MODULE DESCRIPTION

Module title	Module code
Combinatorics and graph theory	

Lecturer(s)	Department where the module is delivered
Coordinator: dr. Gintaras Skersys **Other lecturers:**	Department of Computer Science Faculty of Mathematics and Informatics Vilnius University

Cycle	Type of the module
First	Optional

Mode of delivery	Semester or period when the module is delivered	Language of instruction
Face-to-face	5, 7 semester	Lithuanian

Prerequisites
Prerequisites: Discrete mathematics

Number of credits allocated	Student's workload	Contact hours	Self-study hours
5	130	72	58

Purpose of the module: programme competences to be developed

Purpose of the module – provide basic combinatorics and graph theory knowledge which will help to study other mathematical and computer science subjects and to read mathematical and computer science literature. It also aims to develop analytical thinking and basic skills needed to independently construct discrete models of the reality and to apply the acquired knowledge in solving practical problems.

Specific competences:

- Knowledge and skills of underlying conceptual basis *(SK4).*

Learning outcomes of the module: students will be able to	Teaching and learning methods	Assessment methods
To define principal combinatorics and graph theory concepts, to illustrate them by examples.	Lecture Practice classes Individual reading Problem solving	Test (written) Exam (written)
Formulate and prove principal combinatorics and graph theory statements.		
Apply combinatorics and graph theory methods to construct discrete models and to solve practical problems related to them.		

Content: breakdown of the topics	Contact hours							Self-study work: time and assignments	
	Lectures	Tutorials	Seminars	Practice	Laboratory work (LW)	*Tutorial during LW*	**Contact hours**	**Self-study hours**	**Assignments**
1. Arrangements and combinations. Binomial and polynomial coefficients.	5			4			**9**	**8**	Individual reading Problem solving
2. Inclusion-exclusion principle. Examples.	3			4			**7**	**7**	
3. Stirling numbers.	3			2			**5**	**4**	
4. Generating functions. Recurrence.	5			6			**11**	**10**	
5. Basic concepts of graph theory.	4			4			**8**	**7**	
6. Forest and trees. Spanning trees. Minimum spanning trees.	3			4			**7**	**6**	
7. Relations of graph parameters.	2			2			**4**	**4**	
8. Planar graphs. Euler‘s theorem.	2			2			**4**	**4**	
9. Colouring of graphs.	2			2			**4**	**4**	
10. Number of trees. The Prüfer code of a tree.	3			2			**5**	**4**	
Test		2					**4**		2 hours for tutorial, 2 hours for test.
Exam		2					**4**		2 hours for tutorial, 2 hours for exam.
Total	**32**	**4**		**32**			**72**	**58**	

Assessment strategy	Weight %	Deadline	Assessment criteria
Test (written)	50	During the semester	Test and exam consist of tasks of diverse difficulty (theory questions and exercises). Each task is assessed as follows: 100% – excellent knowledge and abilities; 75% – strong knowledge and abilities; 50% – mediocre knowledge and abilities; 25% – minimal knowledge and abilities; 0% – minimal requirements are not satisfied.
Exam (written)	50	Exam session	

Author	Publishing year	Title	Number or volume	Publisher or URL
Required reading				
M. Bloznelis	1996	Combinatorics lectures (in Lithuanian)		Vilnius: Vilnius university press
E. Manstavičius	2006	Discreet mathematics: basics of combinatorics and graph theory. Lecture notes (in Lithuanian)		http://www.mif.vu.lt/katedros/ttsk/bylos/man/files/KOMB-21.pdf
Recommended reading				
Rosen K.H.	2010	Discrete Mathematics and Its Applications, Sixth Edition		McGraw-Hill Higher Education
Wilson R.J.	1996	Introduction to Graph Theory, Fourth edition		Longman
P.J. Cameron	1994	Combinatorics: Topics, Techniques, Algorithms		Cambridge University Press