Syllabus
Academic Year 2021 -2022

1. General information	
Course Code	DM 1205
Course Title	Discrete Mathematics
Degree Cycle (Level)/ Major	Information technologies
Year, trimester	1, 2
Number of Credits	5
Language of Delivery:	English
Prerequisites	No prerequisites
Postrequisites	Theory of Probability and Statistics, Algorithms and Data structures, Advanced programming.
Instructurs	Nurlan Ismailov, PhD in Mathematics, associate professor, nurlan.ismailov@astanait.edu.kz.
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: - 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	- 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: - Know basic mathematical concepts; - Learn main proof techniques of mathematics; - Be familiar with important discrete objects; - Understand counting principles of combinatorics; - Be able to transform discrete problems into simple forms; - Describe programing questions in terms of graphs and trees.	
6. Methods of Assessment	- Homework - Quiz - Midterm, Pre-Final and Final exams	
7. Reading List	1. Lecture presentations. **Main textbooks:** 2. E. Goodaire and M. Parmenter Discrete Mathematics with Graph Theory (third edition); 3. Kenneth H. Rosen. Discrete Mathematics and Its Applications (seventh edition); **Additional textbooks:** 4. Ralph P. Grimaldi. Discrete and Combinatorial Mathematics (fifth edition); 5. А.С. Джумадильдаев, Элементы дискретной математики, Алматы, 2004; 6. Д. Андерсон Дискретная математика и комбинаторика. 2004;	
8. Open Online Resources	1. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-042j-mathematics-for-computer-science-fall-2010/ 2. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-042j-mathematics-for-computer-science-spring-2015/index.htm	
9. Course policy	**Course and university policies include:** **Attendance:** Students are expected to attend all scheduled online 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. In case the student is not able to attend the online 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/offline class time, otherwise he/she fails the course. **Office hours:** There will be two online office hours held on every Monday and Tuesday between 18:30-19:20. 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/offline 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.

Online class work: The duration of each lecture and practical lesson is 50 minutes.
Offline class work: 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.

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 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.

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 offline final exam for the course "Discrete Mathematics" includes eight theoretical and practical tasks for 90 minutes.

The online final exam for the course "Discrete Mathematics" includes twenty theoretical and practical multiple-choice tasks or eight theoretical and practical writing exam tasks for 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.

Cheating and plagiarism are defined in the Academic conduct policies of the university and include:
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.

Any student who is found cheating or plagiarizing on any work for this course will receive 0 (zero) for that work and further actions will also be taken regarding academic conduct policies of the university.

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).

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.

3. Course Content

3.1 Lecture, practical/seminar/laboratory session plans

3.2 List of assignments for Student Independent Study

	Topic	Lecture (50 minutes)	Practice (50 minutes)	Reference
1	**Logic.** Propositional Logic. Logical operators. Truth table. Applications of Propositional Logic. Propositional Equivalences. Disjunctive normal forms. Functionally complete system of logic operators.	3	2	[2]: Chapter 1
2	**Sets and Relations.** Set operations. Venn diagrams. Binary Relations: reflexive, symmetric, anti-symmetric and transitive relations. Equivalence relations.	3	2	[2]: Chapter 2
3	**Functions**. One-to-one, onto and bijective functions. The inverse functions. The composition of functions. Cardinality of sets.	3	2	[2]: Chapter 3
4	**The Integers.** Divisibility and Modular Primes. Arithmetic Euclidean algorithm and GCD. Solving congruence relations. Chinese remainder theorem. Diophantine Equations.	3	2	[2]: Chapter 4
5	**Induction and Recursion.** Mathematical Induction. Recursively defined sequences. Solving recurrence relations:	3	2	[2]: Chapter 5
6	**Principles of Counting.** The principle of Inclusion-Exclusion. The sum and product rules. The Pigeonhole principle.	2	2	[2]: Chapter 6
7	**Permutations and Combinations.** Permutations and Combinations. Combination with repetitions. Derangements. Binomial Theorem.	3	2	[2]: Chapter 7
8	**Graphs.** Definitions and basic properties. Isomorphism	2	2	[2]: Chapter 9
9	**Paths and Circuits.** Eulerian circuits. Hamiltonian cycles. Adjacency Matrix.	2	2	[2] Chapter 10
10	**Planar Graphs and Colourings**. Planar graphs. Colouring graphs.	2	2	[2]: Chapter 13

№	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	Classes.	10	Books, internet resources	Exercises

4. Student performance evaluation system for the course

Period	Assignments	Number of points	Total
1st attestation	a. 2 Homework b. 1 Quiz c. Midterm	10+10 20 60	100
2nd attestation	a. 2 Homework b. 1 Quiz c. Pre-Final	10+10 20 60	100
Final exam	Multi choice exam		100
Total	**0,3*1stAtt+0,3*2ndAtt+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	Excellent
B+	3,33	85-89	Good
B	3,0	80-84	Good
B-	2,67	75-79	Good

C+	2,33	70-74	
C	2,0	65-69	Satisfactory
C-	1,67	60-64	
D+	1,33	55-59	
D	1,0	50-54	
FX	0	30-49	Fail
F	0	0-29	

5. Methodological Guidelines

Assessment is administered continuously throughout the course. The students are rated against their performance in continuous rating administered throughout the trimester (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.

- **Midterm and Pre-Final** is a review of the topics covered and assessment of each student's knowledge.
- **The offline final exam** for the course "Discrete Mathematics" includes eight theoretical and practical tasks for 80 minutes.
- **The online final exam** for the course "Discrete Mathematics" includes twenty theoretical and practical multiple-choice tasks for 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.
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6. Lecturer approvals

Lecturer	Sign	Date
Nurlan Ismailov		