CSc 245
Introduction to
Discrete Structures

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CSc 245 - Summer 20

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Websites:

- Class: https://rjfaust.github.io/teaching/summer2020/csc245
- D2L: https://d2l.arizona.edu/d2l/home/899542
- Piazza: piazza.com/home/summer2020/csc245/home
- GradeScope: https://www.gradescope.com/courses/124297

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Homework: (48%)

- 1 per week
- Due on Friday, at 5pm
- Submitted on Gradescope
- Typed homework preferred.

Exams: (35%)

- Midterm (15%)- "Take home"
- Final (20%) - On Gradescope

Participation: (17%)

- Lecture Videos (5%)
- Quizzes (12%)

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Typical Week:

- (Hopefully) Release lecture videos at the end of the weekend

  - Lectures posted on D2L with Playposit

  - Students must watch videos by end of week

- Tuesday Quiz

- Friday: Release new homework, last homework due by 5pm

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Ways to Contact Us:

- Office Hours

- Piazza

  - Most questions/comments should go here

- Email

  - For private, confidential and sensitive matters

Syllabus

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What you should do this week

- Watch all lectures

- Homework 1

  - Due **THIS** Friday (06/12)

  - Math Review

Course Background

(Why you're here and what you learned to get here)

What is Discrete Math?

Definition: *Discrete Mathematics*

Discrete Mathematics is the study of collections of distinct objects

Contrast this with "the calculus", which was developed by Newton and Leibniz to study objects in motion. As a result:

• 'The Calculus" trends to focus on real values

• Discrete Mathematics tends to focus on integer values

Sample Discrete Math Topics

Topics that fall under the umbrella of discrete math:

- Integral Functions and Relations
- Matrix Operations and Representations
- Sets
- Sequences and Summations
- Discrete Probability
- Counting (Permutations/Combinations, Recurrence Relations)

To understand those, you also need:

- First-Order logic
- Logical Arguments
- Proof Techniques
- … and a fair amount of pre-calculus mathematics

How Discrete Math Relates to CS

Discrete Structures is an ACM/IEEE core curriculum topic

- See https://www.acm.org/binaries/content/assets/education/cs2013_web_final.pdf

DM topics underlie much of Computer Science, including:

- **Logic** -> Knowledge Representation, Reasoning, Natural Language Processing, Computer Architecture

- **Proof Techniques** -> Algorithm Design, Code Verification

- **Relations** -> Database Systems

- **Recurrence Relations** -> Recursive Algorithm Analysis

- **Probability** -> Algorithm Design, Simulation

Topics You May Need to Review

Mathematical concepts, including, but not limited to:

- Fractions
- Rational Numbers
- Basics of Sets
- Associative, Commutative, Distributive, and Transitive Laws
- Properties of Inequalities
- Summation and Product Notation
- Integer Division (Modulo, Divides, Congruences)
- Even and Odd Integers
- Logarithms and Exponents
- Working with Quadratic Equations
- Positional Number Systems

Read the Math Review handout on the course website

Notations for Sets of Values

$\mathbb{Z}$	All integers	$\{\ldots, -2, -1, 0, 1, 2, \ldots\}$
$\mathbb{Z}^+, \mathbb{N}^+$	All positive integers	$\{1, 2, 3, \ldots\}$
$\mathbb{Z}^*, \mathbb{N}_0$	All non-negative integers	$\{0, 1, 2, 3, \ldots\}$
$\mathbb{Z}^{even}$	Even integers	$\{\ldots, -4, -2, 0, 2, 4, \ldots\}$
$\mathbb{Z}^{odd}$	Odd integers	$\{\ldots, -3, -1, 1, 3, \ldots\}$
$\mathbb{Q}$	Rational numbers	$\frac{a}{b}, a, b \in \mathbb{Z}, b \neq 0$
$\overline{\mathbb{Q}}$	Irrational Numbers	$\{i \mid i \notin \mathbb{Q}\}$
$\mathbb{R}$	The real values	$\{\mathbb{Q} \cup \overline{\mathbb{Q}}\}$

Note: Avoid the term "natural numbers" and the symbol $\mathbb{N}$

Homework 1

- Due Friday

- Intended to be refresher on these math topics

- If you are not comfortable with these topics, read the math review excerpt from Dr. McCann's book, found on the webpage.