

COMP 3004-1 Bridge Course: Discrete Math and Algorithms

Course Description

This course develops the discrete math and algorithmic foundations of security and privacy. We will study logic, sets, functions, proofs, counting, graphs, hashing, and cryptographic foundations with an emphasis on how they show up in security work.

The course is theoretical, but it is not meant to be detached from practice. The goal is to become better at reading technical material, building models, checking reasoning, and explaining why a conclusion is justified.

Topics Covered

By the end of the course, students should be able to use discrete mathematics and algorithmic reasoning to:

- Analyze propositions, predicates, quantifiers, truth tables, logical equivalences, and satisfiability.
- Model identities, permissions, mappings, state spaces, and transformations using sets, functions, and sequences.
- Read technical documentation, formal specifications, and algorithm descriptions carefully enough to identify assumptions, inputs, outputs, and limitations.
- Use rules of inference, proof techniques, proof of correctness, and loop invariants to justify conclusions.
- Apply divisibility, congruence, and modular arithmetic to understand RSA and Diffie-Hellman conceptually.
- Reason about attack complexity using instruction counting, Big-O notation, tractability, brute-force limits, and exponential blowups.
- Use graphs, permission graphs, trust graphs, depth-first search, breadth-first search, and shortest paths to reason about access, network structure, anomaly detection, and trust ranking.
- Calculate and interpret probabilities, entropy, false positives, false negatives, collision risk, and risk scores.
- Analyze hash tables, cryptographic hashing, collisions, integrity, and related security assumptions.

The exact pacing may change based on class needs, but Canvas will contain the current readings, activities, assignments, and due dates.

Textbook & Materials

The course will use two recommended references. Specific assigned readings, slides, links, and alternatives will be posted in Canvas.

- Kenneth H. Rosen, *Discrete Mathematics and Its Applications*, for discrete mathematics.
- Aditya Y. Bhargava, *Grokking Algorithms, Second Edition: An Illustrated Guide for Programmers and Other Curious People*, for algorithms and data structures.

Both books are readily available in print and electronic formats. Students do not need a specific edition unless an assignment states otherwise.

You will need a good internet connection and a laptop that meets DU specifications. For technical support in using Canvas, please go to <http://otl.du.edu/knowledgebase/canvas>.

Meeting Times

Class meets on Mondays and Wednesdays from 5:00 PM to 6:50 PM.

Location: University Park Campus, Engineering & Computer Science, Room 201.

Instructor Information

Instructor: Alex Stevens
Email: Alex.Stevens@du.edu
Office: ECS 345

Instructor Availability

Office hours are Mondays and Wednesdays from 4:00 PM to 4:50 PM in ECS 345.

For a one-on-one Zoom meeting or a coffee chat about computer science, please use this scheduling link: [schedule a time with Alex](#).

I am also very available on Slack. Message me there whenever something comes up and I will get back to you when I am able. I am likely quicker to respond to Slack messages than email.

For questions that may be of general interest, please post them in the course Slack so everyone can benefit from the answer. For personal questions about grades, absences, extensions, or other private matters, please send me a direct Slack message or email.

Notifications and Email Communication

Your email address in Canvas is the email address that will be used for official course communications. Please check to make sure that this is an email account that you check regularly.

Also check your Canvas settings for email notifications. Click "Settings" in the red menu bar at upper right, then click "Notifications" in the panel on the left. Your "Announcement" setting should be "✓ASAP"; adjust other notifications as desired.

Attendance

Attendance at scheduled Core Assessments is required. Attendance at class is *highly recommended*; class discussions will often cover material not in the book. Should you need to miss a class, please check with a classmate for notes and also check Canvas for any announcements or assignments. If you cannot attend a Core Assessment for any reason, or are unable to complete an assignment, contact me as soon as possible *in advance*.

Core Assessments

Core Assessments are mastery-based individual assessments of the central course ideas. There are three Core Assessments:

- **C1: Logic and Satisfiability**
- **C2: Sets, Functions, and Sequences**
- **C3: Rules of Inference and Proof Techniques**

Each Core Assessment is worth 5% of the course grade, for 15% total. Students may attempt each Core Assessment repeatedly through the end of Week 10. When scheduling allows, there may be one opportunity after each class.

Core Assessment attempts are timed. Banked questions and solutions will be available beforehand so students can study from the full set of possible problems. Students are encouraged to use whatever means are helpful while studying, including notes, classmates, office hours, online references, and tools. Tutoring and outside-class support from the instructor or a graduate teaching assistant can be very helpful for Core Assessments; please chat with me if you would like help making a study plan. During a timed Core Assessment attempt, students work individually and follow the instructions for that attempt.

The highest attempt counts. A result of **Exceeded** earns full credit for that Core Assessment. A result of **Met** earns 80% for that Core Assessment. A result of **Not yet met** earns 0 until a later attempt meets or exceeds expectations.

The scheduled final exam period is reserved as a final opportunity to complete Core Assessments. The exact timing and format will be announced in Canvas.

Final Presentation

The course also includes a Final Presentation on a data structure, algorithm, or closely related cybersecurity theory topic. The assignment and rubric in Canvas describe the

expectations for topic selection, historical context, theoretical understanding, modern impact, experimental comparison, and technical communication.

Weekly Reading Quizzes

Weekly Reading Quizzes will be administered through Canvas throughout the quarter. They are a regular way to check your understanding of the assigned reading before or around class. They will usually take about 30 minutes.

You should be comfortable explaining the reasoning behind any answers you submit. You are welcome to ask the instructor or TA questions after submission as part of reviewing your understanding.

Weekly Group Readings

Weekly Group Readings and groupwork are collaborative class activities connected to the week's readings, problems, and Core Assessment skills. These activities will include study sessions for the Core Assessments.

Weekly Group Readings will normally take place during the first course meeting of the week. The lowest Weekly Group Readings grade will be dropped.

Homework

Homework and projects give students practice applying theory to concrete problems, examples, and cybersecurity-motivated cases. Electronic copies are due at the time specified on Canvas. Source code, when required, must be submitted as source code files that are directly runnable or compilable according to the assignment instructions.

All homework and project submissions must be submitted by Canvas. No other means of submission will be accepted.

Collaboration and Academic Honesty

When you turn in work in this course, you are agreeing that you followed the collaboration rules for that assignment. In general:

- For homework and projects, you may consult with classmates and the instructor. Do not use web searches or LLMs to obtain solutions unless an assignment explicitly permits that use. If you discuss a problem with somebody else, you must acknowledge your collaborators. You must submit your own independent work. Each write-up must be the work of the student receiving credit.
- For Core Assessment preparation, you may use the posted banked questions, posted solutions, notes, classmates, office hours, online references, and tools to study. During a timed Core Assessment attempt, you will work individually.

Violations of conduct policies may have serious consequences, including receiving 0 for an assignment or assessment, receiving a failing grade in the course, and reporting of violations to the Office of Student Conduct. Please familiarize yourself with the [University of Denver Honor Code](#). When in doubt about any academic conduct policy, please consult your instructor or academic advisor for guidance.

I trust you, and I know that graduate school can be incredibly stressful. Please communicate early and honestly if you have concerns about collaboration, tools, deadlines, or course expectations.

Due Dates, Rescheduling, and Late Policy

If you are unable to take a Core Assessment at the scheduled time, you must notify me as soon as possible *in advance*. Rescheduling of Core Assessments and assignments will be possible only in exceptional circumstances, for well-documented reasons.

For homework and projects, the due date and time will be noted in the assignment description. I am happy to grant reasonable extensions when students contact me before the due date. If you need more time, email me as soon as you know there may be a problem and include the assignment name, the original due date, and a realistic proposed submission date. Extensions must be approved in writing.

Work submitted late without an approved extension will be accepted with a penalty of 5% per day. Submissions more than 5 days late may not be accepted. Extenuating circumstances are not a problem; please continue to communicate with me as soon as you can so we can make a reasonable plan.

Self-advocacy is hard and takes practice. Often the people most deserving of an extension are the last to ask for one, so please be bold, let me know what is going on, and do not let the policy hurt you unnecessarily.

Assignments which are turned in on time will be graded as soon as possible. In the case of multiple submissions, the latest submission available for grading will be graded, with any applicable late penalty applied.

Grade Evaluation

Assignments and assessments are graded without a curve. The course grade will be made up of the following components:

Category	Weight
Weekly Reading Quizzes	20%
Weekly Group Readings	20%
Homework/Projects	30%
Grab Bag	5%

Category	Weight
Core Assessments	15%
Final Presentation	10%
Total	100%

Core Assessments are the three mastery-based assessments described above. The Final Presentation is a separate graded component with its own rubric in Canvas.

Final grades will be based upon the following scale:

Letter Grade	Course Percentage
A	93% and above
A-	90% to less than 93%
B+	87% to less than 90%
B	83% to less than 87%
B-	80% to less than 83%
C+	77% to less than 80%
C	73% to less than 77%
C-	70% to less than 73%
D+	67% to less than 70%
D	63% to less than 67%
D-	60% to less than 63%
F	Less than 60%

Individual assignments and assessments are not curved. At the end of the course, final grade cutoffs may be lowered if warranted by overall class performance. Any adjustment will only benefit students, and the instructor will announce the rationale in Canvas.

General Policies

The syllabus may be updated if class needs change. I will communicate any changes to the schedule, syllabus, or policies clearly through Canvas announcements.

Honor Code

All students are expected to abide by the [University of Denver Honor Code](#). These expectations include the application of academic integrity and honesty in your class participation and assignments. Violations of these policies include, but are not limited to:

- Plagiarism, including any representation of another's work or ideas as one's own in academic and educational submissions.

- Cheating, including any actual or attempted use of resources not authorized by the instructor(s) for academic submissions.
- Fabrication, including any falsification or creation of data, research or resources to support academic submissions.

Violations of the Honor Code may have serious consequences including, but not limited to, a zero for an assignment or assessment, a failing grade in the course, and reporting of violations to the Office of Student Conduct.

Students with Disabilities

If you have a disability/medical issue protected under the Americans with Disabilities Act (ADA) and Section 504 of the Rehabilitation Act and need to request accommodations, please visit the [Disability Services Program website](#). You may also call (303) 871-2372, or visit them in person on the 4th floor of Ruffatto Hall; 1999 E. Evans Ave., Denver, CO.

Disability Services determines accommodations based on documented disabilities/medical issues. Please submit a Faculty Letter to the instructor from Disability Services in a timely manner so that your needs may be addressed.

Religious Accommodations

Accommodations will be provided to students for religious obligations and observances according to University policy. You are expected to notify the instructor by the end of the first week of class of any absences or other conflicts with the course schedule. For further details, please see the the [University of Denver Religious Accommodation Policy](#).

FERPA and Privacy

The University of Denver is committed to the safeguarding and accurate maintenance of student records. The Family Educational Rights and Privacy Act (FERPA) of 1974 provides students with a number of rights regarding their educational records. For more information about this act and student privacy, see the [Notification to Students of Educational Records and Student Information Rights and Policies](#) or contact the Office of the Registrar at 303.871.4300 or registrar@du.edu.

Canvas Support

Before starting the course, please make sure you have reviewed the [Online Student Orientation](#). If you have questions or issues related to Canvas, use the Help link located in the upper right corner in Canvas for support.

Please see the list of [Supported Browsers for Canvas](#) and the [Canvas accessibility information](#).

Technical Questions?

For technical support unrelated to Canvas, or if you have problems logging in, call the DU helpdesk at 303.871.4700 or email support@du.edu.