Introduction to Discrete Structures
Spring 2026
Course Information

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January 27, 2026

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E-mail

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Internet

- http://www.sci.brooklyn.cuny.edu/~amotz/discretemath.html

Zoom links

- ★ **TR11:** https://brooklyn-cuny-edu.zoom.us/meeting/register/7fpc6zrRST228am0ozk5Bw
- ★ **TR2:** https://brooklyn-cuny-edu.zoom.us/meeting/register/p67MROqWRe66O_YucJPrdg

Classes

Class Hours: Tuesdays and Thursdays

- ★ TR11: 11:00am–12:15pm
- ★ TR2: 2:15pm– 3:30pm

Classroom

- ★ TR11: 1141 IH
- ★ TR2: 2127 IH

Office Hours: Room 2112 or Classroom

- ★ TR11: Thursdays 12:30pm–1:30pm
- ★ TR2: Thursdays 3:45pm–4:45pm

What is Discrete Math?

A long answer part 1

- Discrete mathematics is the study of mathematical structures that are **fundamentally** discrete rather than continuous.
- In contrast to real numbers that have the property of varying smoothly, the objects studied in discrete mathematics – such as integers, graphs, and statements in logic – do not vary smoothly in this way, but have distinct, separated values.
- Discrete mathematics therefore excludes topics in continuous mathematics such as calculus or Euclidean geometry.
- Discrete objects can often be enumerated by integers.

What is Discrete Math?

A long answer part 2

- More formally, discrete mathematics has been characterized as the branch of mathematics dealing with countable sets (finite sets or sets with the same cardinality as the natural numbers.
- However, there is no exact definition of the term discrete mathematics.
- Indeed, discrete mathematics is described less by what is included than by what is excluded: continuously varying quantities and related notions.
- The set of objects studied in discrete mathematics can be finite or infinite. The term finite mathematics is sometimes applied to parts of the field of discrete mathematics that deals with finite sets, particularly those areas relevant to business.

What is Discrete Math?

A shorter answer

- Discrete mathematics is the part of mathematics devoted to the study of discrete (i.e. distinct) objects.
- In general, it is used whenever objects are counted, when relationships between finite (or countable) sets are studied, and when processes involving a finite number of steps are analyzed.
- It is important for computer science because in computing machines, information is stored and manipulated in a discrete fashion.

Why study Discrete Math (Discrete Structures)?

Proofs, proofs, and more proofs

- What distinguishes Math from other "exact" sciences.

More subjective answers

- Problem solving: Talent, Intuition, Luck, Experience, **Hard Work**.
- Mathematical thinking, critical thinking, mathematical reasoning,...
- **Fun** with math (e.g., via puzzles) and Math as an **art**.

Do we or I really need Math?

- What if I want to be a programmer?
- What if I want to be a system person?

This Course

Flexible curriculum

- Quantity vs. quality.
- Many orders among the topics are good.

Are we starting from the beginning?

- **No!!!** It is assumed that you already know a lot!

Resources for study

- Textbooks, lecture notes, video lectures, online tutorials, practice exercises, blogs, wikipedia, . . .
- There are too many choices, how to select the **"right"** one?

What if I care only about the final grade?

- **Master** the material studied in this course?!

Syllabus

Our course

- Part 1 the fundamentals:
  - Proofs; Sets; Logic;
- Part 2 the heart:
  - Induction; Recursion; Counting; Combinatorics; Probability;
- Part 3 some pillars:
  - Algorithms; Graphs; Number Theory;

MIT OpenCourseWare Mathematics for Computer Science

- Syllabus: `https://ocw.mit.edu/courses/6-1200j-mathematics-for-computer-science-spring-2024/pages/readings/`
- Book: `https://courses.csail.mit.edu/6.042/spring18/mcs.pdf`
- Lectures: `https://ocw.mit.edu/courses/6-1200j-mathematics-for-computer-science-spring-2024/resources/lecture-videos/`

Prerequisite Courses and Knowledge

Computer and Information Science

- 1.10, or 1.20, or 1110 [1.5], or 1115, or both of 1113 and 1114, or 1170, or 1180, or 1215

Mathematics

- 1011 [2.9] or 2.92
- or assignment to Mathematics 3.20, 1201 [3.3], or 4.10 by the Department of Mathematics.

Computer and Information Science Prerequisite

Syllabus 1110/1115:

- Algorithms, computers and programs. Writing, debugging, and testing programs. Loops and conditional control structures. Method definition and parameter passing. Arrays, ArrayLists, and Strings. Sorting, searching and other basic algorithms. Input and output. Programming applications selected from various disciplines. History and basic concepts of computer science.

General link

- `http://www.brooklyn.cuny.edu/courses/ShowCourse.do?redirect=/acad/course_info.jsp&dsc=CISC.&crs_num=1115&div=U`

Math Prerequisite

Syllabus

- Preparation for calculus. Trigonometry. The concept of function, including, linear and quadratic functions, composition of functions, polynomials and rational functions, exponential, logarithmic, trigonometric, and inverse trigonometric functions. Conic sections. Binomial theorem.

General link

- `http://www.brooklyn.cuny.edu/courses/ShowCourse.do?redirect=/acad/course_info.jsp&dsc=MATH.&crs_num=1011&div=U`

Some Textbooks

- A book with an online tutorial: “Discrete Mathematics An Open Introduction,” by Oscar Levin (3rd Edition).
  http://discrete.openmathbooks.org/pdfs/dmoi-tablet.pdf
- A “good fit to this course” text book: “Discrete Mathematics for Computer Science,” by Bogart, and Stein. and Drysdale.
  https://www.google.com/books/edition/Discrete_Mathematics_for_Computer_Scienc/N-tyQgAACAAJ?hl=en
- A “popular” BC-CIS text book: “Discrete Mathematics and its Applications,” by Kenneth H. Rosen (6th, 7th, 8th editions).
  https://www.mheducation.com/highered/product/discrete-mathematics-applications-rosen/M9781259676512.html
- A free online book: “Discrete Math Elements,” by Richard Hammack.
  https://richardhammack.github.io/DiscreteWSP/
- A list of books on “Discrete mathematics for Computer Science” from Google:
  https://www.google.com/search?q=list+of+books+on+discrete+mathematics+for+computer+science&rlz=1C1CHBF_enUS762US762&source=univ&tbm=shop&tbo=u&sa=X&ved=0ahUKEwiEk5HHiKDfAhUIm-AKHWYIAGgQsxgIzAE

Some Course Notes

- Yale “Notes on Discrete Mathematics (2025)”:
  http://www.cs.yale.edu/homes/aspnes/classes/202/notes.pdf
- Stanford “Mathematical Foundations of Computing (2013)”:
  http://theory.stanford.edu/~trevisan/cs103-14/keith.pdf
- Duke “Discrete Mathematics for Computer Science (2009)”:
  https://www2.cs.duke.edu/courses/spring09/cps102/Lectures/Book.pdf
- University of Pennsylvania “Discrete Mathematics for Computer Science Some Notes (2008)”:
  https://arxiv.org/pdf/0805.0585.pdf
- Cornell “A Course in Discrete Structures”:
  https://www.cs.cornell.edu/~rafael/discmath.pdf

Some Online Resources

Video Lectures

- Trevtutor Discrete Math 1 and Discrete Math 2 (lectures and exercise sessions):

  https://www.youtube.com/playlist?list=PLDDGPdw7e6Ag1EIznZ-m-qXu4XX3A0cIz

  https://www.youtube.com/playlist?list=PLDDGPdw7e6Aj0amDsYInT_8p6xTSTGEi2

- Introduction to Higher Mathematics (first 12 lectures):

  https://www.youtube.com/playlist?list=PLZzHxk_TPOStgPtqRZ6KzmkUQBQ8TSWVX

Text tutorials

- “Discrete Mathematics An Open Introduction” by Oscar Levin:

  http://discrete.openmathbooks.org/dmoi2/frontmatter.html

- “Discrete Mathematics Tutorial” by tutorialspoint:

  https://www.tutorialspoint.com/discrete_mathematics/index.htm

Some Online Resources

Books with Problems and Solutions

- "Theory and Problems of Discrete Mathematics" by S. Lipschutz and M. Lipson (Schaum's book):

  `https://quizlet.com/explanations/textbook-solutions/schaums-outline-of-discrete-mathematics-3rd-edition-9780071511018`

  - Many examples with full solutions.

- "Problems on Algorithms" by I. Parberry and W. Gasarch:

  `https://ianparberry.com/books/free/poa.pdf`

  - Although most of the problems are about Algorithms, there are many that are relevant to Discrete Math.

Tentative Schedule

Classes 1,2	Jan 27,29, 2026	Introduction
Classes 3,4	Feb 3,5, 2026	Proofs
Classes 5,6	Feb 10,19, 2026	Sets
Classes 7,8	Feb 24,26, 2026	Logic
Class 9	Mar 3, 2026	**First Midterm Exam**
Classes 10,11	Mar 5,10, 2026	Induction
Classes 12,13	Mar 12,17 2026	Recursion
Classes 14,15	Mar 19,24, 2026	Counting
Classes 16,17	Mar 26,31, 2026	Combinatorics
Classes 18,19	Apr 14,16, 2026	Probability
Class 20	Apr 21, 2026	**Second Midterm Exam**
Classes 21,22	Apr 23,28, 2026	Algorithms
Classes 23,24	Apr 30, May 5, 2026	Graphs
Classes 25,26	May 7,12, 2026	Number Theory
Classes 27,28	May 14,19 2026	Conclusions
Class 29	May 21,26 2026	**Final Exam**

Remarks

- No classes: Feb 12, Feb 17, Apr 2, Apr 7, and Apr 9.
- On Tuesday April 21 classes will follow a Thursday class schedule.

Zoom Sessions

Links

- If we cannot meet in person, classes will proceed via Zoom according to the existing schedule.
- The Zoom links are:
  - ★ **TR11:** https://brooklyn-cuny-edu.zoom.us/meeting/register/7fpc6zrRST228am0ozk5Bw
  - ★ **TR2:** https://brooklyn-cuny-edu.zoom.us/meeting/register/p67MROqWRe66O_YucJPrdg

Procedure

- Joining the Zoom session on time is essential. If you are not present before the session starts, you may not be admitted.
- In Zoom classes: mute your audio unless asked to speak by the instructor. Cameras are encouraged but optional. You can ask questions via chat, though a response is not guaranteed.

Classes and Attendance

Classes

- Each 75-minute class involves a lecture with slides and internet videos. These slides will be available on the course website
- `http://www.sci.brooklyn.cuny.edu/~amotz/discretemath.html`

Attendance

- You are required to attend the first two classes, the last class, and all exams and quizzes. For all other class sessions, attendance is not mandatory.
- You will be responsible for any material covered if you are absent.

Reward

- **In-person attendance** will be graded as 100 and can constitute up to 5% of the final grade, depending on the number of classes attended.

Communication With The Instructor

From the Instructor

- Important announcements will come through the Brooklyn College system (or CUNYFirst).
- Verify that both systems have your preferred email address.
- Course material (lectures, assignments, exams&quizzes, announcements, etc.) will be posted on the course website.

To the instructor

- Send all course-related questions to the class email.
- Emails sent to my other email addresses might go **unanswered**.

Office hours

- One hour on Thursdays 15 minutes after the end of the class either in room 2112 or in the classroom.

Assignments

Type of Assignments

- **Reading assignments:** prepare students for upcoming topics.
- **Writing assignments:** provide practice on material already covered in class.

Submission procedure

- Writing assignments are due on scheduled class dates.
- You can submit a physical copy (preferably typed) before or after that day's class.
- Alternatively, email a PDF version to the class email.

Assignments

Grading assignments

- Assignments will receive a **Pass or Fail** grade.
- Detailed solutions for each assignment will be made available on the course website after their respective due dates.

Preparing assignments

- Try your best to do assignments **independently**.
- Seek help **only** when essential.
- You **must** understand all your written work and be prepared to explain it to the instructor.

Exams and Quizzes

Final exam tentative time and room

- Date and time: Thursday May 21 or Tuesday May 26 from ? to ?
- Room: ???

Midterm exams tentative dates

- Both midterm exams will be taken during class sessions.
  - ★ Midterm Exam 1: Tuesday Mar 3, 2026.
  - ★ Midterm Exam 2: Tuesday Apr 21, 2026.
- The midterms are scheduled for two hours:
  - ★ **TR11: From 11:00am to 1:00pm.**
  - ★ **TR2: From 1:30pm to 3:30pm.**

Quizzes

- Advance notice will be given for quizzes.
- Usually, there are two, but the total number could be more or less.

Grading Exams and Quizzes

Grading

- Exams and quizzes will be meticulously graded.
- Detailed solutions will be made available.

Answering questions

- For all exams, quizzes, and assignments, write your answers only within the given space.
- Use legible handwriting for exams and quizzes, and type your assignments.
- You will get 20% credit for a blank answer and 0% credit for an incorrect answer.

A Discrete Math Project

Scope

- The project is “open ended” and as such there will be no specific instructions on what to do. Instead, examples will be provided to show the kinds of projects that are acceptable.

Approval

- Only projects with an approved proposal will be graded.

Submission

- Project submission is not mandatory, but it is a great way for students to enhance their final grade.

Deadlines

- The proposal deadline is **Tuesday Apr 21, 2026** and the submission deadline is **Tuesday May 5, 2026**. These deadlines are strict. No exceptions.

Final Grade

Components of the final grade

* 20% for the first midterm exam.
* 25% for the second midterm exam.
* 0% – 15% for the quizzes.
* 0% – 10% for the assignments.
* 0% – 15% for the project.
* 0% – 5% for detecting errors and typos in posted material.
* 0% – 5% for attendance.
* 5% – 55% for the final exam.

The final exam percentage

- The weight of the final exam in your overall grade will be determined by how well you perform in all the areas previously mentioned.

Final Grade

Remarks

- The midterms and quizzes are mandatory. Usually, but not always, a midterm or a quiz grade lower than the final exam grade will be dropped, with its percentage weight transferred to the final exam.
- Nine writing assignments will be given. Each submission earns 1% towards the final grade (at a score of 100). Submitting all nine assignments is worth 10% of the final grade (at a score of 100).
- You are encouraged to email the instructor about any errors/typos found in course materials all semester. This can earn a grade of 100, up to a maximum of 5% of your final grade.
- Attempting an approved project has no downside. Completed projects earn a 100 grade. This project can then count for up to 15% of the final grade if outstanding, or 0% if it doesn't meet minimum standards.

Honor Code

This course policy

- All exams, quizzes, and the project must be completed individually without external help (e.g., people, internet, books, notes), unless explicitly permitted otherwise.
- Cheating will be punished severely. This means a guaranteed fail on the exam/quiz, and potentially failing the entire course.
- Additionally, cheaters risk further disciplinary action according to the CUNY policy on Academic Integrity.

CUNY policy on Academic Integrity

Academic Dishonesty is prohibited in the City University of New York and is punishable by penalties, including failing grades, suspension, and explusion, as provided herein.