COMP 283–001: Discrete Structures

Lectures: TTh 2:00 – 3:15pm, Hanes Art Ctr. 121 (map)
Instructor: Jack Snoeyink, DM on Campuswire, Sitterson 329
(Less preferred alternatives: cell: 919-344-4226, snoeyink@cs.unc.edu)
TA: DM on Campuswire: Ankur Sharma
LAs: DM on Campuswire: Mattheus Bezerra, Jeane Carruthers, Audrey Dockendorf, Matthew Gregoire, Eli Handwerk, Natalie Huggins, Stephanie Lu, Rosh Sharma, Eric Zhu
Office hours: TBA on Campuswire (or by appointment)

Welcome: Underlying the many applications of computers in our daily life are discrete structures like Boolean logics, relations, finite state machines, graphs, and networks that have mathematical specifications. You can tell your parents that the primary purpose of this class is to introduce these discrete structures and the formal proof techniques that support the production, verification, and maintenance of correct software. In fact, many of these are familiar from puzzles and games: already in 1990 Super Mario World expects kids to immediately understand a finite state machine diagram…

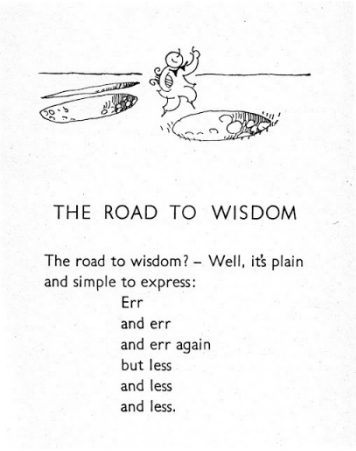
This is a language class: you will learn vocabulary and idioms of a language that is more precise and less ambiguous than the languages that we usually speak or write. With any new language, you may at first struggle to make yourself understood, but by frequent immersion and fearless practice you can become comfortable thinking and expressing yourself creatively in the language. Students pick up languages at different rates, so work to teach each other. All can gain fluency with effort and a willingness to make mistakes. And fluency will help all your computer science endeavors – precise and unambiguous language helps you catch mistakes early, when they are cheaper to fix.

Math381, Discrete Mathematics, shares many of our goals of teaching formal reasoning and mathematical rigor, but they do so by delving deeply into number theory. We will find our examples more broadly, so that we can also provide students with a toolbox of mathematical techniques and concepts that are fundamental in most areas of computer science.

Prerequisites: 1st semester of Calculus, an enjoyment of puzzles, and a willingness to work to separate truth from falsehood.

Principles: Several principles inform the design elements of this course.
Come to class prepared, having read assigned chapters (textbook). As in a language class, keep a notebook or flashcards of vocabulary and idioms (quizlets), speak and write without worrying about mistakes (campuswire), spend time immersed (collaboration), hear from many voices (cohorts, youtube). Regular short practice is better than a long cram session (quizzes). We use advanced material to exercise the basics (small type). The aim is not to memorize (cheat sheets). Spend time to understand a problem: draw figures, create notation (scratch paper). Math is not a spectator sport (hidden text in textbook). Write solutions precisely and concisely. Be skeptical; always ask, "What could go wrong?" You learn best by teaching (groups).

Textbook: I am writing the book for this class; Sakai>Resources>Textbook has pdfs for different screen sizes. I recommend Adobe Acrobat (software.sites.unc.edu/adobe/) or Reader, Apple Preview, or Foxit Reader (www.foxitsoftware.com/pdf-reader/), all of which support annotation and tooltips that I use for dynamic content. Comments and corrections welcome; I've set up a forum on sakai to receive them. If you annotate the pdf in Adobe, the comment panel at right lets you to save just the comments by clicking Options»"Export all as Data File..." Add your name to the file name and save as fdf (e.g. dsbook200105_yourname.fdf). I can merge these as I make improvements.



Other texts: Other good texts: Epp's "Discrete Math with Appl," 4th or 5th ed (new $240). Rosen's "Discrete Math and its Appl." is also good, if you get the whole book. (Math381 uses a custom-print subset.) It has useful self-assessments online. A great, more advanced text is Invitation to Discrete Math, 2nd ed., by Matousek and Nesetril.

Sakai: sakai.unc.edu hosts lesson plans, handouts, assignments, and the on-line gradebook. Access with your ONYEN onyen.unc.edu; Reset passwords in the Ugrad library basement.

Campuswire: https://campuswire.com/p/GD29E3743 is the question and answer site. code 3709. The instructor, LAs, and your classmates can answer your questions (like *piazza*). You can also form Campuswire groups to communicate with your study group.
Several assignments will ask you to answer questions and comment/vote on others' answers on https://campuswire.com/p/GB09DD178, code 6302, (like *stack overflow*). Specific instructions and due dates will be posted on sakai (see Assn 2, for example). Please do not delete text or posts that have comments; use ~~strikethrough markup~~ (double tilde) to ~~scratch out text~~.

Gradescope: www.gradescope.com for written assignment and quiz feedback: click **Sign Up** on their home page, select Student, and paste entry code **9DYXJV** in the form.

Groups & assigned seating: I'm experimenting with assigned groups and seating to facilitate in-class activities, and to give you a study group that you can meet outside of class. The pre-class survey (https://unc.az1.qualtrics.com/jfe/form/SV_38HPA6F3uJaODEF) asks for your available times.

Other technology: Quizlet flash card sets: https://quizlet.com/join/W7tYbxNeB, Polleverywhere for in-class polls: https://poll.unc.edu, and a YouTube channel with just a few videos and playlists so far.

Evaluation Grades are based on Assignments (17%), Thurs quizzes (17%), two midterms, and a final exam (28%), and participation (5%) using data from Campuswire and Polleverywhere,

Assignments: See Sakai>Assignments for instructions for all assignments. Some will also be submitted on sakai, but many will be staged on the Campuswire Assn site. (See Assn 2). Assignments are due at midnight; late assignments are accepted until the grader begins grading. Once grading has begun, late assignments are not accepted.
Look at assignments early, even if you don't plan to write solutions until they are due. Remember that you are communicating with a human – restate the question you are solving, distinguish between what you know and what you want to show, be neat, complete, and concise. Make sure images are readable, and staple if you hand in > 1 page on paper.

Thurs Quiz: Each expository chapter of the textbook has quiz prep questions that will be the basis for a 10-minute quiz at the end of class on most Thursdays. See also practice questions on Sakai Lessons. No makeup is given for missed quizzes, but the lowest two quiz scores are dropped. You are welcome to pose quiz questions on Campuswire.

Midterms and final exam are cumulative, and will have a combination of take-home and in-class problems. Midterms are planned for Thurs, 13 Feb and Thurs, 26 Mar. The course final is given in compliance with UNC final exam regulations is noon Monday, May 4.

Cheat sheet: For any in-class midterm or exam, you may take a one-page, 8.5x11in "cheat sheet" with whatever you want to write on it. (Definitions, formulae, theorems, words of encouragement…) You must, however, write it yourself; photocopies or scans are only permitted if that is how you reduce larger writing to smaller size. (The process of preparing a sheet is usually more valuable than the sheet itself.)

Collaboration: Collaboration is encouraged on assignments and on the take-home parts of the midterms and final. I insist that whatever you hand in must be your own writing/typing. (In-class portions will include questions to test your understanding of take-home portions). Good scholarship requires that resources used and collaboration be acknowledged. Thus, if you collaborate on the solution of a problem set, I expect that you list your collaborators at the top of the page. Collaboration on in-class evaluations is, of course, a violation of the Honor Code. http://www.cs.unc.edu/Admin/Courses/HonorCode.html

Creative opportunities: As mentioned under Textbook, I welcome your suggestions for improving the textbook. I'm told that I need to "dumb it down," but I'm also cognizant of "Lem's Law, 'No one reads; if someone does read, they don't understand; if they do understands, they immediately forget' -- owing to general lack of time, the oversupply of books, and the perfection of advertising." I also welcome quizlets, puzzles, videos you create or find, and will direct you to the LA czars who can make them available to the entire class.

Rough plan: Detailed schedule maintained on Sakai>Lessons.

Ch. (lectures)	Topic	Assn	Goal
1(1)	Problem solving	A1: Kara	Connect the topics to computing; form groups.
2(2)	Predicate logic	A2: Islanders	Likely familiar concepts; likely new notation.
3.1&4(2)	Sets & Quantifiers	quantifier ws	Extend logic (∀, ∃) to disambiguate English.
3(2)	Counting	A3: Counting	Sum & product rules to break complex problems down.
5&6.1(2)	Sets & Relations I	set ws; Mid1 TH	Define new operations and establish their properties.
1-5	**Midterm I**	13 Feb	Demonstrate facility with this new language & notation.
6(2)	Relations II & Functions	Mid redo	From common examples and their properties, we find a level of abstraction that lets us transfer insights.
7(3)	Math review	A4: Rel. properties	Log, exp, mod, floor, ceil, divides, and their properties.
9(2)	Proof		A challenge; hones skills of precisely breaking things down.
8(1)	Recursive defn	A5: Proof	Eliminating … from definitions by recursion.
10(2)	Induction I	Mid2 TH	Proving properties "for all" in small steps (also recursion).
1-9	**Midterm II**	16 Mar	Will make you put together concepts from across the class, so this will be challenging. (I expect 65% to be the average.)
10(1)	Induction II	A6: Induction	Induction often makes us change the problem to solve it.
11(2)	Deriving Algorithms	Binary Search ws	Proof helps us derive correct algorithms the first time.
13(4)	Graphs & Trees	A7: Notebook	Applying definition and proof in graph theory.
cumulative	**Final Exam**	4 May	Note: collect your cheat sheet items throughout the class, and you'll be ready when this comes.