Discrete Mathematics

Course Description

Basic Information

Field of Study : Analytical Computer Science

Path : -

Organizational Unit : Faculty of Mathematics and Computer Science

Education Level : first-cycle studies

Form of Studies : full-time studies

Study Profile : general academic

Obligatory Status : mandatory

Education Cycle : 2022/23

Course Code : UJ.WMIIANS.120.01914.22

Languages of Instruction : Polish

Course Related to Scientific Research : Yes

Disciplines : Computer Science, Mathematics

ISCED Classification : 0541 Mathematics, 0613 Software and applications development and analysis

USOS Code : WMI.TCS.MD.OL

Course Coordinator

Tomasz Krawczyk

Course Instructor

Tomasz Krawczyk

Period Semester 2	Form of verification of learning outcomes exam Form of instruction and hours lecture: 45 tutorials: 45	Number of ECTS credits 8.0

Learning Outcomes for the Course

Code	Effects in terms of	Field-specific learning outcomes	Verification methods
Knowledge – The student knows and understands:			
W1	knows and understands the most important concepts and theorems in combinatorics and graph theory, especially those listed in the Syllabus Content field.	IAN_K1_W02	graded credit, written/oral exam
Skills – The student can:			
U1	define basic concepts of discrete mathematics and illustrate them with simple examples. Can formulate the most important theorems of discrete mathematics and illustrate them with simple examples. Can present mathematical reasoning in an understandable way. Can use combinatorial structures in formulating and solving computer science problems. Can solve a simple combinatorial problem and present the solution orally and in writing. Can present the topics discussed in class and formulate questions to better understand the subject.	IAN_K1_U01, IAN_K1_U02, IAN_K1_U21, IAN_K1_U22	graded credit, written/oral exam
Social competences – The student is ready to:			
K1	approach with appropriate reservation opinions and statements that have not been sufficiently justified.	IAN_K1_K01	graded credit

ECTS Credit Balance

Student activity form	Average number of hours* dedicated to completed activity types
lecture	45
tutorials	45
preparation for tutorials	105
exam preparation	43
participation in exam	2

Total student workload	Number of hours 240	ECTS 8.0

* hour (lesson) means 45 minutes

Program Content

No.	Program Content	Learning outcomes for the course
1.	1. Induction, recursion. 2. Counting: binomial coefficients, Stirling numbers, Bell numbers, Catalan numbers, and others. 3. Generating functions. Solving recurrence relations. 4. Partial orders. Dilworth's theorem. 5. Sperner families, Erdos-Ko-Rado theorem. 6. Ramsey's theorem. 7. Flow networks. 8. Graph theory: * trees, cycles, * bipartite graphs, matchings, * k-connectivity, Menger's theorem, * graph coloring, Brooks' theorem, * planar graphs, geometric intersection graphs, * relationships between coloring number, chromatic number, list chromatic number, and other graph parameters.	W1, U1, K1

Extended Information

Teaching Methods:

conventional lecture, problem solving, subject tutorials

Type of classes	Forms of credit	Course completion conditions
lecture	written/oral exam	positive grade on the exam, preceded by admission to it based on a positive grade from tutorials
tutorials	graded credit	activity in class, solving homework assignments

Prerequisites and Additional Requirements

completed courses in Formal Methods in Computer Science and Algebraic Methods in Computer Science

Literature

Required

1. V.Bryant, "Aspekty kombinatoryki", Wydawnictwa Naukowo-Techniczne 1977.
2. R.L.Graham, D.E.Knuth, O.Patashnik, "Matematyka Konkretna", Państwowe Wydawnictwo Naukowe, Warszawa 1996.
3. W.Lipski, "Kombinatoryka dla programistów", Wydawnictwa Naukowo-Techniczne 2004.
4. K.A.Ross, Ch.R.B.Wright, "Matematyka Dyskretna", Państwowe Wydawnictwo Naukowe, Warszawa 1996.

5. Z.Palka, A.Ruciński, "Wykłady z kombinatoryki", Wydawnictwa Naukowo-Techniczne, Warszawa 1998.
6. R.J.Wilson, "Wprowadzenie do teorii grafów", Państwowe Wydawnictwo Naukowe, Warszawa 1985.