Программа вступительного испытания
по предмету **«Теория игр и исследование операций»**
для поступающих на обучение по образовательной программе магистратуры
«Теория игр и исследование операций»
направления подготовки **01.04.02 Прикладная математика и информатика**

Section 1: Content of the theoretical part of the test

1. Complex numbers: definitions and algebraic operations. Trigonometric form of complex numbers.
2. The Gauss method of solving systems of linear equations.
3. Matrices: basic definitions and operations.
4. Definition of the determinant. Determinant: elementary properties.
5. Kronecker-Capelli theorem. General solution of a system of linear equations.
6. Eigenvalues and Eigenvectors of Matrices.
7. Continuous functions. Definition, properties.
8. Derivative of a function. Continuity of a differentiable function.
9. The concept of an indefinite integral. Formula for integration by parts.
10. Degree series. Radius of convergence of a power series.
11. Linear spaces. Basic definitions (linear independence, basis, dimensionality of space, subspace).
12. Definite integral. Riemann sums. Properties of the definite integral.
13. Convexity/concavity of a function. Condition of convexity/concavity of a function.
14. 1st order ordinary differential equations and their solutions.
15. Existence and uniqueness theorem of the solution of the Cauchy problem of the 1st order differential equation (Picard's theorem). Lipschitz condition. Examples.
16. Equations with separable variables. Examples.
17. Ordinary differential equations of n-th order with constant coefficients.
18. Linear dependence and independence of a system of functions.
19. Linear homogeneous equations of n-th order with constant coefficients. Fundamental system of solutions.
20. Linear systems of homogeneous equations. Properties of solutions. Fundamental matrix.
21. Random events. Classical definition of the probability.
22. Conditional probability.
23. Bayes' Formula.
24. Cumulative distribution function and its properties.
25. Probability density function and its properties.
26. The linear programming problem.
27. Duality theorem in linear programming.

Section 2: Organisational and Methodological Section

Structure and content of the admission test

The duration of the admission test

180 minutes (3 hours).

The test is divided into two parts.

1. **Part 1. Research activity.** The candidate presents him/herself in depersonalized form (not allowing his/her identity to be established): *Research activity section is* a summary of the corresponding thesis.
2. **Part 2. Theoretical section.** The candidate answers the two exam questions in writing chosen at random by the selection board (see section 1).

The methodology of the exam

1.The entrance examination is written without the use of any source of information during the examination.

2.When marking a question for maximum marks, the completeness and correctness of the answer, the ability to formulate the answer mathematically accurate and compactly will be taken into account.

3. In case of execution of exam in electronic form using software tools that do not provide the possibility of entering formulas and formatted text, mathematical formulas are recommended to be entered in (La)TeX format

4.A minimum of 35 in all sections is required to pass the examination, with no section being compulsory.

5.If technical or other problems occur in answering the questions in Sections 1 or 2, the questions will be marked 0, but the examination will not be considered failed.

All answers should be in English.

Grading criteria for the entrance test

The final score for the entrance test is calculated by adding the points awarded for each section. The entrance test is scored on a scale of 0 to 100 points.

Part 1. Motivation and research activity

Criterion	Maximum score
Clarity of summary of the corresponding thesis or publications in scientific journals and/or conference proceedings	*15*
Originality of summary of the corresponding thesis or publications in scientific journals and/or conference proceedings	*15*
Review of the literature on your field of research	*15*
Correspondence of the topic and results of previous research with the topic of program	*15*

Total: from 0 to 60 points for this section.

Part 2

The answers to the two questions will be marked separately, from 0 to 20 points each.

Each question will be marked as follows

Quality of the answer	**Number of points**
Completely correct answer	*20*
Minor inaccuracies, typing errors	*15*
Inaccuracies that do not affect the reasoning and presentation	*10*
Inaccuracies that affect the flow of argument or presentation	*5*
Answer showing a lack of understanding of the question and its subject matter	*0*
Answer containing substantive (including mathematical) errors	*0*

Total: 0 to 40 marks for this section.