Denote $\delta^2 - \delta_1^2 = -\omega^2$, $\sqrt{C_1^2 + C_2^2} = A$, $C_1/\sqrt{C_1^2 + C_2^2} = \sin\alpha$, $C_2/\sqrt{C_1^2 + C_2^2} = \cos\alpha$. Then we obtain the general solution (4) in the form:

$$x = Ae^{-\delta t}\sin(\omega t + \alpha). \tag{5}$$

The expression (5) indicates that there are damped oscillations, where ω is the oscillation frequency, $Ae^{-\delta t}$ is the oscillation amplitude, which is equal to A at initial moment of time $(t = 0)$ and it decreases with time.

Therefore, the considered chemical reaction in biological systems goes in an oscillatory mode.

As you can see, one needs to use the knowledge on ecology, biology, chemistry, physics in addition to mathematical knowledge in this research study.

AN ACTIVE LEARNING E-ENVIRONMENT FOR THE COURSE «DISCRETE MATHEMATICS» INTENDED FOR SPECIALTY «SOFTWARE OF INFORMATIONAL TECHNOLOGIES»

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The goal of the course Discrete mathematics for specialty "Software of informational technologies" is to give students all of the mathematical foundations they need for their future studies and an understanding of important mathematical concepts together with a sense of why these concepts are important for applications, to show the practicality of discrete mathematics.

We wanted to design a comprehensive course using web-technologies and Problem Based Learning. We hope that we have achieved these goals. We have created practically oriented, engaging, online learning course with different kinds of student-to-student and student-to-professor interaction via the Internet. We have provided e-support of the course through university data portal including e-versions of lectures, laboratory classes, seminars, home tasks, individual home tasks, tests, projects for quick access to information. We propose two languages of teaching: English and Russian. We hope English variant of the course will give students an opportunity to integrate in European educational and professional areas.

The list of topics under consideration in the course is as follows.

Propositional logic. Propositions. Compound propositions. Conditional statements. Truth tables of compound propositions. Tautologies and contradictions. Logical equivalences. Propositional satisfiability. Satisfiability problem.

Predicates and quantifiers. Predicates. Quantifiers. Quantifiers with restricted domains. Logical equivalences involving quantifiers. Negating quantified expressions. Nested quantifiers.

Valid arguments Rules of inference. Valid arguments in propositional logic Rules of inference. Rules of inference for quantified statements. Using rules of inference to build arguments.

Set Theory. Terminology. Venn diagrams. Set operations. Boolean algebra of sets. Computer representation of sets. The multiplication principle. The addition principle. The pigeonhole principle. The principle of inclusion-exclusion.

Relations. Relations, properties of relations. Equivalence relations. Partial orderings. Hasse diagrams. The topological sorting algorithm.

Combinatorics. Permutations. Combinations. The binomial theorem. Pascal's identity and triangle. Permutations with repetition. Combinations with repetition. Rearrangement theorem.

Solving linear recurrence relations. Linear homogeneous recurrence relations with constant coefficients. Solving linear homogeneous recurrence relations with constant coefficients. Solving linear homogeneous recurrence relations with constant coefficients of degree two and of degree three. Linear nonhomogeneous recurrence relations with constant coefficients. Generating functions. Using generating functions to solve recurrence relations.

Graph theory. Definitions and examples. Paths and cycles. Eulerian paths Hamiltonian cycles. Isomorphism of graphs. Trees. Planar graphs. Rooted trees. Weighted graphs. An algorithm which produces a minimal spanning tree (Prim's algorithm). The shortest-path problem. Dijkstra's algorithm. The travelling salesman problem. The nearest neighbour algorithm. The nearest insertion algorithm.

Boolean functions. Boolean functions. Boolean algebra. Disjunctive normal form. Conjunctive normal form. Functional completeness. Karnaugh maps. Minimization of Boolean functions. Karnaugh maps. Circuits. Minimization of circuits.

Regular languages. Strings and languages. Regular languages and regular expressions. Graph representations for regular expressions.

Group codes. Codes. Generator matrix. Parity check matrix. Groups. Syndrome. Decoding tables. Decoding tables with syndromes.

Turing Machines. Turing machines. Using Turing machines to recognize sets. Computing functions with Turing machines. The Church-Turing thesis.

The list of the topics for dirigible unassisted work: methods of proof (some terminology, direct argument, contrapositive argument, proof by contradiction, mathematical induction); Huffman coding; decoding tables with syndromes.

We also propose a variety of projects in this course to enrich students learning. The list of projects under consideration in the course is as follows.

1. Correctness of algorithms.
2. Knowledge-based systems.
3. Database management systems.
4. Functional programming languages.
5. Efficiency of algorithms.
6. Sorting and searching.
7. Communications networks.
8. Designing a 2-bit adder.

Practice-oriented education through project work in teams concerning different applications of discrete mathematics within a computing context is very useful. This activity provides the opportunity to test theory through practical application, introduces students to the culture of their field, engages them in meaningful relevant work. Such approach enhances the workplace environment by generating new ideas, enriching student learning and development, establishing links between theory and practice. Working at projects students solve the following tasks: determining whether a problem exists; creating an exact statement of the problem; identifying information needed to understand the problem; generating possible solutions; analysing solutions; and presenting a solution, orally or in writing.

We hope that all these features create an active learning environment, improving students abilities of critical thinking, increasing the use of deep approaches, improving the retention of information, and developing students independence and motivation in learning.

We discuss the results of such approach to teaching of the course and emphasize good preparation of graduates to be lifelong learners and creative specialists.

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