

# MATH 212-01: DISCRETE STRUCTURES (3 cr.)

## SYLLABUS & COURSE POLICIES

### DORDT UNIVERSITY

### SPRING 2024

*Last updated: 2024-01-05 13:12*

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<b>Instructor:</b>	Dr. Mike Janssen, Professor of Mathematics
<b>Email:</b>	Mike.Janssen@dordt.edu; I will endeavor to reply to every email within one school day.
<b>Classroom:</b>	SB 2736
<b>Class time:</b>	2:00–2:50 PM MWF
<b>Office:</b>	SB 1612
<b>Office Phone:</b>	(712) 722-6398
<b>Student Hours:</b>	By appointment: <a href="https://fantastical.app/mkjanssen/student-hours">https://fantastical.app/mkjanssen/student-hours</a>
<b>Required Resources:</b>	<i>Mathematics for Human Flourishing</i> by F.E. Su Access to our course notes: <a href="https://prof.mkjanssen.org/ds/notes">https://prof.mkjanssen.org/ds/notes</a> Regular access to Overleaf.com for Written Work
<b>Prerequisite:</b>	Grade of C– or better in Math 152

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**Catalog course description:** A study of topics in discrete mathematics that are relevant to computer science and mathematics, including logic and proof, induction and recursion, elementary set theory, combinatorics, relations and functions, Boolean algebra, and introductory graph theory. Prerequisite: a grade of C– or better in Math 152.

## COURSE OVERVIEW

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Welcome to Discrete Structures! I am glad you are here. This course represents a shift in your mathematical education in multiple ways. First, we'll be studying mathematics that is discrete in nature, as opposed to the continuous mathematics of analytic geometry and calculus.

Second, this course marks a transition point in your mathematical education. Most high school and early university math courses tend to consist of fairly straightforward problem-solving in which there is 'one right answer'. Not so in this class. Our primary concern will be to develop reasoning and proof-writing skills in foundational areas, and apply these skills to questions in discrete mathematics. Writing proofs is an art, and our course will allow for ample opportunities to develop that art.

## LEARNING OBJECTIVES

In this course, students will:

be *communicators* through regular presentations to the Math 212 learning community and growing fluency in the writing of mathematical proofs. (CD)

be *explorers* by engaging with in-class activities and regular work outside the classroom. (CD)

be *learners* by leveraging knowledge of logic, functions, and sets to explore foundational questions in discrete mathematics. (CS)

be *ambassadors* of mathematics by reflecting on the ways the practice of mathematics can promote human flourishing. (RO, CD, CR)

# COURSE LITURGIES

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In this section, we briefly describe the basic rhythms of the course. It is a truism that mathematics is not a spectator sport, and this course is designed with that in mind. There are two types of regular work in this course: daily work, and written work.

## DAILY WORK

The work of the course will be primarily driven by you, the student.

## PROBLEMS AND PRESENTATIONS

You will be assigned approximately three to seven problems from the course notes to work on before coming to class. You may not use any outside resources to help you solve these problems—NO BOOKS, NO WEBSITES, NO FRIENDS WHO HAVE TAKEN THIS COURSE BEFORE. Using these resources will constitute plagiarism and will be reported to the Student Life Committee. You *may* work with others currently enrolled in the course, but you will need to ensure that you can completely understand and explain the solutions and proofs you come up with.

One of the main goals of this course is to improve your mathematical communication. Thus, the majority of each class period will be devoted to you PRESENTING YOUR WORK on these problems to the class. You should expect that approximately 90% of the typical class period will consist of presentations and discussion.

By 11:00AM before each class, you will claim on Canvas problems whose solutions you are willing to present. In general, you will be allowed to present at most one problem per class meeting. You will earn 0.1 daily work points per problem you sign up to present, even if you are not ultimately the person to present it.

Daily jobs (presenter, support, scribe) will typically be assigned by 12:00pm on Canvas.

You will then write the problem and solution up on the board, highlight the main points of the proof/solution, and generally lead the class discussion. THAT IS, MERELY WRITING THE SOLUTION ON THE BOARD WILL NOT BE SUFFICIENT TO EARN FULL CREDIT. The presenter will earn points as follows.

1 POINT. The solution/proof is correct and complete, the explanation clear, and all questions are answered.

1/2 POINT. The solution/proof was prepared, but there are gaps in the solution/explanation, and/or questions that are not satisfactorily answered.

−0.1 POINTS. The solution/proof was either not prepared or is in completely the wrong direction.

## SUPPORT

Of course, not everyone can be assigned the problems they sign up for. However, you may be assigned as *support* for a given problem, typically a problem you've indicated a willingness to present. Prior to the presentation, it is your job to make sure that the presenter's written proof is clear. During and following the presentation, it is your job to try to answer any questions alongside the presenter. Engaging as a problem support person will earn you half the credit of the presenter (1/2, 1/4, or −0.05 points).

## SCRIBES

Each presented problem will also have a *scribe* assigned on Canvas. The first problems will be scribed (more or less) in alphabetical order by last name, and subsequent scribes will be assigned in ascending order from least daily work points to most.

The scribe will have the responsibility of taking notes on the presented proof and asking questions when something is not clear. They then will write up a formal version of the proof AND discussion and post it to our Overleaf document. The scribe will earn 1/4 point when a correct, *well-written* proof is submitted.

## ACADEMIC INTEGRITY

This course structure effectively models the way professional mathematicians conduct and share their research. Thus, we will abide by the Policy Statement on Ethical Guidelines<sup>1</sup> adopted by the American Mathematical Society, in particular Section I on mathematical research and its presentation. As this statement describes, “[t]he knowing presentation of another person’s mathematical discovery as one’s own constitutes plagiarism and is a serious violation of professional ethics. Plagiarism may occur for any type of work, whether written or oral and whether published or not.” When you present your work in this class, both orally and in writing, you must cite ANY CONVERSATIONS you have had about your problem with ANYONE IN THE CLASS. Looking to ANY RESOURCE outside of the people in our class—including generative AI models like ChatGPT!—for information about the problems at hand constitutes plagiarism and will be reported to the Student Life Committee.

Daily work points will be monitored and factored into the final grade.

## WRITTEN WORK

Roughly every other week (other than the weeks we have exams), you will be assigned three problems to solve, write up, and submit online by 11:59pm on **Jan. 19, 31; Feb. 14, 28; Mar. 20; Apr. 3, 17**. These will be written in  $\LaTeX$ , and will generally not be problems that have been presented in class (though they may have been assigned as daily work). Each problem will be graded on a four-level scale (each explained more fully on the proof rubric distributed on Canvas) as:

Exceeds expectations. Dr. Janssen would be happy to post this as the official class solution.

Meets expectations. The logic is generally correct and it is reasonably well written, but there is room for improvement.

Revision needed. Some major gaps in logic, misuse of notation, or unclear communication requires revision.

Not assessable. This is difficult to read, abuses notation, or contains significant mathematical flaws. Probably best to start over.

Writing proofs is as much art as science, and initially it can seem daunting and confusing. If you submit by the deadline above, you will receive a first round of feedback from an experienced teaching assistant by the following Monday. You’ll then have until Friday of *that* week to submit a revised version of the homework based on the TA feedback. Dr. Janssen will then give an initial assessment and feedback which may be revised once before becoming final.

In short, your submissions will go through the following workflow:

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<sup>1</sup>See the AMS website for more: <http://www.ams.org/about-us/governance/policy-statements/sec-ethics>.

- (a) Initial submission due 11:59pm Wednesday
- (b) Initial feedback returned (no grades)
- (c) First revision submitted; grades returned within a week
- (d) Second revision submitted/graded

Your written work *must* include an acknowledgments section or it will be returned ungraded. You may work on this homework with others in the course, but if you discuss ANY mathematical content of any problem with another person, you *must* include their name in the acknowledgments, and ensure that your final writeup is completely your own. EVEN IF YOU DISCUSS A PROBLEM WITH SOMEONE AFTER YOU TURNED THE ASSIGNMENT IN, but before the assignment is due, you should resubmit the assignment and acknowledge the conversation! Looking to ANY RESOURCE outside of the people in our class for information about the problems at hand constitutes plagiarism. Failure to meet these criteria will constitute academic dishonesty and will be reported to the Student Life Committee.

Work submitted more than 24 hours late or work initially assessed at an N requires a meeting with Dr. Janssen and short accompanying reflection on why the work was assessed at an N and how such assessments will be avoided in the future. If earning an N becomes a regular occurrence on written assignments due to perceived lack of effort, you may lose the grace afforded by the revision process and only be allowed a single submission.

## PORTFOLIO

At the end of the semester, you will compile a selection of your work (both written and daily), along with 3–5 new problems, into a portfolio, due at the final exam time, which is 3:30pm on Tuesday, May 7. An initial (ungraded) draft may be submitted for feedback by April 22. You'll then each present your favorite problem from the semester during the final exam timeslot. More details will be available on Canvas.

## REFLECTIONS

As we mature in our mathematical studies, we'll consider the formative nature of mathematical practice. (Former Dordt First Mondays Speaker) Francis Su argues that mathematics can help inculcate certain virtues in its practitioners. We'll read Su's book in chunks, complete reflection essays, and discuss them in class. Reflection assignments will be due **Feb. 2, 23; Mar. 22; Apr. 19**. See the reflection assignments' Canvas pages for more details.

## EXAMS

There will be one oral exam, held at the end of the semester. The Exam and Portfolio will average together to be a major component of your final grade.

## OTHER POLICIES AND ADVICE

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I am generally fairly accepting of late work, with a built-in 24-hour grace period for any non-classroom activities. Additional time beyond the 24-hour grace period must be approved ahead of time.

**Student hours** are your time to ask questions about all aspects of the class and college life. Please check online for an appointment. If you can't find one, send me an email! I will do my very best to accommodate your you.

**Email Policy:** I check my email twice per school day: once in the morning, where I'll deal with any emergencies, and once in the afternoon, when I'll respond to other emails (including any that have come in since the morning). If you require a more immediate response, you're welcome to come find me in my office.

**Policy on Generative AI:** Unless specifically permitted by Dr. Janssen in advance of student submission of work, any use of AI will be considered a breach of academic integrity. Suspected cases of misuse of AI tools will be treated as plagiarism and submitted to the Student Life Committee.

## GRADING POLICY

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In general, the **highest fully completed row** in Table 1 will determine your final grade<sup>2</sup>.

Grade	DW Points	WW Pass	WW E	Reflections	Exam/Portfolio
A	42	18/19	13	4	87%
A-	40	17/19	11	4	84%
B+	38	16/19	9	4	80%
B	36	15/19	8	3	77%
B-	34	14/19	7	3	74%
C+	32	13/19	6	3	70%
C	30	12/19	5	3	67%
C-	28	11/19	3	2	64%
D	20	10/19	0	1	55%

Table 1: The Final Grade table.

## TENTATIVE SCHEDULE

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As the course will be driven by your work and interests, it is difficult to predict the amount of time that will be spent in each chapter. However, here is my best guess.

- Chapter 1, Logic: January 12–24
- Chapter 2, Introduction to Graphs: January 26
- Chapter 3, Proof Techniques: January 29–February 16
- Chapter 4, Set Theory: February 19–March 18
- Chapter 5, Relations and Functions: March 20–April 8
- Chapter 6, Further Explorations in Graph Theory: April 10–April 24
- Chapter 7, Infinity: April 26, 29

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<sup>2</sup>The A-level for Daily Work was obtained thusly: 85% of 240 daily work signups (20.4 points), scribing your share of daily work (3 points), and presenting your share of daily work (including support; 18 points):  $\lceil 20.4 + 3 + 18 \rceil = 42$ .

# INSTITUTIONAL POLICIES

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## **DORDT UNIVERSITY STUDENT'S RIGHT TO ACCOMODATIONS POLICY**

Dordt University is committed to providing reasonable accommodations for students with documented qualifying disabilities in accordance with federal laws and university policy. Any student who needs access to accommodations based on the impact of a documented disability should contact the Coordinator for Service for Students with Disabilities: Sharon Rosenboom, Academic Enrichment Center, 712-722-6490, Email: Sharon.Rosenboom@dordt.edu.

## **DORDT UNIVERSITY ACADEMIC HONESTY POLICY**

Dordt University is committed to developing a community of Christian scholars where all members accept the responsibility of practicing personal and academic integrity in obedience to biblical teaching. For students, this means not lying, cheating, or stealing others' work to gain academic advantage; it also means opposing academic dishonesty.

Students found to be academically dishonest will receive academic sanctions from their professor (from a failing grade on the particular academic task to a failing grade in the course) and will be reported to the Student Life Committee for possible institutional sanctions (from a warning to dismissal from the university). Appeals in such matters will be handled by the student disciplinary process. For more information, see the Student Handbook section concerning Academic Integrity.

## **DORDT UNIVERSITY ATTENDANCE POLICY**

Class attendance policies and procedures as outlined in the Student Handbook are in place. To paraphrase the Student Handbook, Dordt University as an institution remains committed to in person instruction for face-to-face courses. As a result, you are expected to be present for every class period and laboratory period. Should you need to miss class for any reason, contact your instructor as soon as possible (either prior to the absence or immediately following). If the absence is the result of a documented disability, academic accommodations will be handled by the Coordinator for Service for Students with Disabilities. Absences for Dordt-sponsored curricular or co-curricular activities will be communicated by the activity sponsor and are considered excused. You are responsible to contact your instructor to make arrangements for missed work. Your instructor is not required to provide real time (synchronous) learning for you should you be absent for class for any reason (e.g., Zooming into your real time class). Your instructor is also not required to provide asynchronous virtual learning materials for you (e.g., recordings of missed classes, slide decks, other materials on Canvas). While some instructors might utilize some of the synchronous/asynchronous methods of making up work on occasion, you should not expect all instructors to provide these experiences automatically. Methods of making up missed work might include: contacting a fellow student to get notes from class, extensions on assignments or labs, or other methods as determined by your instructor. Making arrangements for missed class work is your responsibility! Please see your instructor's specific attendance policy.

**I reserve the right to make changes to this document as the need arises.**