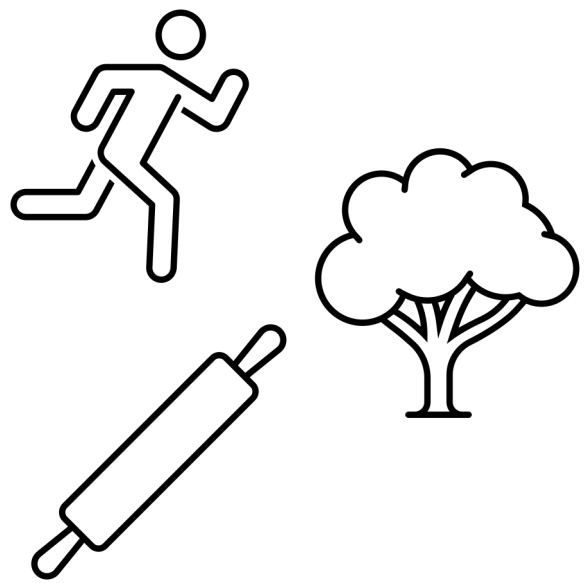
Discrete Structures– Welcome!

Dr. Ab Mosca (they/them)

Plan for Today

- Who am I?
- Who are you?
- What will we do in this class?
- What is discrete math?
- Mathematical Statements

Who Am I?



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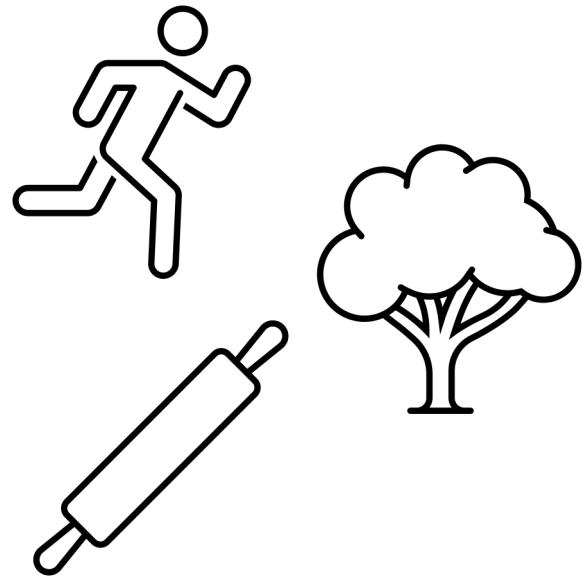

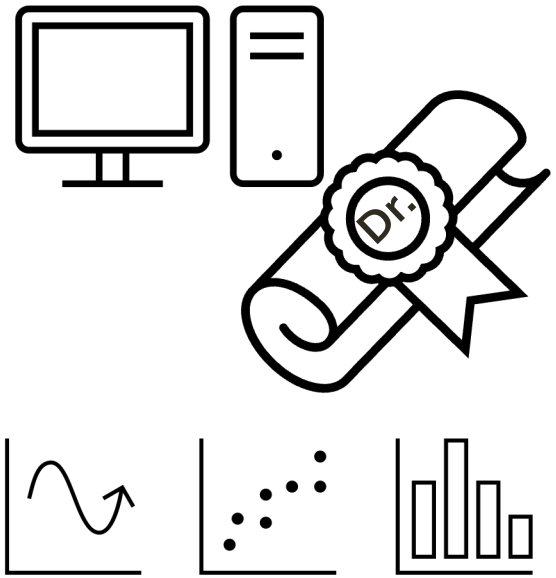

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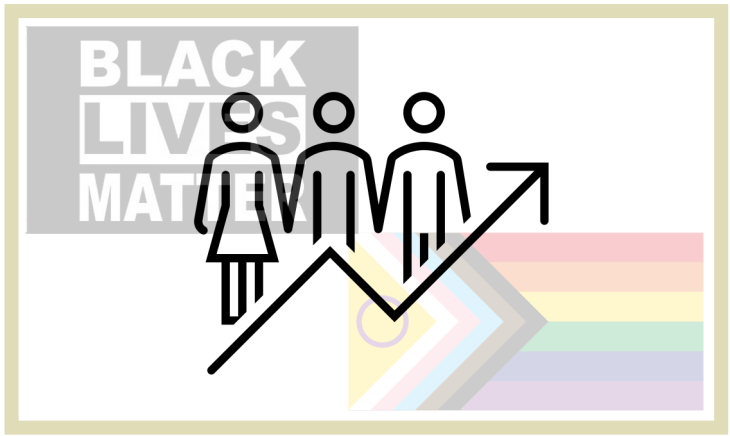

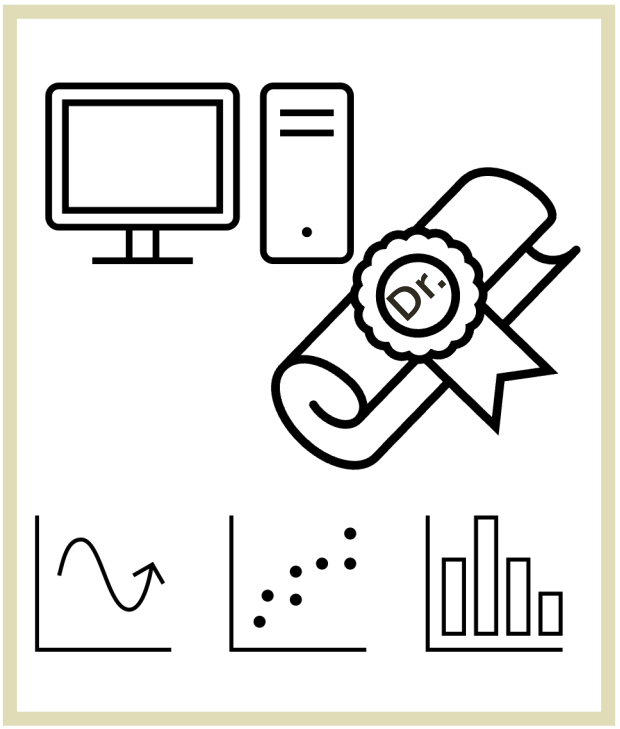

Who Are You?

- Form groups of 3
- Introduce yourselves (name, pronouns)
- Share:
  - A highlight of your winter break
- Find 1 thing that your entire group has in common (favorite color? hometown? left-handed? Be creative!)
- After about 5 minutes we will go around, introduce ourselves, and share what each group has in common

Who Are You?

- Form **new groups** of 3 (move around!)
- Introduce yourselves (name, pronouns)
- Share:
  - Would you rather have telekinesis (the ability to move things with your mind) OR telepathy (the ability to read minds)?
- After about 5 minutes we will go around, introduce ourselves, and share our would you rather answers

Who Are You?

- Form **new new groups** of 3 (move around!)
- Introduce yourselves (name, pronouns)
- Share:
  - Would you rather take amazing selfies but look terrible in all other photos OR take terrible selfies but look amazing in all other photos?
- After about 5 minutes we will go around, introduce ourselves, and share our would you rather answers

What You Will Learn & Logistics

What Is This Class?

- An introduction to discrete mathematics
- You will learn to…
  - Logically prove mathematical statements
  - Model scenarios combinatorically
  - Describe functions, relations, and sequences
  - Model scenarios graphically

Important Info

- Course website (**write this down**!): https://amosca01.github.io/CAIS117-S24/

- Office Hours
  - Wilson Hall 325
    - Wednesday 09:30 - 11:00
    - Thursday 14:30 - 16:30
    - By Appointment

Important Info

- Textbook: *Discrete Mathematics: An Open Introduction*, 3rd Edition
  - See course website for instructions
- Assignments:
  - Turn in on Gradescope (https://help.gradescope.com/article/ccbpppziu9-student-submit-work)
- Due Dates: As listed on course schedule.
  - 24hr grace period; no late submissions
  - Lowest homework dropped
  - See syllabus for revise and resubmit policy

Important Info

Assignments

- Homework
  - Pair assignments
  - Graded on effort and correctness
- Quizzes
  - Individual assignments
  - Can re-take as many times as wanted before deadline
- In-class Activities
  - Graded on effort
- Final Project
  - Small group
  - Graded on creativity and correctness

Important Info

- I’m here to help you succeed
- Please come to office hours or reach out if you need any additional support

Now the good stuff

What is Discrete Math?

discrete adjective

dis·crete di-'skrēt 'dis-

Synonyms of *discrete* >

1 : constituting a separate entity : individually distinct

> several *discrete* sections

2 a : consisting of distinct or unconnected elements : NONCONTINUOUS

b : taking on or having a finite or countably infinite number of values

> *discrete* probabilities

> a *discrete* random variable

https://www.merriam-webster.com/dictionary/discrete

What is Discrete Math?

In this class we'll cove four main topics:

- Logic
- Combinatorics (counting)
- Sequences
- Graphs

Warm Up

While walking through a fictional forest, you encounter three trolls guarding a bridge. Each is either a *knight*, who always tells the truth, or a *knave*, who always lies. The trolls will not let you pass until you correctly identify each as either a knight or a knave. Each troll makes a single statement:

Troll 1: If I am a knave, then there are exactly two knights here.

Troll 2: Troll 1 is lying.

Troll 3: Either we are all knaves or at least one of us is a knight.

Which troll is which?

Vocab

statement: any declarative sentence which is either true or false

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Example Statements:

- Telephone numbers in the US have 10 digits.
- The moon is made of cheese.

Example non-Statements:

- Would you like some cake?
- The sum of two squares.

Vocab

statement: any declarative sentence which is either true or false

Which are statements and which are not?

- 42 is a perfect square.
- 1 + 3 + 5 + 7
- Go to your room!
- 3 + 7 = 12
- 3 + x = 12

Vocab: Types of Statements

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molecular: a statement that *can* be divided into smaller statements

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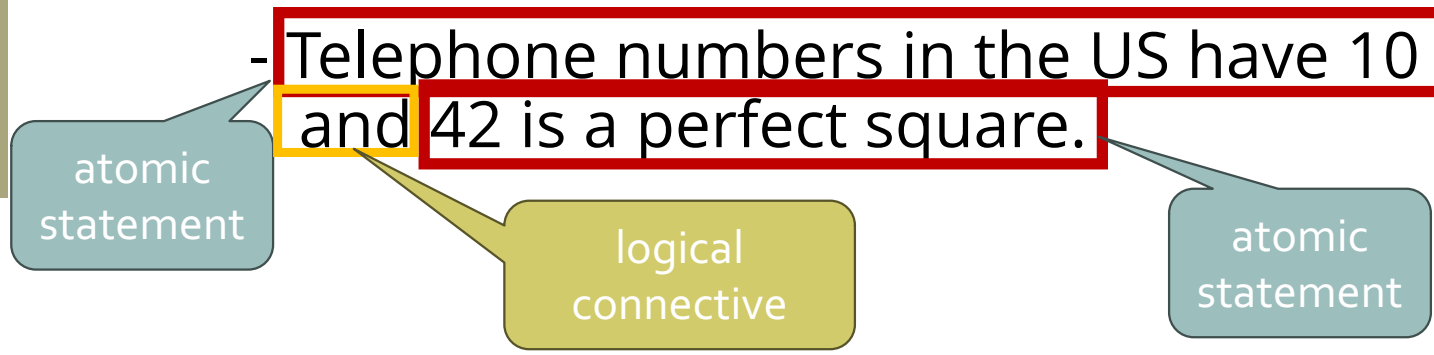

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Practice: Form 5 groups. Each will be assigned a connective. Come up with two examples of statements using your connective. For each example, identify molecular statements, atomic statements, and connective.

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Practice: Return to your groups. Re-write your statements from the previous exercise using variables.

Symbolic Representation

- We also have shorthand symbols for connectives:
  - ***and***
    - Symbol: ∧
    - Example: $P \wedge Q$
  - ***or***
    - Symbol: ∨
    - Example: $P \vee Q$
  - ***if … then …***
    - Symbol: →
    - Example: $P \rightarrow Q$
  - ***if and only if***
    - Symbol: ↔
    - Example: $P \leftrightarrow Q$
  - ***not***
    - Symbol: ¬
    - Example: $\neg P$

Symbolic Representation

- We also have shorthand symbols for connectives and fancy names:
  - ***and*** *conjunction*
    - Symbol: ∧
    - Example: $P \wedge Q$
  - ***or*** *disjunction*
    - Symbol: ∨
    - Example: $P \vee Q$
  - ***if … then …*** *implication* or *conditional*
    - Symbol: →
    - Example: $P \rightarrow Q$
  - ***if and only if*** *biconditional*
    - Symbol: ↔
    - Example: $P \leftrightarrow Q$
  - ***not*** *negation*
    - Symbol: ¬
    - Example: $\neg P$

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  - ***if and only if*** *biconditional*
    - Symbol: ↔
    - Example: $P \leftrightarrow Q$
  - ***not*** *negation*
    - Symbol: ¬
    - Example: $\neg P$

Practice: Return to your groups. Add the appropriate connective to your statements from the previous exercise.