«APPROVED»

Member of the Board – Vice Rector for Academic Affairs NJC «Al-Farabi KazNU»

_____ Kazmagambetov A.G.

«__» _____ 2025

The program of
the entrance exam for the group of educational programs of the Faculty of Information Technologies for
PhD degree
for foreign citizens to study on a paid basis

1. General Provisions

1.1 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 Regulations for admission to studies in educational organization, implementing educational programs of technical and vocational education» (hereinafter – the Standard Rules).

1.2. In Al-Farabi KazNU for educational programs of postgraduate education (doctoral studies) are admitted persons who have mastered educational programs of postgraduate education. The admission to the doctoral program is allowed to applicants who have a "Master's" degree.

1.3. Entrance examinations according to Annex 2 to the Standard Rules are held **in the format of an interview** for the following groups of educational programs:

- ✓ 8D06101 – Information Systems
- ✓ 8D06102 – Computer Engineering
- ✓ 8D06103 – Computer Science
- ✓ 8D06105 – Systems Engineering
- ✓ 8D06107 – Data Science
- ✓ 8D06301 – Information security systems
- ✓ 8D06114 – Artificial intelligence in medicine
- ✓ 8D07128 – Intelligent control systems
- ✓ 8D07109 – Automation and Internet of Thing

1.4 For the organization and conduct of entrance examinations for admission of a foreign applicant by the decision of the rector of AL-FARABI Kazakh National University is creating an examination committee for the period of examinations.

The commission of entrance examinations for admission of a foreign applicant to KazNU includes employees of the Internationalization and Recruiting Office (hereinafter referred to as the Office) and the professor-teaching staff of KazNU.

1.5 In case a foreign applicant who meets the above requirements has no possibility to come to the University for an Entrance Interview, he has the opportunity to take it online.

1.6 Entrance exam in the form of oral conversation (interview) for admission to a foreign applicant are evaluated on a 100-point system. When enrolling on a paid basis, 75 points are counted.

1.7 Based on the results of the entrance exam, an interview protocol is drawn up in the established form. The interview protocol is signed through the "Salem office" system by the chairman and all present members of the commission and transferred to the DIR.

1.8 The decision on admission is considered by the selection committee for the enrollment of foreign applicants and is formalized in a protocol through the Salem office system. The results of the entrance exam are announced on the day of the exam.

1.9 Retaking the entrance exam is not permitted.

1.10 An appeal against the results of the interview is not considered.

1. Conducting the entrance exam in 2024

2.1 The interview is conducted in Russian, Kazakh and English. The oral interview also contains questions aimed at revealing the ability to learn, creative activity and critical thinking, personal qualities of the applicant.

2.2 An indicative list of interview topics:

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.

2.3 List of recommended literature for preparation:

1. A.N. Kovartsev, A.N. Danilenko. Algorithms and complexity analysis: a textbook. - Samara: Publishing House of Samara University, 2018. - 128 p.

2. Rafgarden Tim. The perfect algorithm. Greedy algorithms and dynamic programming. - St. Petersburg: St. Petersburg, 2020. - 256 p.

3. Selivanova, I. A. Construction and analysis of data processing algorithms: textbook.- the method. stipend. Yekaterinburg: Ural Publishing House. Unita, 2015. - 108 p.

4. Rod Stevens. Algorithms. Theory and practical application. - Moscow: Publishing house "E", 2016. - 544 p.

5. Cormen Thomas H. Algorithms: Construction and analysis / 3rd edition. – St. Petersburg: Dialectics LLC, 2019. – 1328 p.

6. Trevor Hastie, Robert Tibshirani, Jerome Friedman. Elements of statistical learning: data mining, logical inference and forecasting / Springer, 2017. – 737 p.

7. Hal Daume III. Machine learning course / TODO First printing, 2015. -191 p.

8. Lawrence Moroni. Artificial Intelligence and Machine Learning for programmers: A Programmer's Guide to Artificial Intelligence, 1st edition, 2020. – 543 p.

9. Andreas Muller, Sarah Guido. An introduction to machine learning using Python. A guide for data professionals. – O'Reilly. 2016.

10. Sebastian Rashka, Vahid Mirjalili. Machine learning in Python. – Third edition. Packt Publishing House. 2019.

11. Stuart Russell, Peter Norvig. Artificial intelligence: a modern approach. – Fourth edition, 2020.

12. Aurelien Geron. Practical Machine Learning with Scikit-Learn, Keras and TensorFlow: Concepts, Tools and Methods for Building Intelligent Systems, 2nd edition, Madison College Supplies, 2019. – 500c.

13. Place J. Vander. Python for business purposes: data information and machine learning. – St. Petersburg: Peter, 2018.

14. Scholle Francois. Deep learning in python. – St. Petersburg: Peter, 2018.

15. Dale E. Seborg, Thomas F. Edgar, Duncan A. Mellichamp, Francis J. Doyle III. Process Dynamics and Management, 4th edition. John Wiley & Sons, Incorporated, 2016 – 512 p.

16. Foerster, A. Introduction to wireless sensor networks. – New York: Wiley, 2016. – 186 p.

17. Components and services for Internet of Things platforms: Paving the way to Internet of Things standards / Georgios Keramidas, Nikolaos Voros, Michael Huebner. – Berlin: Springer, 2017. – 383 p.

18. The Internet of Things: A practical approach, Arshdeep Bahga and Vijay Madisetti. 2014. 446 p.

19. Greenhard Samuel. The Internet of Things. The future is already here. The Essential Knowledge series from MIT Press. 2021. 296 pages.

20. Introduction to Embedded Systems: An Approach to Cyberphysical Systems, by Edward Ashford Lee and Sanjit Arunkumar Seshia. Second edition. Publishing House of the Massachusetts Institute of Technology. 2016. 568 p.

21. J. Grus, Data Science from Scratch: First Principles with Python, 2nd ed. Sebastopol, CA, USA: O'Reilly Media, 2019.

22. F. Provost and T. Fawcett, Data Science for Business: What You Need to Know About Data Mining and Data-Analytic Thinking, 1st ed. Sebastopol, CA, USA: O'Reilly Media, 2013.

23. T. Hastie, R. Tibshirani, and J. Friedman, The Elements of Statistical Learning: Data Mining, Inference, and Prediction, 2nd ed. New York, NY, USA: Springer, 2009.

24. C. M. Bishop, Pattern Recognition and Machine Learning, New York, NY, USA: Springer, 2006

25. W. McKinney, Python for Data Analysis: Data Wrangling with Pandas, NumPy, and Jupyter, 3rd ed. Sebastopol, CA, USA: O'Reilly Media, 2022.

3. Scale and assessment criteria of the entrance examination for admission to the doctoral program for foreign citizens on a fee-paying basis:

Number of points	Compliance criteria
90–100 points «Excellent»	Demonstrates knowledge of the fundamental processes within the studied subject area; depth and completeness of addressing the issue; logically and sequentially expresses own opinion on the discussed problem; possesses conceptual-categorical framework, scientific terminology; logical coherence of the answer, adherence to the norms of contemporary scientific language.
80–89 points «Good»	Competent use of scientific terminology; mastery of conceptual-categorical framework; problem-oriented presentation of formulated questions; occasional errors in presenting factual material; incompleteness in presenting scientifically established facts within the scope of questions; logical coherence of the answer, adherence to the norms of contemporary scientific language.
75–79 points «Satisfactory»	Insufficient use of scientific terminology; inadequate mastery of conceptual-categorical framework; ability to address only one of the problems formulated in the questions; errors in presenting factual material; superficial knowledge of the subject area; violation of logical coherence in the answer, norms of contemporary scientific language.
0–74 points «Unsatisfactory»	Absence of necessary scientific terminology in the answers; descriptive presentation of discussed issues, inability to identify and present problems; gross errors in presenting factual material; lack of knowledge of historiography of the studied subject area.