospects.
35. Artificial intelligence: deterministic and non-deterministic approaches.

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