EECS 210: Discrete Mathematics
Spring 2020

Instructor:	J. Garrett Morris
Email:	garrettm@ku.edu
Office hours:	TH 2:20–4:00, *and by appointment*, Eaton 2028
TA:	Scott Costen
Email:	costonjs@ku.edu
Office hours:	W 3:00-4:00 PM, Eaton 3011
Lectures:	TH 9:30–10:45 PM, Learned 2133
Course website:	https://ittc.ku.edu/~garrett/eecs210s20/
	https://piazza.com/ku/spring2020/eecs210

Description. Edsger Dijkstra (1972 recipient of the Turing Award) has said that "computer science is no more about computers than astronomy is about telescopes". This course will introduce you to the concepts and intellectual tools needed to separate (the ideas of) computer science from any particular choice of (that is to say, restriction to) particular machines and the ways they are operated.

We will frame these concepts in *formal mathematics*. (Although, at this point, it might be more correct to say that the foundations of mathematics lie in formal computer science.) If we want to talk about how long program X takes to run on machine M with data set A, we can rely on empirical measurement and observation. However, we will need something more than observation to validate claims about how long program X would take on an arbitrary machine or for arbitrary input data. This course, then, interleaves an introduction to mathematical reasoning with a survey of the basic objects, notations, and techniques used in computer science.

By mathematical reasoning, I mean *proof*. You should not find this intimidating. You may have think of proofs as a kind of rarified accomplishment produced by brilliant young theoreticians. And, some of you will be brilliant young theoreticians. But a proof is really just any believable mathematical argument—it's the advanced version of "showing your work". Proofs are the language of mathematics, and much of computer science; my own work is full of theorems and proofs. And, just as how in high-school algebra or calculus you learn standard approaches and useful tricks for solving probles, we'll discover that there are standard approaches and useful tricks for constructing proofs in computer science or mathematics.

We'll also learn about a collection of (formal) objects and ideas that will provide the foundation for much of what you'll learn in the rest of your CS education. We'll learn about sets, relations, and functions, which will serve as the foundations for our formal representations, and are closely connected to how we describe computation abstractly. We'll learn about combinatorics (which is a big word for counting) and probability, which lie at the foundation of many ideas in cryptography and data science. And, we'll learn about graphs and trees, which we can use to represent things from physical networks to interacting software components to programming language syntax.

Hopefully you're excited by what I've said so far, and eager to see how these ideas play out for their own sake. But I realize that many of you are future software engineers and systems architects, not future theoreticians. Why should you take this course? First, many of the ideas we'll begin to explore are relevant to practice. Logic underlies the development of new programming languages and new approaches to verifying programs in existing languages. For example, Amazon uses a tool called TLA+, based in formal logic, to assure

that key components of AWS won't crash or misbehave under load. Combinatorics and probability underlie public-key infrastructures, like RSA or elliptical-curve cryptography. These in turn guarantee everything from e-commerce purchases to the blockchains. Trees appear in many areas of computer science, from programming language compilers to geographic information systems to video game renderers.

I believe that the ideas of theoretical computer science are remarkable for both their beauty and their practicality. I hope by the end of this course, you'll agree. Welcome aboard!

Textbook. Our primary textbook is

- Rosen, *Discrete Mathematics and its Applications*, 8th edition.

You have a variety of options to obtain this book, including online access and loose-leaf editions available from the publisher and the KU bookstore. Rosen provides a comprehensive and thorough overview of the material in the course. Unfortunately, in my view, his explanations are not always the easiest to follow, or correct. I encourage you to do the assigned readings from Rosen, but warily. Ask yourself: "Does this explanation make sense?" "Do I understand the point of this example?"

We will supplement Rosen's explanations of some subjects. Rather than his account of recursion, we will use Jeff Erickson's, available at:

- Erickson, *Algorithms*, appendix 1 (proof by induction). http://jeffe.cs.illinois.edu/teaching/algorithms/notes/98-induction.pdf

I may provide additional supplemental material as the course proceeds.

Homework. There are 14 homework assignments, due each week of the semester except for the first week and Spring Break. Homework will be available on the course webpage and on Blackboard on Tuesday; homework will be due at the beginning of lecture on Tuesday. Late homework will not be accepted. We will drop your **3** lowest homework grades when determining your homework average. *You must receiving a passing grade on the homework to receive a passing grade in the class.*

Discussions. There will 13 discussion section problem sets. They will be distributed during discussion sections, and collected at the end. Late submissions will not be accepted. We will drop your **3** lowest discussion section grades when computing your discussion section average. *You must receive a passing grade on the discussion sections to receive a passing grade in the class.*

Exams. There will be 3 exams, on February 13th and March 19th during the regularly schedule class times, and during the University-assigned final time on May 15th. Exams will be held in the regular class room, and will be *closed book*. You will be permitted one hand-written page of notes, to be submitted along with your exam. However, you should not *require* any notes to complete the exams.

Grading. Grades will be assessed as follows. *This course will not use +/- grading in Spring 2020.*

Homework	10%	A	90–100%
Discussions	10%	B	80–89%
Exams	80%	C	70–79%
		D	60–69%
		F	0–59%

Keep in mind that you must pass the homework and discussion sections individually to pass the course. That is to say, if you have a 75% exam average, but 50% averages on the homework and discussion sections, you will not pass the class.

Evaluating academic work is a necessarily imprecise discipline. I will adjust the thresholds down if I think that they are not accurately reflecting student accomplishment; I will not adjust thresholds up. *You must receive a passing grade on the exams to pass the course.*

Honesty and academic misconduct. The work you submit in this course should be yours, and yours alone. You are encouraged to discuss course materials, including homework problems, with the other students in the class. However, you should only submit work that is entirely yours, and has not been derived from other sources or been shared with other students. Submitting work that is not yours is academic misconduct, and will result in receiving a score of 0 on the assignment or exam, and being reported to the chair of the department. You should be aware of the university's academic misconduct policies: http://policy.ku.edu/governance/USRR#art2sect6.

There is an ever escalating arms race between the makers of automated systems for detecting cheating and the efforts of some students to get around them. I suggest that at this point it is probably easier to get passing grades honestly than dishonestly.

Accommodation procedure. The Academic Achievement and Access Center (AAAC) coordinates academic accommodations and services for all eligible KU students with disabilities. If you have a disability for which you wish to request accommodations and have not contacted the AAAC, please do so as soon as possible. They are located in 22 Strong Hall and can be reached at 785-864-4064 (V/TTY). Information about their services can be found at http://www.access.ku.edu. Please contact me privately in regard to your needs in this course.

Nondiscrimination. The University of Kansas prohibits discrimination on the basis of race, color, ethnicity, religion, sex, national origin, age, ancestry, disability, status as a veteran, sexual orientation, marital status, parental status, retaliation, gender identity, gender expression and genetic information in the University's programs and activities. Please contact the University's Title IX Coordinator at IOA@ku.edu with any inquiries.

Religious observances. Should the examination schedule for this course conflict with your mandated religious observance, please contact me at the *beginning* of the semester so that we can schedule a make-up exam at a mutually acceptable time. In addition, students will not be penalized for absence from regularly scheduled class activities which conflict with mandated religious observances. Students are responsible for initiating discussion with the instructor to reach a mutually acceptable solution.

Concealed Carry. Individuals who choose to carry concealed handguns are solely responsible to do so in a safe and secure manner in strict conformity with state and federal laws and KU weapons policy. Safety measures outlined in the KU weapons policy specify that a concealed handgun:

- Must be under the constant control of the carrier.
- Must be out of view, concealed either on the body of the carrier, or backpack, purse, or bag that remains under the constant control of the carrier.
- Must be in a holster that covers the trigger area and secures any external hammer in an un-cocked position
- Must have the safety on, and have no round in the chamber.

Instructors are allowed by Kansas Board of Regents policy, to require backpacks, purses and other bags be placed at the front of the room during exams, and as such those items will not be under the constant control of the individual. Students who choose to carry a concealed handgun in a purse, backpack, or bag must review and plan each day accordingly, and are responsible for making alternate arrangements as necessary. The university does not provide appropriate secured storage for concealed handguns.

Individuals who violate the KU weapons policy may be asked to leave campus with the weapon and may face disciplinary action under the appropriate university code of conduct.

Commercial Note-taking. Pursuant to the University of Kansas' Policy on Commercial Note-Taking Ventures, commercial note-taking is not permitted in EECS 210. Lecture notes and course materials may be taken for personal use, for the purpose of mastering the course material, and may not be sold to any person or entity in any form. Any student engaged in or contributing to the commercial exchange of notes or course materials will be subject to discipline, including academic misconduct charges, in accordance with University policy. Please note: note-taking provided by a student volunteer for a student with a disability, as a reasonable accommodation under the ADA, is not the same as commercial note-taking and is not covered under this policy.