**COURSE UNIT (MODULE) DESCRIPTION**

| Course unit (module) title | Code |
|---|---|
| **DISCRETE MATHEMATICS IN COMPUTER SCIENCE** | |

| Academic staff | Core academic unit(s) |
|---|---|
| Assoc. prof. dr. Liepa Bikulčienė | Kaunas Faculty, Institute of Social Sciences and Applied Informatics |

| Study cycle | Type of the course unit |
|---|---|
| First | Mandatory |

| Mode of delivery | Semester or period when it is delivered | Language of instruction |
|---|---|---|
| Auditorium, individual work | 2 | English |

| Requisites | |
|---|---|
| **Prerequisites:** Higher Mathematics, Informatics basic | **Co-requisites (if relevant):** |

| Number of ECTS credits allocated | Student's workload (total) | Contact hours | Individual work |
|---|---|---|---|
| 5 | 130 | 48 | 82 |

| Purpose of the course unit | | |
|---|---|---|
| The aim is to introduce students to discrete mathematics and its applications in computer science. Topics to be covered include a number systems, sets, functions and relations, logic and proof theory, Boolean algebra and logic circuits, mathematical reasoning , combinatorics and discrete probability, graphs and trees and recurrence relations. Applications to computer studies and other related areas will be presented. | | |
| **Learning outcomes of the course unit** | **Teaching and learning methods** | **Assessment methods** |
| Will be able to apply concepts and methods of discrete mathematics in computer science studies and knowledge of formal logic, set and graph theory, solving applied problems. | Lectures, exercises, individual work practical tasks | Exam, tests, presentation, individual work presentation, control work |

| Content | Contact hours | | | | | | | Individual work: time and assignments | |
|---|---|---|---|---|---|---|---|---|---|
| | Lectures | Tutorials | Seminars | Workshops | Laboratory work | Internship | **Contact hours, total** | **Individual work** | **Tasks for individual work** |
| **Formal logic** Logical propositions. Predicates and quantifiers. Logical operators and formulation of conclusions. Evidence methods. Induction. Recursion. | 2 | | | 4 | | | **6** | **12** | Preparation of practical works |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Binary relationships**. Binary functions. Boolean algebra. | 2 | | | 4 | | | **6** | **12** | Preparation of practical works |
| **Elements of set theory**. The concept of a set and the paradoxes of set theory. Properties of operations on sets. Venn diagrams. | 2 | | | 4 | | | **6** | **10** | Preparation of practical works and preparation for control work |
| **Graphs, networks and trees**<br>Graphs and trees. Search trees. Routes, circuits, cycles.<br>Networks. Shortest path algorithm. | 3 | | | 5 | | | **8** | **12** | Individual work<br>Preparation of practical works |
| **Functions and relationships**<br>Representing relationships and functions on a computer. Relationships and databases. | 2 | | | 4 | | | **6** | **10** | Preparation of practical works |
| **Coding**. Coding task. Verbal coding. Interference-insensitive coding. Data compression. Lempel-Ziv algorithm. Data encryption. Symmetric encryption. Public key encryption. Digital signature. Theory of algorithms. Formalization of problems and decision-making. | 3 | | | 5 | | | **8** | **16** | Preparation of practical works and preparation for control work |
| **Theory of algorithms**. Formalization of problems and decision-making.<br>The essence of algorithmization. Turing machine. Markov algorithm. Complexity of algorithms. Search and sorting algorithms. | 2 | | | 4 | | | **6** | **16** | Preparation of practical works |
| Consultation of the exam. | | 1 | | 4 | | | **1** | | Preparation for exam |
| Exam | | | 1 | | | | **1** | **16** | |
| **Total** | **16** | 1 | 1 | **30** | | | **48** | **82** | |

| **Assessment strategy** | **Weight %** | **Deadline** | **Assessment criteria** |
|---|---|---|---|
| Individual work - IN | 15% | During the semester | Self-study and test preparation tasks (7 in total) are solved using software. Each task is evaluated proportionally according to the amount of work done and correct answers. |
| Test - T | 25% | During the semester (5-6 week) | The test consists of open-ended and closed-ended questions and tasks of varying difficulty (ranging from comprehension to evaluation), each valued at one point. It is evaluated on a scale of 1-10 grades. |
| Control work - CW | 25% | During the semester (7-8 week) | The test consists of tasks of different difficulty (of different difficulty, from understanding to evaluation). Tasks are performed using MathCad software equipment. It is evaluated on a scale of 1-10 grades. |
| Presentation - P | 10% | During the semester | Work is done in groups, presentations on different topics. Quality, scope, quality of delivery and answers to questions are evaluated. |
| Exam - E | 25% | Durring the sesion | The exam consists of open-ended and closed-ended questions and tasks of varying difficulty (ranging from comprehension to evaluation), each valued at one point. It is evaluated on a scale of 1-10 grades. |
| **Final grade = IN*0,15+T*0,25+CW*0,25+P*0,1+E*0,25** | | | |
| *The use of artificial intelligence (AI) generative model must be disclosed, therefore, if an AI generative model was used in the report, it must be clearly indicated (respectively by citing and/or submitting a declaration of the use of AI generative model). Failure to disclose the use of the AI generative model in academic work is considered academic dishonesty.* | | | |
| **In case of external studies: Final grade = T*0,3+CW*0,3+E*0,4** | | | |
| A student who (1) **throughout the semester consistently** fails to demonstrate **progress in achieving the expected learning outcomes of a subject (module)** during the practical classes (seminars, exercises, laboratory work, etc.) and (2) fails to complete all interim assessment requirements and tasks within the time specified in the course description, is not allowed to participate in the examination session | | | |

| Author (-s) | Publishing year | Title | Issue of a periodical or volume of a publication | Publishing house or web link |
|---|---|---|---|---|
| **Required reading** | | | | |
| Plukas K., Mačikėnas E. ir kt.. | 2014 | Taikomoji diskrečioji matematika | | Kaunas: Technologija |
| Oscar Levin | 2023 | Discrete Mathematics: An Open Introduction | | https://discrete.openmathbooks.org/pdfs/dmoi3-tablet.pdf |
| Kenneth H. Rosen | 2012 | Discrete mathematics and its applications | | Published McGraw-Hill |
| Sussana S. Epp | 2018 | Discrete mathematics with applications, 5 th edition | | https://digilib.stekom.ac.id/assets/dokumen/ebook/feb_ffa40f116d4322d430e4d4ff287f156f5b2aff8c_1659617647.pdf |
| **Recommended reading** | | | | |
| N. Listopadskis, R.Markauskas | 2014 | Matematinė logika, I d. Teiginių logika | | Kaunas: Technologija |
| Plukas K.. | 2001 | Skaitiniai metodai ir algoritmai/ | | |
| vadovėlis | | Kaunas: Naujasis lankas | | |
| Valdas Dičiūnas Gintaras Skersys | 2003 | Diskrečioji matematika | | VU leidykla |
| N. Listopadskis, R.Markauskas | 2014 | Matematinė logika, I d. Teiginių logika | | Kaunas: Technologija |