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| **SECTION A: Definitive** | | | | | | | |
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| **1.** | **General course information** | | | | | | |
| 1.1 | School: Science and Technology | | | | 1.6 | Credits (ECTS): 6 | |
| 1.2 | Course Title: Discrete Mathematics | | | | 1.7 | Course Code: MATH 251 | |
| 1.3 | Pre-requisites: MATH 162 Calculus II (C and above) | | | | 1.8 | Effective from:  *(year)* | |
| 1.4 | Co-requisites: N/A | | | |
| 1.5 | |  |  | | --- | --- | | Computer Science,  Mathematics | | | Core | Elective |   Programs:  *(in which the course*  *is offered)* | | | | | | |
| **2.** | **Course description (max.150 words)** | | | | | | |
| This course is a one semester course intended for students majoring in Mathematics or Computer Science. It introduces the students to the fundamental concepts of mathematical reasoning. The main themes of the course are logic and proof, induction and recursion, discrete structures, set theory, combinatorics, algorithms, graph theory, and their applications. The students will learn how to formulate precise mathematical statements. The course also explores several common proof techniques and exposes the students in learning how to write mathematical proofs. | | | | | | | |
| **3.** | **Summative assessment methods** (tick if applicable)**:** | | | | | | |
| 3.1 | Examination |  | 3.5 | Presentation | | |  |
| 3.2 | Term paper |  | 3.6 | Peer-assessment | | |  |
| 3.3 | Project |  | 3.7 | Essay | | |  |
| 3.4 | Laboratory Practicum |  | 3.8 | Other *(specify)* | | | \_\_\_\_\_\_\_\_\_\_\_\_ |
| 4. | **Course aims** | | | | | | |
| The aims of the course are:   1. to familiarize students with a few proof strategies; 2. to expose students to abstract mathematical notions such as sets, relations, functions; 3. to familiarize students with combinatorics and its applications to probability; 4. to expose students to elementary notions in graph theory. | | | | | | | |
| 5. | Course learning outcomes (CLOs) | | | | | | |
| 5.1 | By the end of the course the student will be expected to be able:   1. to learn some fundamental mathematical concepts and terminology; 2. to understand the language of sets; 3. to formulate and assess logical expressions; 4. to construct elementary mathematical proofs; 5. to analyze and verify set operations; 6. to solve problems related to number theory; 7. to know the properties of relations and functions; 8. to solve and analyze problems using permutations and combinations; 9. to implement the principle of mathematical induction; 10. to solve problems involving recurrence relations; 11. to create and analyze graphs and trees; 12. to understand the applications of discrete mathematics in real world. | | | | | | |
| 5.2 | |  |  |  | | --- | --- | --- | | **CLO**  **ref #** | **Program Learning Outcome(s) to which CLO is linked** | **Graduate Attribute(s) to which CLO is linked** | | 1-5, 7 | Analyze and critically read a mathematical proof, and write and check proofs of their own. | Possess an in-depth and sophisticated understanding of their domain of study.  Be intellectually agile, curious, creative and open-minded. | | 6, 8, 9, 10, 11,  12 | Apply the main mathematical theorems to solve mathematical problems and derive mathematical consequences from the main mathematical theorems.  Perform calculations and solve modeling problems using the tools and skills taught in the courses.  Connect mathematics with modern applications, construct mathematical models, solve problems using mathematical tools, and analyze the solutions. | Possess an in-depth and sophisticated understanding of their domain of study.  Be intellectually agile, curious, creative and open-minded. | | | | | | | |

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| SECTION B: Non-DefinitiveCourse SyllabusDetails of teaching, learning and assessment | | | | | | | | | | | | | |
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| **6.** | **Detailed course information** | | | | | | | | | | | | |
| 6.1 | Academic Year: 2018-19 | | | | | | | | 6.3 | Schedule (class days, time):  Tuesday, Thursday  10.30 – 11.45 | | | |
| 6.2 | Semester: Fall 2018 | | | | | | | | 6.4 | Location (building, room): #7E.220 | | | |
| **7.** | **Course leader and teaching staff** | | | | | | | | | | | | |
| **Position** | | | | **Name** | | | | | | **Office**  **#** | **Contact information** | | **Office hours/or by appointment** |
| Course Leader | | | | N/A | | | | | |  |  | |  |
| Course Instructor(s) | | | | Francesco Sica | | | | | | #7204 | francesco.sica@nu.edu.kz | | Tuesdays and Thursdays13.00 – 14.00,or by appointment |
| Teaching Assistant(s) | | | | N/A | | | | | |  |  | |  |
| 8. | Course Outline | | | | | | | | | | | | |
| Session | | Date (tentative) | | | Topics and Assignments | | | | | | |
| Week 1 | | August 14 – 16 | | | Logical form and logical equivalence, conditional statements, valid and invalid arguments.  Section 2.1, 2.2, 2.3 | | | | | | |
| Week 2 | | August 23 | | | Predicates and quantified statements (the universal quantifier, the existential quantifier, negations of quantified statements, the relations between the quantifiers and logical connectives), statements with multiple quantifiers  Section 3.1, 3.2, 3.3 | | | | | | |
| Week 3 | | August 28 | | | Set theory, properties of sets.  Section 6.1, 6.2 | | | | | | |
| Week 4 | | September 4 – 6 | | | Functions defined on general sets, one-to-one and onto functions, inverse functions, composition of functions.  Section 7.1, 7.2, 7.3 | | | | | | |
| Week 5 | | September 11 – 13 | | | Relations on sets, reflexivity, symmetry, transitivity, equivalence relations.  Section 8.1, 8.2, 8.3 | | | | | | |
| Week 6 | | September 18 – 20 | | | Direct proof and counterexamples (integers and rational numbers, divisibility).  Section 4.1, 4.2, 4.3 | | | | | | |
| Week 7 | | September 25 – 27 | | | Direct proof and counterexamples (division into cases, floor, ceiling).  Indirect argument (contradiction and contraposition, two classical theorems)  Section 4.4, 4.5, 4.6, 4.7 | | | | | | |
| Week 8 | | October 2 – 4 | | | Algorithms  Section 4.8  **Midterm Exam October 4** | | | | | | |
|  | | October 8 – 12 | | | *Fall Break* | | | | | | |
| Week 9 | | October 16 – 18 | | | Sequences, mathematical induction, strong mathematical induction.  Section 5.1, 5.2, 5.3, 5.4 | | | | | | |
| Week 10 | | October 23 – 25 | | | Defining sequences recursively,  solving recurrence relations by iteration. Second-order linear homogenous recurrence relations  Section 5.6, 5.7, 5.8 | | | | | | |
| Week 11 | | October 30 – November 1 | | | Introduction to probability, possibility trees and the multiplication rule, counting elements of disjoint sets, the addition rule.  Section 9.1, 9.2, 9.3 | | | | | | |
| Week 12 | | November 6 – 8 | | | The pigeonhole principle, counting subsets of a set (combinations).  Section 9.4, 9.5 | | | | | | |
| Week 13 | | November 13 – 15 | | | r-combinations with repetition allowed, Pascal’s formula and the binomial theorem, graphs (definitions and basic properties).  Section 9.6, 9.7, 10.1 | | | | | | |
| Week 14 | | November 20 – 22 | | | Trails, paths, circuits, matrix representations of graphs, isomorphisms of graphs.  Section 10.2, 10.3, 10.4 | | | | | | |
| 9. | Learning and Teaching Methods | | | | | | | | | | | | |
| 1 | All lectures will be delivered on time. If it is necessary, handouts will be provided. | | | | | | | | | | | | |
| 2 | Students are expected to attend all lectures. | | | | | | | | | | | | |
| 3 | Students have to solve each and every problem in each homework assignment. | | | | | | | | | | | | |
| 4 | Students are expected to learn by solving exercises. | | | | | | | | | | | | |
| 5 | Quiz problems will be similar to homework problems. | | | | | | | | | | | | |
| 6 | Examination problems will be similar to homework problems and quiz problems. | | | | | | | | | | | | |
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| 10. | Summative Assessments | | | | | | | | | | | | |
| # | Activity | | | | | | | Date(tentative) | | | **Weighting (%)** | | Notes |
|  | Attendance | | | | | | |  | | | 10% | | 90-100% attendance = full points, 80-89.9% attendance = ½ points, <80% attendance = 0 points. |
|  | Quizzes | | | | | | | Biweekly on Thursdays | | | 15% | | Each quiz on topics learned the previous week |
|  | Midterm Exam | | | | | | | October 4 Room 5.103 19:00-20:00 | | | 35% | | Covering material up to September 27 |
|  | Final Examination | | | | | | | Final Examination Period | | | 40% | |  |
| 11. | Grading | | | | | | | | | | | | |
| Letter Grade | | | Percent range | | | | Grade description (where applicable) | | | | | | |
| A | | | 95-100 | | | | See Section 6 of “Academic Policies and Procedures for Undergraduate Programs”(available at https://registrar.nu.edu.kz/policies-and-procedures) | | | | | | |
| A- | | | 90-94.9 | | | |
| B+ | | | 85-89.9 | | | |
| B | | | 80-84.9 | | | |
| B- | | | 75-79.9 | | | |
| C+ | | | 70-74.9 | | | |
| C | | | 65-69.9 | | | |
| C- | | | 60-64.9 | | | |
| D+ | | | 55-59.9 | | | |
| D | | | 50-54.9 | | | |
| F | | | 0-49.9 | | | |
| 12. | Learning resources (use a full citation and where the texts/materials can be accessed) | | | | | | | | | | | | |
| E-resources, including, but not limited to: databases, animations, simulations, professional blogs, websites, other e-reference materials (e.g. video, audio, digests) | | | | | | N/A | | | | | | | |
| E-textbooks | | | | | | N/A | | | | | | | |
| Laboratory physical resources | | | | | | N/A | | | | | | | |
| Special software programs | | | | | | N/A | | | | | | | |
| Journals (inc. e-journals) | | | | | | N/A | | | | | | | |
| Textbooks | | | | | | Susanna S. Epp, Discrete Mathematics with Applications, 4th edition (International Edition), Brooks Cole, ISBN: 978-0-495-82616-3. | | | | | | | |
| 13. | Course expectations | | | | | | | | | | | | |
| List the expectations of students for the course regarding the course attendance, class participation, group work, late/missed submission of assignments.  *Homework assignments, quizzes, midterm exams*  Homework will be assigned every week. Homework assignments will not be collected and graded.  There are no make-ups or deferrals for the midterm tests and quizzes.  The lowest quiz score will be dropped at the end of the semester.  *Attendance policy*  Students are expected to attend all classes.  *Tardiness policy*  Any student, who is late for 10 minutes without any prior notification, will not be allowed to participate in a lecture or a recitation.  *Class participation*  Students are expected to actively and positively participate in this class.  *Classroom decorum*  The instructor expects that students:   1. Arrive on time for class (instructors have the right to refuse entry to late-arriving students). 2. Notify the instructor if there is a legitimate need to leave class early. 3. Turn off all mobile phones and electronic devices. 4. Refrain from talking to other students except during structured classroom activities (instructors have the right to direct offending students to leave the classroom). 5. Refrain from making disruptive noises such as slamming doors. 6. Behave in a respectful manner towards the instructor and other students (incidents of insulting behavior and/or use of offensive language or gestures can be forwarded to a disciplinary committee for sanctions). 7. Show respect for opinions and beliefs of others even if there is disagreement.   *Missed exams*  All missed midterm tests will be assigned zero, but the instructor will replace up to one missed test with the grade earned on the final, if the student has a valid excuse for missing the test (as determined by the Administration of SST).  *Late assignments*  No late assignments will be accepted.  *Appeals policy*  If a student believes that he or she has received an unfair or erroneous grade, the student may appeal. The student must first consult with the instructor within 10 working days of his or her receipt of the contested grade (that time may be extended in the event the instructor is shown to have been unavailable during the period following the student’s receipt of the grade in question). In the event that the student is still dissatisfied, he or she may appeal to the Dean of the relevant School or the Dean’s designee within 7 days. The Dean or designee shall consult with the instructor before making any decision. The decision of the Dean or designee shall be final.  *Electronic resources*  Students are expected to regularly check their Nazarbayev University email for updates and announcements about the course. Students are also required to use Moodle as determined by the instructor. | | | | | | | | | | | | | |
| 14. | **Academic Integrity Statement** | | | | | | | | | | | | |
| Any plagiarized paper, assignment, and/or exam will receive a score of zero. See the Student Code of Conduct and Disciplinary Procedures (approved by the AC on 05.02.2014), specifically, paragraphs 13-16 (plagiarism and cheating). | | | | | | | | | | | | | |