

CSC-350 Discrete Structures (3 credits)

Calculus is tool par excellence of the 19th century. The Mathematics of Discrete Structures is the tool of the 21th.

Instructor: Dr. Serge Kruk
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Office: SCAN 112
Office hours: Every day at Noon
Textbook: Discrete Mathematics for Computer Scientists,
by Stein, Drysdale and Bogart
Times: T,Th, 1435h-1550h

Course Goals

Introduces the foundations of discrete mathematics as they apply to computer science, focusing on providing a solid theoretical foundation for further work. The pre-requisites are high-school algebra.

Knowledge areas

From the ACM Computer Science Curriculum, this course covers the following knowledge areas (approximate hours between parentheses):

- DS1. Functions, relations and sets (4)
- DS2. Basic logic (7)
- DS3. Proof techniques (8)
- DS4. Counting (6)
- DS5. Graphs and trees (6)
- DS6. Discrete probability (3)
- AL1. Basic algorithmic analysis (5)
- AL5. Basic computability (1)

Topics covered

- Counting
 - 1.1 Basic Counting: Sum and Product principles, two-elements subsets
 - 1.2 Counting List, Permutations and subsets
 - 1.3 Binomial coefficients
- Cryptography and Number Theory
 - 2.1 Modular arithmetic
 - 2.2 Inverses and Greatest Common Divisor
 - 2.3 The RSA crypto algorithm
- Logic
 - 3.1 Equivalence and Implication
 - 3.2 Variables and Quantifiers
 - 3.3 Inference
 - Proofs (Direct and by contradiction)
- Induction, Recursion and Recurrences

- 4.1 Mathematican induction
- 4.2 Recursion, recurrence and induction
- 4.3 Solution to recurrences
- Graphs
 - 6.1 Graph theory
 - 6.2 Spanning trees
 - 6.3 Eulerian and Hamiltonian tours
 - Google’s page rank algorithm
- Probability
 - 5.1 Probability
 - 5.2 Union and Intersection
 - 5.3 Conditional probability and independence
 - 5.4 Random variable
 - 5.5 Conditional expectation

Classes:

In class, I will cover the main concepts of each section and do examples. The best way for you to learn the material is to quickly read the section from the book before class, trying to get the gist of the matter, then pay close attention in class, ask questions about every point that is unclear, try to do the examples before I finish them (I will give you time to do that). There is no value in copying down everything I write on the board or present on slides; you have a book for that! Your task in class is to understand. Taking notes that you do not understand is a waste of time. Finally, after class, read carefully every theorem and definition and do problems, do more problems, then do more problems. Mathematics is not a spectator sport; you need to do problems to deeply understand the material, internalize the definitions and make the necessary connections.

Attendance:

Attendance, though not absolutely mandatory, is necessary for most students to do well in this course. (In addition, my lectures are great!) If you miss class it is your responsibility to learn the material covered that day on your own. This should involve finding out what examples were done in class that day and understanding them on your own.

Computers and Software: There will not be any compulsory programming assignments in this class, but I will sometime illustrate some concepts by programming and you are encouraged to experiment. Some bonus assignments might involved programming.

Grading:

Homework:	50%
Midterm I:	15%
Midterm II:	15%
Final:	20%

There will be homework due almost every week, taken from the book. A subset of the questions will be graded. Your final homework grade, g will be calculated in the following manner:

$$g = \min\left\{100, \frac{\sum_i g_i}{\sum_i t_i} * 1.5\right\}$$

where g_i is the grade you obtained on homework i , and t_i is the maximum possible grade of that homework. So every submission you make increases your g value. The reason I compute the grade this way is because homework are meant for you to learn and learning implies making errors and learning from those errors. But be warned: I might be a harsh grader.

The midterms and final exam will consist of problems taken directly from the homework or slight variations of those problems.

Conversion to letter grade:

100-93	A	92-90	A-	89-87	B+	86-83	B	82-80	B-
79-77	C+	76-73	C	72-70	C-	69-60	D	59-0	F

Late Policy:

Late homework are accepted (unless a solution is posted, of course) but at a cost of 20% deduction per window of 24 hours after the due time. (So, if you submit 1 second after the due time, you get a deduction of 20% of whatever your grade is. After four days, you get zero.) Missed exams may not be made up. If an emergency forces you to miss an exam, permission to be excused must be sought from me in advance, if possible. The final exam score will replace the score of the missed exam.

Academic Integrity:

Plagiarism and academic misconduct are defined in the University Academic Integrity Code www.american.edu/academics/integrity/index.htm.

You should be familiar with what constitutes academic dishonesty. Any information taken from the internet, books, or anywhere else for use on your assignments must be cited. You are permitted to discuss your work with other students at the conceptual level only (that means not in front of a computer and not while taking notes). Your work must be entirely your own work (or your group's work if working in a group). Unless otherwise stated, all exams will be closed-book, closed-notes. Instances of plagiarism may be reported and could result in disciplinary action.