

**Siberian Federal University**

**Entrance test**

**09.06.01 Informatics and Computer Science**

*Course (module) Title*

**Entrance test for applicants to graduate school**

**09.06.01 Informatics and Computer Science**

*Course (module)*

Krasnoyarsk, 2021

### **Module 05.13.11 "Mathematical and software support for computers, complexes and computer networks"**

1. The concept of an algorithm. Turing machine, normal Markov algorithms, recursive functions. Equivalence of these formal models of algorithms. The concept of algorithmic undecidability.

2. The concept of the complexity of algorithms. Classes P and NP. Polynomial reducibility of problems. Cook's theorem on the NP-completeness of the satisfiability problem for a Boolean formula. Examples of NP-complete problems, approaches to their solution. Exact and approximate combinatorial algorithms.

3. Algebra of logic. Boolean functions, canonical forms of specifying Boolean functions. The concept of a complete system. Post completeness criterion. Minimization of Boolean functions in classes of normal forms.

4. First-order predicate calculus. Interpretation concept. Satisfaction and general validity of a first-order formula. Model concept. A theorem on the completeness of the first-order predicate calculus.

5. Relationships and functions. Equivalence and Partitioning. Set factor. Partial order relationships. Set-theoretic and algebraic definitions of a lattice, their equivalence. Lattice properties. Boolean lattices. Full bars.

6. Formal languages and ways of describing them. Classification of formal grammars. Their use in lexical and syntactic analysis.

### **Module 05.13.05 "Elements and devices of computer technology and control systems"**

1. Digital gates. Synchronous logic gates. Special and multifunctional elements. Logic expanders. Digital switches and keys.

2. Classification of storage devices on the basis of defining characteristics. Random access memory. Static and dynamic memory. Elements of semiconductor read-only memory.

3. Electrically programmable ROM, PROM. Elements of reprogrammable ROM.

4. Elements of memory on CCD structures, cylindrical magnetic domains, flexible and hard magnetic disks. Memory on optical discs.

5. Programmable logic devices: programmable logic matrices, programmable matrix logic, programmable gate matrices, programmable logic sequence controllers,

6. Programmable logic elements, programmable macro logic, programmable logic integrated circuits (FPGA).

**Module 05.13.17 “Theoretical foundations of computer science”**

1. Object-oriented approach in programming.
2. Theoretical basis of creating software systems. The UML programming language.
3. Mathematical logic: propositional calculus; predicate calculus; logical models; formal systems; formal grammars; algorithm theory.
4. Probability theory and mathematical statistics: probabilities, random processes, statistical estimation and hypothesis testing, statistical methods for processing experimental data.
5. Multidimensional statistical analysis.