CRN: 48258 MATH-022.35 1:30 PM Discrete Math, Spring, 2023

Instructor: Dr. Karl Schaffer
Class meeting days: Tue/Thu
Class time 1:30-3:45 PM
Classroom: Tue.Thu.: MLC 112
email: schafferkarl@fhda.edu (better than phone)

Office phone: 408-864-8214 (In limited use Spr. 2023)
Office: Online on both days, also in person on Thu.
Office Hours: Mon., 12:30 – 1:20 PM, Thu. 6:20-7:10 PM online and in MLC 112 (or by appointment)
Class web site: Canvas web site

Description: Elements of discrete mathematics with applications to computer science. Topics include methods of proof, mathematical induction, logic, sets, relations, graphs, combinatorics, and Boolean algebra.

Course Philosophy: Discrete Mathematics encompasses a variety of topics of contemporary importance in applications, especially in areas of decision science, information technology, and computer engineering, but also in diverse fields such as biology and the social sciences. The Mathematical Association of America recommends that the course be taught at the intellectual level of calculus. Discrete mathematics incorporates work with algorithms, which are the codified procedures used to solve particular problems. The course explores what proof is and provides students with practice in constructing proofs of different types, especially mathematical induction. Graph theory, which investigates how things are connected, and combinatorics, the science of counting complex arrangements, are important components of this course. The course explores recursion and may go as deeply into that subject as to include generating functions. It also includes an introduction to symbolic logic and set theory, and their ramifications, and notes how Boolean algebras arise in each of these subjects. As the seemingly diverse topics covered in this course are examined, the student discovers that these distinct topics are interwoven and interrelated at many levels. Discrete mathematics can engage the student in challenging problem-solving, and leaves room for the instructor to include topics of contemporary and historical interest and the world-wide history of these topics.

Text: The primary free e-text that we will use is *Discrete Mathematics: An Open Introduction, 3rd edition, by Oscar Levin*. You may freely download and print pages from the pdf version, or purchase a paperback copy on Amazon for $15. We will begin with chapter 5.2, pages 307-324, an "Additional Topic" in Levin's text, due the centrality of the ideas of number theory and modular arithmetic in many areas of contemporary mathematics including encryption. Please at least download a copy of this text prior to the first class meeting.

We will also sometimes use material or problems from several other non-current editions of excellent discrete math texts that are easily available in pdf form online:
Discrete and Combinatorial Mathematics, 5th edition, by Ralph P. Grimaldi, 2004.
Discrete Mathematics and its Applications, 7th edition, by Kenneth Rosen, 2012.
Schaum's Outline Discrete Math, 3rd edition. By Seymour Lipschutz and Marc Lipson, 2007.

It is always helpful to read additional sources on topics that you find confusing, since different authors might explain those topics in a way that is clearer.

For a more advanced look at many discrete math topics, you might read parts of Donald Knuth, Ronald Graham, and Oren Patashnik's *Concrete Mathematics: A Foundation for Computer Science*, 2nd edition, 2004. "Concrete Math" is those authors' name for a combination of continuous and discrete mathematics. For those of you planning to major in areas of computer science, Donald Knuth is the author of the immense and encyclopedic multi-volume set *The Art of Computer Programming*.

If you've read this far note that pdf solutions manuals for Grimaldi and Rosen are also freely available online, and often working backwards or getting hints from the first few words of a solution are a useful learning method. If you haven't read this far, oh well…!

Attendance: you are required to attend and participate in classes. Collaborative class exercises and quizzes will count towards your grade and must be completed during class time. One advantage of having two identical class sessions both of which I am teaching in MLC 112, one TT 1:30 – 3:45 PM and the other TT 4 – 6:15 PM is that if you must miss a class session for the section that you are enrolled in, you may attend the other class and get credit for any work assigned – just let me know that you are in the other class.

Grades: 90-100: A; 80-89: B; 70-79: C; 60-69: D; < 60 F, (no pluses or minuses) based on:

20% short quizzes or in-class assignments, usually to be given during class. These will almost always involve group work. 80% of the possible score will count as full credit, so there will be no makeups – that is, if there are ten such quizzes, and you miss class for two of them, you can still get full credit. One of your quizzes will be just a required visit to office hour to talk to me for 5 minutes at least about how the course is going for you.

Exams:
Exams are open book, notes allowed, in fact encouraged; however, if you are using an ebook for the text, you must print out any pages you need, since communication capable devices are not allowed during timed in-class exams. I always involve collaborative work in my classes. One of the responsibilities of collaboration is to acknowledge and cite ideas and work that are not your own, even if this involves ideas communicated through casual conversation. We will practice such acknowledgement in group work; for example, for group quizzes, each student will turn in a paper, but give the names of those they worked with and cite important contributions of others.

Academic dishonesty regarding tests in this class is defined as using resources not made available by me to everyone in the class during the testing time. Academic dishonesty includes plagiarism. Note that we are finding that AIs like ChatGPT are good at solving simple one answer calculation problems, but are comedically terrible at giving explanations or proofs for more challenging math problems.

20%: one-hour in-person exam, to be taken on Thu., May 4- Bring a scantron (the half page kind). Written notes or written materials are allowed, but communication capable devices are not allowed when taking exams. There will be no make-ups or early exams. The final exam will be used to replace this exam **ONLY** if final is higher.

20%: Exam 2 will include as the major part a report assigned as both written paper and class presentation. Due date will probably be **Tuesday, June 13**, though more details will be announced.

20% Homework assignments. Homework is assigned during each class and posted at the Canvas web site. Your homework will be turned in on Canvas **ONLY** by the assigned due dates, which will be approximately every two weeks. Homework is graded for completion, not correctness – show work and attempts on problems you are not sure about. **NO LATE HOMEWORK ACCEPTED.** You may miss one homework assignment and still receive full credit.

20% Final Exam: mandatory, comprehensive, given on **Tue., June 27, 1:45 -3:45 PM.** There will be no make-ups or early exams. The final exam score may be used to replace the first exam score, **if and only if** the final exam is higher and would raise the grade.

NO LATE WORK IS ACCEPTED - NO MAKE-UPS. IF YOU MUST MISS THE FIRST MAJOR EXAM, IT WILL BE REPLACED WITH THE FINAL EXAM SCORE, BUT THIS IS NOT A GOOD IDEA! IF YOU GET BEHIND DO THE MOST RECENT WORK FIRST, KEEP YOUR WORK CURRENT!

Some background on the instructor: I have a Ph.D. in Mathematics from UC Santa Cruz, did undergraduate work at Univ. of Chicago and Univ. of Alabama, and I grew up in New England and Alabama. I do research in the mathematics of networks or graph theory and am a contemporary dancer and choreographer. The dance company I co-direct often performs concerts about math and dance, as well as issues of social justice (see http://www.mathdance.org/) and we have performed throughout North America and internationally. I am on the Teaching Artist Roster of the John F. Kennedy Center for the Performing Arts for work integrating dance and mathematics and have published widely on the connections between those disciplines. In case you're interested, our dance company's next show will be Apr. 21 and 22 at the Scotts Valley Performing Arts Center; this concert is a six-woman performance of *Nevertheless She Persisted: the Daughters of Hypatia, a Mathematical Herstory,* about important women mathematicians throughout the ages, info here. (If students in this class are interested in attending I will get you a code for discounted tickets.)

Student Learning Outcome(s):

*Critique a mathematical statement for its truth value, defend choice by formulating a mathematical proof or constructing a counterexample.
*Analyze and apply patterns of discrete mathematical structures to demonstrate mathematical thinking.

Office Hours:

M	12:30 PM	01:20 PM	Zoom
TH	06:20 PM	07:10 PM	Zoom