MA 2025 (4-1) Logic and Discrete Mathematics I

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Office Hours : Mon, Tue, Wed, Thu 11-11:50am in 270 Spanagel or any time on MS Teams if I am available – text me in MS Teams chat, and we can connect if available.

Textbook : *Discrete Mathematics and Its Applications*, 7th Edition, K.H. Rosen, WCB/McGraw-Hill 2012.

Course Description: MA 2025 is the first course in a two-course sequence designed to provide a foundation in logic and elementary discrete mathematics. The course is useful for students from a number of disciplines, but has been specifically tailored for students of computer science. The principal emphasis is on logic and its application to mathematical proof. Once the logical underpinnings are firmly in place, the course applies them to a handful of fundamental areas of discrete mathematics that are also essential in computer science. These are naive set theory, properties of functions (and a menagerie of especially useful functions), integer divisibility, mathematical induction, and elementary combinatorics. Three of these areas (elementary number theory, mathematical induction, and combinatorics) are pursued in greater depth in the follow-on course, MA3025.

Grading: You will have three exams of 100 points each. Your final grade is given by the average of these three exams (see the bottom of the last page for additional information if you would like to take the Final Exam). For the letter grade, I will be using the following adjustable scale:

$95\% - 100\% : A$,	$90\% - 94.99\% : A-$,	$85\% - 89.99\% : B+$,
$80\% - 84.99\% : B$,	$75\% - 79.99\% : B-$,	$70\% - 74.99\% : C+$,
$65\% - 69.99\% : C$,	$60\% - 64.99\% : C-$,	$55\% - 59.99\% : D+$,
$50\% - 54.99\% : D$,	and less than 50% is a failing grade.	

Make-up policy : Late or make-up exams only if absolutely necessary. If you cannot attend the day of exams, a makeup will be given only if you have informed me of your expected absence no later than 2 class periods preceding the exams. For sudden illness and accidents, please see me upon your return to class.

Learning Experience: In this course, your classroom experience will be complemented by digital learning experiences as follows:

- All content, information, communication and collaboration will take place in MS Teams, the team named "MA2025_Winter24"
- I will save classroom writing and extra solution in OneNote so that you can have access to it any time, anywhere. OneNote for Windows 10 is accessible either from MS Teams or for more features download it from https://apps.microsoft.com/store/detail/onenote/9WZDNCRFHVJL

Course Learning Outcomes: Your goal is to develop the mathematical sophistication needed to understand and apply standard proof techniques to routine combinatorial problems. In doing this, you will:

1. Prove established results using the main proof techniques:
    - Direct proof
    - Contraposition
    - Contradiction
    - Induction.
2. Demonstrate proficiency/competencies and strategies for:
    - Using counting techniques, permutations, and combinations
    - Explaining and use divisibility and modular arithmetic
    - Applying various properties of relations and partial orders
    - Constructing closure of relations
    - Applying basic principles of counting and combinatorics and differentiating when to apply different rules and combinations thereof
    - Modeling problems using graph theory, and successfully using established theoretical graph concepts.
3. Apply the essential concepts and proof methods of combinatorics to be able to:
    - Distinguish between a correct and incorrect argument
    - Break down a result to analyze its parts and use the proof techniques to complete the proof
    - Identify if two graphs are isomorphic and prove the claim
    - Draw connections and identify differences between the different ideas that use tree in graph theory
    - Contrast the use of the concepts of traversal and spanning trees

Homework: Regular homework assignments will be made but none will be collected:
Section 1.1: 1,3(c,d),9,13,17,27,33,44
Section 1.2: 5,7
Section 1.3: 5,10,14,23
Section 1.4: 5,9,11,13,17
Section 1.5: 3,9,27, 31
Section 1.6: 3,5,11,17,19,27
Section 1.7: 8,11,12,13,17,26,27
Section 1.8: 1,3,9,10
Section 2.1: 1,5,9,17,18,21,24
Section 2.2: 3,16,19,31
Section 2.3: 1,5,12,13,23,36
Section 2.6: 2a),3b),4a),20,27
Appendix A2: 1,2,4
Test 1: February 6
Section 4.1: 9, 21, 35, 36
Section 4.2: 3(a),5(a,b),7(a,b)
Section 4.3: 5,21,24(a,b),25(a,b),33
Section 5.1: 3,7,13,21,31,33,35
Section 5.2: 3
Section 5.3: 3,7,23,25
Section 6.1: 1,3,7,11,23,25,29,33,59
Section 6.2: 1,3,9,11,14,37
Section 6.3: 5(a,b),6(a,b),7,9,13,17,21,27,31,33,35,37
Section 9.1: 1,4,5,33,35,56(a,b)
Section 9.3: 1,3(c),4,8,14,25,26
Section 9.4: 1,5,19,25 (use either Algo 1 or Warshall's Algo),29
Test 2: February 27th
Section 9.5: 3,9-12,21,23,24,35
Section 9.6: 1,3,7,9,27
Section 10.1: 2-9
Section 10.2: 3,7,9,23,24,25,35
Section 10.3: 1,3,13,15,19,35,37,39,41,42,61,64
Section 10.4: 1,3,5,11,15,19,21
Section 11.1: 1,3,19,27
Section 11.2: 1,5,22,25
Section 11.3: 7-15
Section 11.4: 2-6, 13-16.
Test 3: March 14 and March 15th
Additional opportunity for a Final Exam: March 18th, 12-2pm in Spanagel 221. Please know Prof. Gera know by March 1st if you will take the final exam. If you chooe the take the final exam, it will be over Test 1 and Test 2 content, and it will be worth 100 points. Your grade will then be the (unweighted) average of Test 1, Test 2, Test 3, and Final Exam.