

SYLLABUS
Fall semester 2023-2024 academic year
Educational program “6B06107 - Data Science”

ID and name of course	Independent work of the student (IWS)	Number of credits			General number of credits	Independent work of the student under the guidance of a teacher (IWST)
		Lectures (L)	Practical classes (PC)	Lab. classes (LC)		
101215 Mathematics-2 (Algebra and Discrete mathematics)	17	3	3	0	6	17
ACADEMIC INFORMATION ABOUT THE COURSE						
Learning Format	Cycle, component	Lecture types	Types of practical classes	Form and platform final control		
<i>Offline</i>	base	Problematic, analytical	Problematic, problem solving	Oral		
Lecturer - (s)	Sautbekova Merey, senior-lecturer					
e-mail :	merey.sautbekova@gmail.com					
Phone :	+77013095464					
Assistant - (s)	-					
e-mail :	-					
Phone :	-					
ACADEMIC COURSE PRESENTATION						
Purpose of the course	Expected Learning Outcomes (LO) *			Indicators of LO achievement (ID)		
	Describe what is the result of studying the course the student will be able to:			As a result of studying the discipline, the student will be able to:		
	LO 1. Explain the meaning of the basic concepts and theorems of discrete mathematics and mathematical logic based on the means of proof.			ID 1.1 Understand the basic definitions and theorems of discrete mathematics and mathematical logic.		
				ID 1.2 Ability to use definitions and theorems in calculations		
	LO 2. Using the basic definitions and formulas of discrete mathematics, generating model problems of set theory and binary relations			ID 2.1 Consider different ways of proving set equilibria		
				ID 2.2 Examination of special properties of binary relations		
				ID 2.3 Understand and apply the relationship between binary relations and partitioning of sets		
	LO 3. Compilation of combinatorics sample problems			ID 3.1 Ability to use addition and multiplication rules		
				ID 3.2 Using the input-output formula		
				ID 3.3 Use layout and typing in solving the math.problem		
	LO 4. Ability to use the basic tools of number theory			ID 4.1 1 Finding the general solution of the recurrence equation		
				ID 4.2 Find the generating function of the chain and implement the reverse transition.		

		<p>ID 4.3 Ability to use the method of mathematical induction.</p> <p>ID 4.4 Study the properties of Fibonacci numbers</p> <p>ID 4.5 Investigate the properties of multiplicative functions and find a general solution to the Diophantine equation.</p> <p>ID 4.6 Test binary relations for specific properties.</p>
	<p>LO 5. To be able to apply operations to graphs based on the basis of graph theory, to find metric characteristics of graphs and to be able to use graph theory to solve some applied problems effectively.</p>	<p>ID 5.1 Find the intersection, union and composition of graphs</p> <p>ID 5.2 Finding matrices corresponding to graphs</p> <p>ID 5.3 Finding metric properties of graphs</p> <p>ID 5.4 Checking graphs for isomorphism</p> <p>ID 5.5 Checking graphs for Eulerianness. Coloring graphs.</p>
	<p>LO 6. Based on the elements of algebraic logic, construct SKNF, SDNF and Zhegalkin polynomials of functions of algebraic logic.</p>	<p>ID 6.1 Be able to construct truth tables.</p> <p>ID 6.2 Build SCNF and SDNF functions.</p> <p>ID 6.3 Find Zhegalkin polynomials.</p>
Prerequisites	Fundamentals of Algebra, Linear Algebra	
Postrequisites	Mathematical logic	
Learning Resources	<p>Literature: main, additional.</p> <ol style="list-style-type: none"> 1. Kostrikin A., Manin Yu., Linear Algebra and Geometry, Gordon and Breach Science Publishers, 1986. 2. Sets, Functions and Logic – an introduction to abstract mathematics, 3rd edition, Keith Devlin, 2004 3. Introduction to mathematical logic, 4th edition, Elliott Mendelson, 1992. 4. Фадеев Д.К., Соминский И.С. Сборник задач по высшей алгебре. – М.: Наука, 1982. 5. Сборник задач по алгебре. Под редакцией А.И. Кострикина. – М.: Физматгиз, 2002. Изд. 3е, испр. и доп. 6. E-sources: 7. https://byjus.com/maths/mathematical-logic/ 8. https://www.tutorialspoint.com/discrete_mathematics/discrete_mathematics_propositional_logic.htm 	

Academic course policy	<p>The academic policy of the course is determined by <u>the Academic Policy and the Policy of Academic Integrity of Al-Farabi Kazakh National University</u>. Documents are available on the main page of IS Univer .</p> <p>Integration of science and education. The research work of students, undergraduates and doctoral students is a deepening of the educational process. It is organized directly at the departments, laboratories, scientific and design departments of the university, in student scientific and technical associations. Independent work of students at all levels of education is aimed at developing research skills and competencies based on obtaining new knowledge using modern research and information technologies. A research university teacher integrates the results of scientific activities into the topics of lectures and seminars (practical) classes, laboratory classes and into the tasks of the IWST, IWS, which are reflected in the syllabus and are responsible for the relevance of the topics of training sessions and assignments.</p> <p>Attendance. The deadline for each task is indicated in the calendar (schedule) for the implementation of the content of the course. Failure to meet deadlines results in loss of points.</p> <p>Academic honesty. Practical/laboratory classes, IWS develop the student's independence, critical thinking, and creativity. Plagiarism, forgery, the use of cheat sheets, cheating at all stages of completing tasks are unacceptable.</p> <p>Compliance with academic honesty during the period of theoretical training and at exams, in addition to the main policies, is regulated by <u>the "Rules for the final control" , "Instructions for the final control of the autumn / spring semester of the current academic year" , "Regulations on checking students' text documents for borrowings"</u>. Documents are available on the main page of IS Univer .</p> <p>Basic principles of inclusive education. The educational environment of the university is conceived as a safe place where there is always support and equal attitude from the teacher to all students and students to each other, regardless of gender, race / ethnicity, religious beliefs, socio-economic status, physical health of the student, etc. All people need the support and friendship of peers and fellow students. For all students, progress is more about what they can do than what they can't. Diversity enhances all aspects of life. All students, especially those with disabilities, can receive counseling assistance by phone / e- mail merey_sautbekova@gmail.com or via video link Zoom.</p> <p>Integration MOOC (massive open online course). In the case of integrating MOOC into the course, all students need to register for MOOC. The deadlines for passing MOOC modules must be strictly observed in accordance with the course study schedule.</p>
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ATTENTION! The deadline for each task is indicated in the calendar (schedule) for the implementation of the content of the course, as well as in the MOOC. Failure to meet deadlines results in loss of points.

INFORMATION ABOUT TEACHING, LEARNING AND ASSESSMENT			
Score-rating letter system of assessment of accounting for educational achievements			Assessment Methods
Grade	Digital equivalent points	points, % content	Assessment according to the traditional system
A	4.0 _	95-100	Great
A-	3.67	90-94	
B+	3.33	85-89	Fine
B	3.0	80-84	
B-	2.67	75-79	
Formative and summative assessment			Points

Criteria-based assessment is the process of correlating actual learning outcomes with expected learning outcomes based on clearly defined criteria. Based on formative and summative assessment.

Formative assessment is a type of assessment that is carried out in the course of daily learning activities. It is the current measure of progress. Provides an operational relationship between the student and the teacher. It allows you to determine the capabilities of the student, identify difficulties, help achieve the best results, timely correct the educational process for the teacher. The performance of tasks, the activity of work in the classroom during lectures, seminars, practical exercises (discussions, quizzes, debates, round tables, laboratory work, etc.) are evaluated. Acquired knowledge and competencies are assessed.

Summative assessment - type of assessment, which is carried out upon completion of the study of the section in accordance with the program of the course. Conducted 3-4 times per semester when performing IWS. This is the assessment of mastering the expected learning outcomes in relation to the descriptors. Allows you to determine and fix the level of mastering the course for a certain period. Learning outcomes are evaluated.

C+	2.33	70-74		Work in practical classes	18
C	2.0	65-69	Satisfactorily	Independent work	42
C-	1.67	60-64			
D+	1.33	55-59	Unsatisfactory	Final control (exam)	40
D	1.0	50-54		TOTAL	100

Calendar (schedule) for the implementation of the content of the course. Methods of teaching and learning.

A week	Topic name	ID Number	Max. of hours ball	LO			
MODULE 1. Sets. Relations and functions.							
1	L 1. Sets and basic operations on them. Power of the set. Finite and infinite sets.			LO1	ID1	2	2
	PC 1. Proving equilibria in set theory. Applying operations to sets.			LO3	ID1	2	5
2	L 2. Relations. Actions applied to relations. Special binary relations. Ordinal relations. Equivalence relation. Separation theorem.			LO1	ID1 ID2	2	2
	PC 2. Applying operations to binary relations. Study of equivalence relations.			LO3	ID7	2	5
3	L 3. Counting rules. Dirichlet's rule. Input and output formula. Substitutions. Layouts and dials.			LO1	ID1	2	2
	SW1. Ability to use addition and multiplication rules. Using the input-output formula.			LO3	ID2 ID3	2	5
	IWS1. Acceptance of control work on the topic "Application of operations to sets and relations".			LO3	ID1 ID2	1	30
MODULE 2. Elements of Number theory.							
4	L 4. Dirichlet's principle. Principles of counting. Inclusion-exclusion formula. Placements and combinations.			LO1	ID1 ID2	2	2
	PC 4. Apply counting principles. Apply the inclusion-exclusion formula.			LO4	ID10 ID11	2	5
5	L 5. Number of injections, surjections and bijections on finite sets. Method of mathematical induction. Fibonacci numbers. Recurrent relations. Generating functions and their properties.			LO1	ID1 ID2	2	2
	PC 5. Apply placements and combinations to solve problems. Apply the method of mathematical induction. Explore the properties of Fibonacci numbers.			LO4 LO5	ID12 ID13	2	5
	IWS5. Consultation on the implementation of IWS 3				ID10 ID13 ID14		
6	L 6. Simple properties of divisibility. Integers modulo comparable. Chinese remainder theorem.			LO1	ID1	2	
	PC 6. Find a general solution to recurrent equations. Find generating functions. Solve systems of equations with comparisons.			LO5	ID14 ID15	2	
	IWS6. Taking a quiz on the topics: "Principles of Accounting. Inclusionexclusion formula. Mathematical induction". "Multiplicative functions. Fibonacci numbers. Recurrent relations."			LO5	ID14 ID15	1	30
7	L7. Multiplicative functions. Euler's and Fermat's theorems.			LO1	ID1	2	2

	PC 7. Explore the properties of multiplicative functions. Continued fractions. Solving equations in integers.	LO5	ID16	2	5
Module 3					
Basics of graph theory.					
8	L.8 Basic concepts of graph theory. Metric characteristics of graphs.	LO1	ID1 ID2	1	
	PC 8. Chain parts. Solving equations in whole numbers.	LO4	ID10 ID11	2	4
9	L.9 Degrees of graphs' roofs. Operations on graphs.	LO1	ID1 ID2	1	
	PC 9. Study of metric characteristics of graphs.	LO4 LO5	ID12 ID13	2	4
10	L. 10 Internal graphs. Cycles. Bound graphs. Trees.	LO1	ID1 ID2	1	
	PC 10. Proof of isomorphism of graphs. Applying operations to graphs.	LO4	ID10 ID11	2	4
	IWST 5. Consultation on the implementation of IWST	LO1	ID1 ID2		
11	L.11 Matrices corresponding to graphs.	LO4 LO5	ID12 ID13	1	24
	PC 11. Acceptance of control work on the topic "Research of graphs".	LO1	ID1 ID2	1	
12	L.12 Planar graphs. Coloring graphs. Eulerian graphs.	LO1	ID1	2	2
	PC 12. Checking graphs for connectedness, planarity, Eulerianness. Coloring graphs.	LO5	ID16	2	5
MODULE 4. Logic Algebra					
13	L 13. Logic algebra functions. Basic equivalences. SKNF and SDNF.	LO1	ID1 ID2	2	2
	PC 13. Construct truth tables. Check whether the function preserves 0 and 1. Find SCNF and SDNF.	LO6	ID16 ID17	2	5
	IWST 6. Consultation on the implementation of IWST 4.				
14	L 14. Basic equivalences. SKNF and SDNF. ns.	LO1	ID1 ID2	2	
	PC 14. finding the SKNF and SDNF.	LO6	ID18 ID19	2	5
		LO6	ID16 ID17 ID18	1	30
15	L 15 Zhegalkin polynomials. Closed classes. Examples. Duality. Self-dual functions	LO1	ID1 ID2	2	
	IWST 7. Finding the Zhegalkin polynomial in different ways. Check a function for self-duality.	LO6	ID17 ID18	2	
		Midterm control 2			60
		Final control (exam)			40
		TOTAL for course			100

Dean _____ U. S. Abdybekov

Lecturer _____ M. Sautbekova

