

Syllabus
Academic Year 2024-2025

1. General Information	
Course title	DM 1205
Degree cycle (level)/major	Discrete Mathematics
Year, term	1st year, 3rd term
Number of credits	5
Language of delivery:	English
Prerequisites	Pre-calculus, Elementary mathematics
Postrequisites	Theory of Probability and Statistics, Algorithms and Data structures, Advanced programming.
Lecturer(s)	Adilet DUMAN, Senior-lecturer, adilet.duman@astanait.edu.kz, Astana IT University, Expo, C1 block, 3rd floor, office C1.1.336
2. Goals, Objectives and Learning Outcomes of the Course	
1. Course Description	The course includes logics, set theory, functions, and fundamental principles of counting, number theory, inclusion-exclusion principle, recurrence relations, graph theory.
2. Course Goal(s)	Course goal is to familiarize students with an initial base in mathematics such as sets, basic of combinatorics and graph theory. The main goal is to be able to apply above-mentioned tools to problems in postrequisites courses.
3. Course Objectives:	Course objectives include: <ul style="list-style-type: none">- To demonstrate knowledge of mathematical knowledge;- To understand basic mathematical principles (proving, counting, understanding discrete objects);- To solve counting problems using different enumeration methods;- To apply basic techniques involving discrete objects such as sets, functions, graphs and mathematical expressions in discrete mathematics;- To develop mathematical abilities in writing programs by computers.
4. Skills & Competences	<ul style="list-style-type: none">- Basic school mathematical knowledge;- Ability to construct examples and counterexamples
5. Course Learning Outcomes:	By the end of this course the students will be able to: <ul style="list-style-type: none">- Know basic mathematical concepts;- Learn main proof techniques of mathematics;- Be familiar with important discrete objects;- Understand counting principles of combinatorics;

	<ul style="list-style-type: none"> - Be able to transform discrete problems into simple forms; - Describe programming questions in terms of graphs and trees.
6. Methods of Assessment	<p>- Homework assignments: Each student is required to complete and submit two homework assignments during the academic trimester, one for the 1st attestation and another for the 2nd attestation. Students must solve the problems provided by the instructor, record the entire process on video, and upload the video to the designated section in Moodle.</p> <p>- Classwork assignments (worksheets) Each student is required to complete classroom assignments provided by the instructor twice during the trimester, once for the 1st attestation and once for the 2nd attestation. As part of the assignment, students must solve the problems on the whiteboard and explain their solutions to the rest of the class.</p> <p>- Quizzes Quizzes will consist of paper-based multiple-choice questions and will last 30 minutes. Two quizzes are planned for each attestation during the trimester.</p> <p>- Lecture quizzes Lecture quizzes consist of computer-based multiple-choice questions and are planned to take 3–10 minutes after each lecture. In each attestation there are going to be 4 lecture quizzes, in total 8 of them.</p> <p>- Midterm, Endterm and Final exams These exams will consist of open-ended questions and will last between 50 and 80 minutes. During the exams, students are required to demonstrate their full problem-solving and proof capabilities. Solutions must be presented step by step, completely, and with academic accuracy.</p>
7. Reading List	<p>1. Lecture presentations.</p> <p>Main textbooks:</p> <p>2. Discrete Mathematics with Graph Theory by Edgar Goodaire and Michael Parmenter is the 3rd edition, published in 2023</p> <p>3. Kenneth H. Rosen. Discrete Mathematics and Its Applications (seventh edition);</p> <p>Additional textbooks:</p> <p>4. Ralph P. Grimaldi. Discrete and Combinatorial Mathematics (fifth edition);</p> <p>5. Susanna S. Epp, Discrete Mathematics with Applications, 4th edition (International Edition), Brooks Cole, ISBN: 978-0-495-82616-3.</p>
1. Resources	<p>1. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-042j-mathematics-for-computer-science-fall-2010/</p> <p>2. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-042j-mathematics-for-computer-science-spring-2015/index.htm</p>
2. Course policy	Course and University policies include:

Attendance: Students are expected to attend all scheduled in-person class sessions with all required reading and supplementary materials. Readings are to be completed prior to class.

The student won't obtain additional points for course attendance, but the attendance is important to pass the course. **If a student plans to miss class for any reason, this must be reported and the instructor's permission obtained in advance.** In case the student is not able to attend the online/in-person classes for some reasons, he/she must inform the dean's office in advance and the student itself is responsible for learning all materials, which were given during unattended lessons.

In case if **the student did not attend more than 30% of the classes** without any reasonable excuses, the teacher has a right to mark him as "not graded", and the student wouldn't be admitted to the exam. In other words, students must participate in at least 70% of all online/in person class time, otherwise he/she fails the course.

Office hours: There will be two online-office hours held on every Monday between 12:10-13:00 (Time can be updated due to the availability of the instructors, and will be published on the moodle). This is a time when I am guaranteed to be online and at my office and ready to answer questions about the course. Please do not hesitate to make use of it. You can also email me to set up an online/in person appointment if you have an unavoidable scheduling conflict.

Preparation for Class: Class participation is a very important part of the learning process in this course. Although not explicitly grade, students will be evaluated on the QUALITY of their contributions and insights. Quality comments possess one or more of the following properties:

- Offers a different and unique, but relevant, perspective;
- Contributes to moving the discussion and analysis forward;
- Builds on other comments.

Procedure for preparing for class:

1. The student must first look at what is uploaded on the site.
2. If a student has a lecture first, then practice. The student should then come to the lecture prepared and listen to the lecture in detail. And then solve the problems that are loaded into the moodle, and come to the practical lesson to make sure the decisions are correct.
3. If a student has practice first and then lecture. Then the student should, after watching the online lecture on the learn astanait website, then try to independently solve the problems that are uploaded on the moodle and come to the

practical lesson to verify the correctness of the problem.

Afterwards, the student must attend the lecture and listen carefully to understand the essence of the topic.

In general, learning method includes active learning and some components of flipped classroom.

In person classwork: The duration of each lecture and practical lesson is 50 minutes.

Students are expected to complete all readings and assignments ahead of time, attend class regularly and participate in class discussions. In case of systemic student's misconduct, the student would be dispensed from the classes, will be marked as a "absent". If a student engages in misconduct that negatively affects other learners, the instructor may be compelled to lower the student's grade, potentially resulting in a failing grade for the course.

Being late on class: When students attend class late, it can disrupt the flow of a lecture or discussion, distract other students, impede learning, and generally erode class morale. Moreover, if left unchecked, lateness can become chronic and spread throughout the class. By the policy of this course, students who come attend online/in person class for more than 5 minutes are not allowed to get in to class and consequently, they will be marked as "absent" for the specific hour.

Homework / Assignments: The assignments are designed to acquaint students with the theoretical knowledge and practical skills required for the course. The textbook readings will be supplemented with materials collected from recent professional articles and journals. In case of using someone's work (papers, articles, any publications), all works must be properly cited. Failure to cite work will be resulted as a cheating from the students and may be a subject of additional disciplinary measures.

Late assignments: Most assignments will be discussed in class on the due date; therefore, late assignments will not receive credit. It is expected that all work will be submitted on time. Failure to pass assignments in on time will result in 0% for the assignment. In other words, no late submissions are allowed. All grading is based using a percentage grading scale.

Assessment: Faculty will grade quizzes, homework, midterm, endterm and final exams throughout the semester in the Discrete Mathematics course. Quizzes, midterm, endterm and final exams are summative assessments. Homework assignments, classwork assignments and lecture quizzes are considered as formative assessment. In this course, formative assessment **does not** allow late submissions. No exceptions.

Summative assessments can be written late **only** by prior agreement with the instructors.

1st and 2nd Attestations grades. In case a student's grade from an attestation is less than 25%, he/she fails the course.

In the event of some extraordinary case, students should notify the teacher and request an extension of the deadline. If approved, a new date will be given to the student depending upon the circumstances.

Final exam: The in person final exam for the course "Discrete Mathematics" includes eight theoretical and practical tasks for 60-90 minutes.

In case of online final exam for the course "Discrete Mathematics" includes twenty theoretical or practical multiple-choice tasks or eight theoretical and practical writing exam tasks for 60-90 minutes. Students will be given multichoice tasks in LMS and must give their answers by choosing one variant. At the completion of the exam, all works must be submitted in the Learning Management System (moodle.astanait.edu.kz). No late submissions are allowed in the exam.

Laptops and mobile devices can only be used for classroom purposes when directed by the teacher. Misuse of laptops or handheld devices will be considered a breach of discipline and appropriate action will be initiated by the teacher.

Sabotage, forgery, cheating, fabrication, plagiarism and facilitating academic dishonesty are defined in the Academic conduct policies of the university and there are some examples:

1. Submitting work that is not your own papers, assignments, or exams;
2. Copying ideas, words, or graphics from a published or unpublished source without appropriate citation;
3. Submitting or using falsified data;
4. Submitting the same work for credit in two courses without prior consent of both instructors.
5. Copying and pasting from the internet
6. Re-arranging words, sentences and formulas
7. Copying answers for anything, such as homework, a worksheet, a lab report, etc.

Any student who is found sabotage, forgery, cheating, fabrication, plagiarism and facilitating academic dishonesty on any work for this course will receive 0 (zero) for that work or for entire class. Also, further

actions will also be taken regarding academic conduct policies of the university.

Definitions for Types of Academic Dishonesty:

Intentionally using or attempting to use unauthorized materials, information, or study aids in any academic exercise. The term academic exercise includes all forms of work submitted for credit or hours. **Type:**

Cheating

The deliberate adoption or reproduction of ideas, words or statements of another person as one's own without explicit acknowledgement or citation. However, the adoption or reproduction of the ideas or words of another person as one's own without complete and correct acknowledgement, often the result of a misunderstanding or citational misattribution, can be considered unintentional. **Type: Plagiarism**

The intentional and unauthorized falsification or invention of any information or citation in an academic exercise. **Type: Fabrication**

The altering of a score, grade, or official academic university record or forging the signature of an instructor or other student. **Type: Forgery**

Intentionally or knowingly helping or attempting to help another to violate a provision of the institutional code of academic integrity. **Type: Facilitating academic dishonesty**

Acting to prevent others from completing their work or willfully disrupting the academic work of others. **Type: Sabotage**

Academic Conduct Policies of the university: The full texts of all the academic conduct code will be posted to the students using Learning Management System (moodle.astanait.edu.kz).

Some consequences of academic misconducts: The teacher may lower scores or may not accept certain work if the student has previously violated academic integrity.

Laptops and mobile devices can only be used for classroom purposes when directed by the course instructor. Misuse of laptops or handheld devices will be considered a breach of discipline and appropriate action will be initiated by the instructor.

Contacting the Instructor (Teacher): The easiest and most reliable way to get in touch with the teacher is by email. Students must feel free to send email if you have a question related to the course. The

teachers will respond as soon as they can but not always instantaneously. Besides that, students are also welcomed to arrange a one-to-one meeting online with the teacher by their office during office hours to discuss the class.

Email etiquette:

It is essential to be correct, clear, and adhere to proper email etiquette when communicating with the professor. Failure to do so may result in the professor not responding. If a message contains any form of blackmail or aggression, it will be considered academic dishonesty, and appropriate measures will be taken.

Changing the syllabus: The syllabus may change depending on the preferences of the teacher (For example: weather conditions, holidays, Unplanned events at the university or for personal reasons of the instructors).

3. Course Content

#	Abbreviation	Meaning
1	ISIS	Instructor-supervised independent work
2	SIS	Students' independent work
3	IP	Individual project
4	PA	Practical assignment
5	LW	Laboratory work
6	MCQ	Multiple choice quiz

3.1 Lecture, Practical/Seminar/Laboratory Session Plans

	Topic	Lecture (50 minutes)	Practice (50 minutes)	ISIS (H\W)	SIS (H\W)
1	Logic. Propositional Logic. Logical operators. Truth table. Applications of Propositional Logic. Propositional Equivalences. Disjunctive normal forms.	3	2	2	3
2	Sets and Relations. Set operations. Venn diagrams. Binary Relations: reflexive, symmetric, anti-symmetric and transitive relations. Equivalence relations. Partial and total orders.	3	2	2	3
3	Functions. One-to-one, onto and bijective functions. The inverse functions. The composition of functions. Cardinality of sets.	3	2	2	3
4	The Integers. Divisibility and Modular Primes. Arithmetic Euclidean algorithm and GCD. Solving congruence relations. Chinese remainder theorem. (Diophantine Equations).	3	2	2	3
5	Induction and Recursion. Mathematical				

	Induction. Recursively defined sequences. Solving recurrence relations: The characteristic polynomials.	3	2	2	3
6	Principles of Counting. The principle of Inclusion-Exclusion. The sum and product rules. The Pigeonhole principle.	3	2	2	3
7	Permutations and Combinations. Permutations and Combinations. Combination with repetitions. Binomial Theorem.	3	2	2	3
8	Graphs. Definitions and basic properties. Isomorphism	3	2	2	3
9	Paths and Circuits. Eulerian circuits. Hamiltonian cycles. Adjacency Matrix.	3	2	2	3
10	Planar Graphs and Colorings. Planar graphs. Coloring graphs.	3	2	2	3
	Total hours:	30	20	20	20

3.2 List of Assignments for Student Independent Study

No	Assignments (topics) for Independent study	Hours	Recommended literature and other sources (links)	Form of submission
1	2	3	4	5
1	Techniques of proofs	3	[1], Chapter 0	Exercises
2	Algorithms	3	[1], Chapter 8	Exercises
3	Applications of Paths and Circuits	3	[1], Chapter 11	Exercises
4	Trees	3	[1], Chapter 12	Exercises
5	The Max Flow-Min Cut Theorem	3	[1], Chapter 14	Exercises
6	Conjunctive normal form	3	[2], Chapter 1	Exercises
7	Functionally complete system of logic operators	3	[2], Chapter 1	Exercises
8	The generating functions		[2], Chapter 5	Exercises
9	Derangement		[2], Chapter 7	Exercises
10	Classes.	10	Books, internet resources	Exercises

4. Student Performance Evaluation System for the Course

Period	Assignments	Number of points	Total
1 st attestation	Assignments**:	60	100
	quiz 1	20	
	classwork assignments	10	
	homework assignments	10	
	lecture quizzes	4*5=20	
	Mid Term Exam	40	
2 nd attestation	Assignments**:	60	100
	quiz 2	20	
	classwork assignments	10	
	homework assignments	10	
	lecture quizzes	4*5=20	
	End Term Exam	40	
Final exam*	Written Exam	100	100
Total	0,3 * 1st Att + 0,3 * 2nd Att + 0,4*Final		100

Achievement level as per course curriculum shall be assessed according to the evaluation chart adopted by the academic credit system.

Letter Grade	Numerical equivalent	Percentage	Grade according to the traditional system
A	4,0	95-100	Excellent
A-	3,67	90-94	
B+	3,33	85-89	Good
B	3,0	80-84	
B-	2,67	75-79	
C+	2,33	70-74	
C	2,0	65-69	
C-	1,67	60-64	Satisfactory
D+	1,33	55-59	
D	1,0	50-54	
FX	0	25-49	
F	0	0-24	Fail

Based on the specific grade for each assignment, and the final grade, following criteria must be satisfied:

Grade	Criteria to be satisfied
90-100	<ul style="list-style-type: none"> - Work would be worthy of further dissemination under appropriate conditions - Mastery of advanced methods and techniques at a level beyond that explicitly taught - Ability to synthesize and employ in an original way idea from across the subject - Outstanding command of critical analysis and judgment

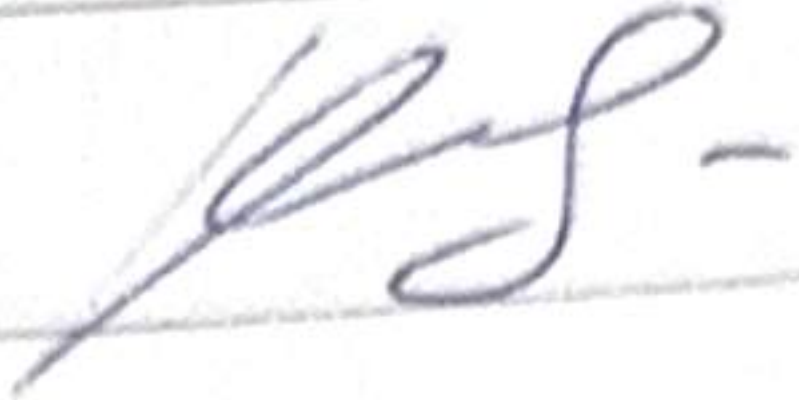
80-89	<ul style="list-style-type: none"> - Excellent range and depth of attainment of intended outcomes - Mastery of a wide range of methods and techniques - Evidence of study and originality of what has been taught - Able to display a command of critical analysis and judgement
70-79	<ul style="list-style-type: none"> - Attained all the intended learning outcomes for a unit - Able to use well a range of methods and techniques to come to conclusions - Able to employ critical analysis and judgement
60-69	<ul style="list-style-type: none"> - Some limitations in attainment of learning objectives, but has managed to grasp most of them - Able to use most of the methods and techniques taught - Evidence of study and comprehension of what has been taught but grasp insecure - Some grasp of the issues and concepts underlying the techniques and material taught, but weak and incomplete
50-59	<ul style="list-style-type: none"> - Attainment of only a minority of the learning outcomes - Able to demonstrate a clear but limited use of some of the basic methods and techniques taught - Weak and incomplete grasp of what has been taught - Deficient understanding of the issues and concepts underlying the techniques and material taught
25-49	<ul style="list-style-type: none"> - Attainment of nearly all the intended learning outcomes deficient - Lack of ability to use at all or the right methods and techniques taught - Inadequately and incoherently presented - Wholly deficient grasp of what has been taught - Lack of understanding of the issues and concepts underlying the techniques and material taught
0-24	No significant assessable material, absent or assessment missing a must pass component

5. Methodological Guidelines

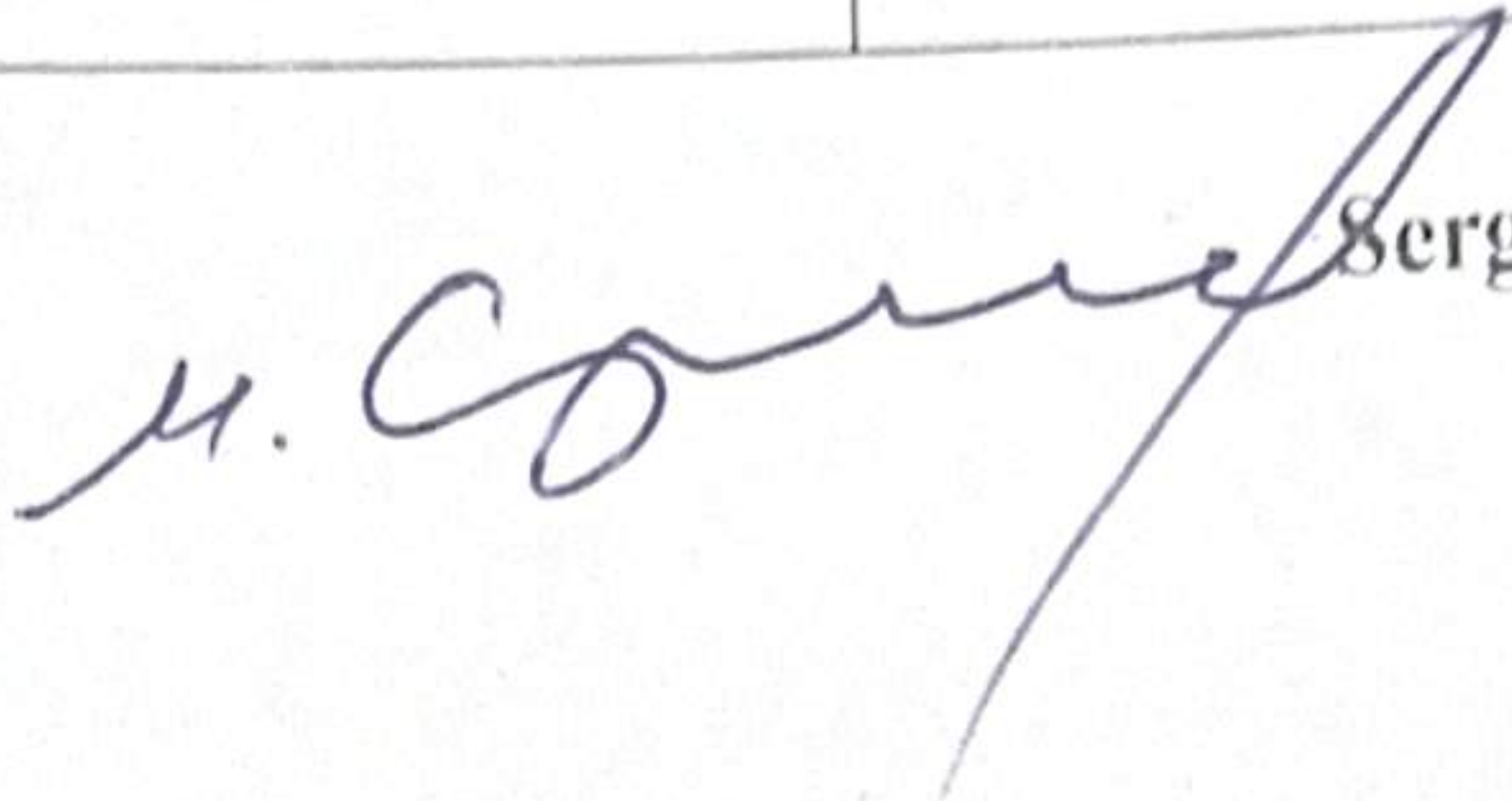
Assessment is administered continuously throughout the course. The students are rated against their performance in continuous rating administered throughout the semester (60%) and summative rating done during the examination session (40%), total 100%. Continuous rating is students' on-going performance in class and independent work. Class work is assessed for attendance, laboratory works' defense and in- class assessments.

- **ISIS (Instructor Supervised Student Independent Study)** -comprises presentation to be done by students independently and checked by instructor.
- **Mid-term and End-term** is a review of the topics covered and assessment of each student's knowledge. The form of the midterm and end term exams is complex.
- **Final assessment** is a combination of both individual (team) project (report) and oral presentation (slides) to evaluate the students' academic performance and professional skills. At the completion of this course each student has to submit an online project version conforming to the project outline, as well as to prepare and present a slide presentation that follows the presentation outline. Project iterations would be required to submit as well. Students should submit the written Report of Final project and slide-Presentation 3 days before the Final exam day.

6. Instructors (lecturers) approvals Full name Job title Date Sign

Full name	Job title	Date	Sign
Adilet DUMAN	Senior-lecturer	14.03.2025	

Director

 Sergaziyev M.Zh.