Syllabus for CSC/MAT 220A/B
Discrete Structures

Fall 2019
Section A: MWF 12:30pm-1:20pm, Chambers 3068
Section B: MWF 1:30pm-2:20pm, Chambers 3068
Lab days: Chambers LRC
(aka B261 in South Basement)

> *Success is not final, failure is not fatal: it is the courage to continue that counts.*
> *-attributed to Winston Churchill*
>
> *Develop success from failures. Discouragement and failure are two of the surest stepping stones to success.*
> *-Dale Carnegie*

Instructor: Heather C. Smith
Email: hcsmith@davidson.edu
Office: Chambers 3039

Office Hours (tentative): Monday and Wednesday 2:30pm-3:30pm,
Tuesday 9:00am - 10:30am,
Thursday 1:00pm - 2:30 in Chambers 3039
and by appointment

I. **Textbook** E. R. Scheinerman. *Mathematics: A Discrete Introduction, 3rd edition* Brooks/Cole Cengage Learning, 2013.

II. **Course description** An introduction to proof techniques and discrete mathematics, with a focus on topics relevant to computer science, and an introduction to functional programming. Topics include logic, sets, functions, equivalence relations, algorithm analysis, methods of proof, essential combinatorics, recurrence relations, and discrete probability, as well as the essentials of functional programming. Additional topics may be selected from graph theory, number theory, or automata theory. This course prepares students for advanced work in both computer science and mathematics.

III. **Prerequisites** A passing grade in MAT 140, MAT 150, or MAT 160, and the ability to program in a high-level language such as Python, C++, or Java at the level expected in CSC 121 or an equivalent course.

IV. **Learning Outcomes** Upon successful completion of the course, students should be able to:

- Logic and Proof Techniques
  - Convert logical statements from informal language to propositional and predicate logic expressions.
  - Use the rules of inference to construct proofs in propositional and predicate logic.
  - Outline the basic structure of each proof technique (direct proof, proof by contradiction, proof by contrapositive, and induc- tion) and apply each correctly in the construction of a sound argument.
  - Determine which type of proof is best for a given problem.
  - Explain the parallels between ideas of mathematical and structural induction to recursion and recursively defined structures.
  - State the well-ordering principle and its relationship to mathematical induction.
- Sets, Relations, and Functions
  - Explain with examples the basic terminology of functions, relations, and sets.
  - Perform the operations associated with sets, functions, and relations.
  - Relate practical examples to the appropriate set, function, or relation model, and interpret the associated operations and terminology in context.
- Basics of Counting
  - Apply counting arguments, including sum and product rules and the inclusion-exclusion principle.
  - Map real-world applications to appropriate counting formalisms, such as determining the number of ways to arrange people around a table, subject to constraints on the seating arrangement, or the number of ways to determine certain hands in cards (e.g., a full house).
  - Apply the pigeonhole principle in the context of a formal proof.
  - Solve a variety of basic recurrence relations.
  - Analyze a problem to determine underlying recurrence relations.
- Discrete Probability
  - Calculate probabilities of events and expectations of random variables.
  - Differentiate between dependent and independent events.
  - Identify a case of the binomial distribution and compute a probability using that distribution.
  - Compute the variance for a given probability distribution.

- Graphs and Trees
  - Illustrate by example the basic terminology of graph theory, and some of the properties and special cases of each type of graph/tree.
  - Demonstrate different traversal methods for trees and graphs, including pre, post, and in-order traversal of trees.
  - Show how concepts from graphs and trees appear in data structures, algorithms, proof techniques (structural induction), and counting.

V. **Assessment and Grading**

- **In-Class Assignments:** In-Class Assignments will be given regularly, completed in groups, and worth 5% of the total course grade. They will primarily be graded for effort and will serve as an another opportunity for you to receive feedback on your proof-writing. *No make-up* in-class assignments will be given, but the lowest 3 scores will be dropped.
- **Homework:** Solving homework problems is the easiest, best, and perhaps only way to properly learn the material and prepare for reviews. Resist the temptation to search the internet for solutions, which is cheating yourself out of a learning opportunity! *Some struggle is expected and is necessary in learning mathematics.* You are encouraged to collaborate with your peers, but you must write your own submission *independently*. What you turn in should reflect your own understanding, i.e. you can redo what you turn in without external aid.

  Homework will be assigned almost every class, and will collected *every Friday* (except Fridays when full reviews are due). Check Moodle for current assignments. Homework grades will be assigned based on effort and correctness. A portion of your grade will reflect the amount of effort seen in your submission. The correctness portion of the grade will be earned from a careful grading of your work on a select few of the homework problems.

  Submitted homeworks *require* a properly filled out **cover sheet**, available on Moodle. Solutions are due at the *beginning* of class on the specified due date. Late homework will not be accepted.
- **Reviews:** We will follow a mastery-based system for reviews this semester. In short, you will only receive credit for standards on which you have displayed a mastery-level of understanding, but you will have multiple opportunities to display mastery. I will describe it in a bit more detail below, but please feel free to ask questions.

  There are a total of 25 standards that will be reviewed throughout the semester. The following table tells which standards will be included on which reviews.

Due Date		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Sept. 20	Mini Review A	✓	✓	✓	✓																					
Oct. 11	Review 1	✓	✓	✓	✓	✓	✓	✓	✓	✓																
Nov. 1	Review 2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓										
Nov. 15	Mini Review B																✓	✓	✓	✓	✓					
Dec. 6	Review 3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Dec. 11	Mini Review C																					✓	✓	✓	✓	✓
Dec. 18	Final Review	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

  Your work for each question will receive one of three letters: "M" for master, "J" for journeyman, or "A" for apprentice. Mastery means that you have achieved a deep understanding of the standard being tested, giving full justification for your answer. Journeyman means that you are well on your way to mastery, but there are some issues with your answer and you could benefit from reviewing the topic once more. Apprentice means that you need to review this concept more thoroughly.

  Once you master a standard, then you **do not** need to solve any more questions testing that standard on later exams. If you do not master a standard, then you can try another question related to that standard on a future review.

  Your overall review grade directly corresponds to the number of categories for which you have mastered a problem during or before the final exam. **If you master m standards, then your review grade will be $4m$.**

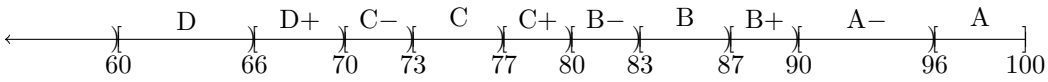
  We each learn at different paces, and this grading system gives you several chances to display mastery with no penalty attached to the number of attempts needed. A passing grade in this course indicates a

deeper, more complete level of understanding of the mastered material rather than just enough partial credit to get by. Your final grade will reflect your mastery of the material at the end of the course, making it possible to go into the final review on shaky ground and complete the course with a respectable grade.

- **Course Grades:** Grades will be weighted as follows:

5%	In-Class Assignments
20%	Homework
75%	Review Grade

Letter grades will be assigned as follows:



VI. Course Policies

- **Effective Failure:** Learning is about the journey, not just the destination, and that journey is not always smooth. We want a classroom environment where we can learn from one another and where we can celebrate "effective failure."

  Throughout the semester, there will be many different opportunities for you to share your knowledge, ask questions, and learn from your peers. There is no shame in making mistakes and we will all make them. Commit to learning from your own mistakes and those of your peers. In turn, commit to respecting your peers so that we can all learn together.

- **Attendance:** Daily attendance and participation is expected. If you miss a class period, please make arrangements with a classmate to obtain the class notes and any other material missed. Keep in mind that it is impolite and disruptive to arrive late or leave early unless you have notified me of this before class begins.

  The college attendance policy (missing 25% of classes results in an automatic F) will be enforced. In addition, any and every absence after 6 will result in a reduction of 1 from the total number of standards you have mastered in the calculation of your review grade.

- **Late work:** Late work will NOT be accepted. You are welcome to submit homework assignments early if you will not be in class.

- **Disruptions:** Disruptive behavior of any kind will not be tolerated. All electronic devices should remain silenced, put away, and NOT USED during class unless otherwise specified. If you have a potential emergency and need to check your phone during class, please let the me know before class begins.

- **Honor Code:** The Honor Pledge of Davidson College states: "On my honor I have neither given nor received unauthorized information regarding this work, I have followed and will continue to observe all regulations regarding it, and I am unaware of any violation of the Honor Code by others." This pledge applies to all work for our course.

VII. Important Dates

August 26, Monday	First day of classes for the fall semester
August 26–30, Mon.–Fri.	Drop/add Week 1 (online or in person at Registrar's office)
September 2–6, Mon. – Fri.	Drop/add Week 2 ($20 fee, in person only, instructor permission required)
October 14–15, Mon.–Tues.	Fall break – no classes
November 27–29, Wed.–Fri.	Thanksgiving break – no classes
December 11, Wednesday	Last day of classes for the fall semester
December 13–18	Final Examination Period

VIII. **Getting help** I personally believe that everyone in my class can succeed and I am here to help you do just that. If you find that you are struggling with the material or starting to fall behind, be proactive and seek help early. Here are some suggestions:

- **Office Hours:** I am perhaps your best resource for getting help. Office hours are times that I have specifically set aside for you. If you are unable to come at the posted times, please catch me before or after class or send me an email and we'll find a time that works for both of us.
- **Study Groups:** I strongly encourage you to work with your peers on homework and when studying for reviews. Support one another by embracing the diversity of previous experience and gifts for different subjects among your classmates.

IX. **Access and Accommodations**

The college welcomes requests for accommodations related to disability and will grant those that are determined to be reasonable and maintain the integrity of a program or curriculum. To make such a request or to begin a conversation about a possible request, please contact the Office of Academic Access and Disability Resources, which is located in the Center for Teaching and Learning in the E.H. Little Library: Beth Bleil, Director, bebleil@davidson.edu, 704-894-2129; or Alysen Beaty, Assistant Director, albeaty@davidson.edu, 704-894-2939. It is best to submit accommodation requests within the drop/add period; however, requests can be made at any time in the semester. Please keep in mind that accommodations are not retroactive.

X. **Meet potential study partners!**

Name:	**Contact Information:**
Name:	**Contact Information:**
Name:	**Contact Information:**
Name:	**Contact Information:**
Name:	**Contact Information:**