

# MA 138 SYLLABUS - DISCRETE MATHEMATICS I

ANDREW SCHWARTZ, PH.D.

## **Catalog Description:** 138-01 Discrete Mathematics (Spring 2012)

Applied mathematics course emphasizing fundamental principles of discrete mathematics and application to computer science. Topics include logic, mathematical induction, sets, relations, functions, algorithms, permutations and combinations, and graph theory. Prerequisite: MA 134 with a grade of 'C' or higher. (3)

**Text:** Kenneth H. Rosen, (2012) *Discrete Mathematics and Its Applications* (7th ed.), New York, NY: McGraw-Hill.

**Office Location and Hours:** Johnson Hall 307 – MWF 9:55am-10:55am and whenever I'm around (I want you to always feel free to stop by and see if I'm in. If I'm not, see if the Mathematics Learning Center can help with your question. If none of these times or situations work for you, you can make an appointment that is an appropriate time for the both of us.)

**Contact Information:** office phone: (573) 651-5065 e-mail: [aschwartz@semo.edu](mailto:aschwartz@semo.edu)  
my homepage: <http://cstl-csm.semo.edu/aschwartz>

**Classroom Location and Hours:** JH 105 – MWF 11:00am-11:50am

**Class Webpage:** <http://cstl-csm.semo.edu/aschwartz/ma138sp12>

**Course Objectives:** The course is designed to teach fundamental mathematical principles and techniques that are widely used in computer science applications. Upon completion of the course, you should be able to (among others):

- Be familiar with the structures and ideas of beginning discrete mathematics, including set theory, propositional logic, elementary proof techniques, and graphs (networks).
- Be familiar with the basic concepts of mathematical induction.
- Be proficient in modular arithmetic, enumeration, and in dealing with numbers in bases other than decimal.

## **Expectations of Students:**

- (1) Attend class.
- (2) Acquisition of insight into methods of discrete mathematics.
- (3) Regular participation through problems assigned and class discussion as a contributing member of the class.
- (4) Provide and use a scientific calculator.
- (5) Do, pass, and present the homework.
- (6) Pass quizzes and tests.

**Course Procedures:** We will combine traditional lecture using chalk and board with presentations from students on the assigned problems along with class discussion as time permits. In addition to working in class students are encouraged to work together outside of class. This is why I have placed fewer and more challenging problems in your homework assignments. You are expected to read the book on the section we are going over and handouts prior to class.

## **Tentative Schedule:**

- (1) Intro, Syllabus, 1.1 Propositional Logic # 2, 4, 8, 12, 14, 16, 18, 24, 28, 32, 44 (note fuzzy logic)
- (2) Syllabus Quiz, 1.3 Propositional Equivalences # 2, 4, 6, 8, 10, 14, 20, 32, 34, 46, 48, 62
- (3) 1.4 Predicates and Quantifiers # 2, 6, 8, 10, 12, 16, 20, 24, 32, 36, 52
- (4) 1.7 Introduction to Proofs # 2, 6, 10, 12, 18, 24, 28, 38
- (5) 1.8 Proof Methods and Strategy # 2, 6, 8, 14, 28, 36, 40
- (6) 5.1 Mathematical Induction # 4, 6, 8, 10, 12, 14, 16
- (7) 5.1 Mathematical Induction # 18, 20, 28; 5.2 Strong Induction and Well-Ordering # 4, 10, 12, 26

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*Date:* Spring 2011.

- (8) 5.3 Recursive Definitions and Structural Induction # 2, 4, 6, 8, 10, 12, 24 (note that Ackermann's function [48-55] is what Daly gave a presentation on for Math Club)
- (9) 2.1 Sets # 6, 8, 10, 12, 14, 18, 20, 26, 28, 30, 32, 38 (note Russell's paradox 46)
- (10) 2.2 Set Operations # 2, 4, 12, 14, 18, 20, 25, 26, 32, 36, 48, 50 (note multisets and fuzzy sets)
- (11) 2.3 Functions # 2, 4, 6, 8, 12, 14, 20, 22, 26, 30, 42, 44
- (12) 2.4 Sequences and Summations # 2, 4, 6, 10, 12, 14, 16, 30, 32, 34 (note Sloane's bio as in Sloane's integer sequence website)
- (13) 9.1 Relations and Their Properties # 2, 4, 6, 10, 14, 21, 26, 30, 32
- (14) 9.3 Representing Relations # 2, 4, 6, 8, 12, 14, 22, 24, 26, 28
- (15) 9.5 Equivalence Relations # 2, 16, 22, 24, 27, 42, 44, 46
- (16) EXTRA DAY over Chapters 1, 2, 5, & 9
- (17) REVIEW over Chapters 1, 2, 5, & 9
- (18) TEST over Chapters 1, 2, 5, & 9
- (19) 4.1 Divisibility and Modular Arithmetic (The Integers and Division) # 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 24, 32
- (20) 4.2 Integer Representations and Algorithms (Integers and Algorithms) # 2, 4, 6, 8, 10, 22, 24 (note Cantor expansion)
- (21) 6.1 The Basics of Counting # 2, 4, 6, 8, 18, 20, 24, 26, 32, 34, 36, 44
- (22) 6.2 The Pigeonhole Principle # 2, 4, 6, 8, 12, 14, 16, 18, 32, 44
- (23) 6.3 Permutations and Combinations # 2, 4, 5, 6, 8, 10, 14, 16, 18, 22, 24, 26, 28, 30, 32, 34, 38, 40
- (24) 6.4 Binomial Coefficients # 2, 4, 6, 8, 12, 20, 22, 24, 28
- (25) 6.5 Generalized Permutations and Combinations # 2, 4, 6, 8, 10, 16, 20, 22, 24, 30, 54
- (26) 8.1 Applications of Recurrence Relations # 2, 4, 8, 12, 20, 28 (note Josephus problem)
- (27) 8.2 Solving Linear Recurrence Relations # 2, 4, 6, 8, 12, 14, 18, 22, 24
- (28) 8.5 Inclusion-Exclusion # 2, 4, 6, 8, 10, 12
- (29) EXTRA DAY over Chapters 4, 6 & 8
- (30) REVIEW over Chapters 4, 6 & 8
- (31) TEST over Chapters 4, 6 & 8
- (32) 10.1 Graphs and Graph Models # 4, 6, 8, 10, 12, 14, 16
- (33) 10.2 Graph Terminology and Special Types of Graphs # 2, 4, 8, 18, 20, 30, 36, 50
- (34) 10.3 Representing Graphs and Graph Isomorphisms # 10, 12, 14, 20, 24, 36, 38, 40, 42, 62, 64
- (35) 10.4 Connectivity # 2, 4, 6, 12, 14, 20, 22, 24, 26, 32, 34
- (36) 10.5 Euler and Hamiltonian Paths # 2, 4, 6, 8, 18, 20, 22, 26, 30, 32, 34, 36
- (37) 10.6 Shortest-Path Problems # 2, 4, 6, 8, 10, 26, 28
- (38) 10.7 Planar Graphs # 2, 4, 6, 8, 16, 18, 20, 22, 24, 26
- (39) 11.1 Introduction to Trees # 2, 4, 6, 8, 10, 16, 18, 20, 22, 28, 40
- (40) 11.2 Applications of Trees # 2, 4, 6, 14, 20, 22, 24, 26a, 30, 34, 36
- (41) 11.3 Tree Traversals # 2, 4, 6, 8, 10, 14, 16, 18, 22, 23, 24, 30
- (42) 11.4 Spanning Trees # 2, 4, 6, 8, 10, 14, 16, 28; 11.5 Minimal Spanning Trees # 2, 4, 6, 8
- (43) REVIEW for Comprehensive Final (which is more heavily weighted towards Chapters 10 & 11)

**Grading Scale:**

- A 90 – 100
- B 80 – 89.9
- C 70 – 79.9
- D 60 – 69.9
- F 0 – 59.9

**Grading Scheme:**

- Homework, Quizzes, Participation - 25%
- Tests 1 and 2 - 25% each
- Final (required) - 25%

**Tutoring:** Tutoring sessions are also available to you in the Mathematics Learning Center (this is free). The hours are 8:00am-5:00pm M-R, 8:00am-2:00pm F, and 6:00pm-9:00pm on Sunday. The MLC is in Johnson Hall room #104. The Center for Student Involvement also provides tutoring on the second floor of the University Center through the Learning Assistance Program. Furthermore, Jamie Birkman (the Administrative Assistant in the Mathematics Department) has a list of personal (paid) tutors that are available.

**Disability Support Services:** “Any student who believes that they may need an academic accommodation based on the impact of a disability should contact me to arrange an appointment to discuss their individual needs. We instructors rely on Disability Support Services to verify the need for academic accommodations and developing accommodation strategies. Students that have not already registered with Disability Support Services as a student with a disability will be encouraged to do so.” The official information about disabilities from Learning Assistance and Disability Support Services is located at <http://www.semo.edu/cs/services/lec.htm>

**Classroom and Final Exam Policy:** The use of a scientific or graphing calculator is allowed for use on the class and final examinations for this course; however, computers with word-processing, symbolic manipulation or programming capabilities will not be allowed for these exams (unless specifically allowed by Disability Support Services). If you cannot afford to purchase a calculator, these may be rented from Textbook Rental Services for a nominal fee. The use of books, notes, or other resource materials will not be permitted on the final examination. **ALL CELL PHONE USAGE PROHIBITED IN EVERYDAY CLASSROOM UNLESS OTHERWISE EXCEPTED.** You may NOT use the calculator on your cell phone for quizzes, tests, and the final exam. Furthermore, you are expected to be prepared for every quiz, test, or exam in this class. There will be no sharing of calculators, pencils, or erasers during any quiz, test, or the final exam. The final is at 10:00am Wednesday, May 9 in JH105 (the same room this class is in).

**Absences on Exam Days:** If the absence is known ahead of time and you find that you will be unable to take an exam at the regularly scheduled time, you need to let me know as soon as possible in advance of the regularly scheduled time for said exam (no exceptions) so that a make-up time can be arranged before the rest of the class is scheduled to take the exam. If it is an emergency absence (you are hospitalized or arrested, etc.), you must take it the first or second day you are physically able to be in my office or at Testing Services. Documentation is required for credit in the case of any absence on an exam day.

**Homework Policy:** Homework, quizzes, and class participation cannot be made up regardless of whether the absence is known ahead of time or it is of the emergency variety. Homework is always due according to the above schedule unless otherwise noted by me in class or via an e-mail to the class. Homework can always be turned in early. Moreover, it is due by the time the class is over and not a minute later (in emergency situations it can be submitted via e-mail, fax, or my department mailbox). Homework needs to be titled, stapled, and orderly (both numerically and physically) in order to receive credit.

**General Student Behavior:** “Every student at Southeast is obligated at all times to assume responsibility for his/her actions, to respect constituted authority, to be truthful, and to respect the rights of others, as well as to respect private and public property. In their academic activities, students are expected to maintain high standards of honesty and integrity and abide by the University’s Policy on Academic Honesty. Alleged violations of the Code of Student Conduct are adjudicated in accordance with the established procedures of the judicial system.” Dishonorable actions, such as cheating will result in an immediate zero for the correlating classroom activity. Additional unethical actions will result in a referral to the Department Chair, Dean of the College of Science and Math, and/or the University Judicial Affairs Committee. The official statement about academic honesty, including plagiarism, may be accessed at <http://www.semo.edu/bulletin/>

**Checklist for Assignments:**

- (1) Top left corner of the first page should contain:
  - Your name.
  - Course number, Section number.
  - Homework number.
  - Date due.
- (2) Is the work done neatly? (stapled, no fingerprints, legible) Unreadable and chaotic papers will be returned with a zero credit. To receive partial credit, you must redo your paper in acceptable manner.
- (3) Did you answer the questions asked? Read the questions to be sure.
- (4) Have you used symbolic, graphical, numerical and verbal support of your answers? Where possible have you included algebra, numerical examples or tables and a graph (that is clear and labeled) to support your work? Always support your answer. If you used a calculator, say so; write the instruction you typed into the calculator to get your answer.
- (5) Are your answers readable? Have you used complete sentences and mathematical terminology and notation to describe the procedure by which the answer is derived? Did you justify your answer?