Welcome!

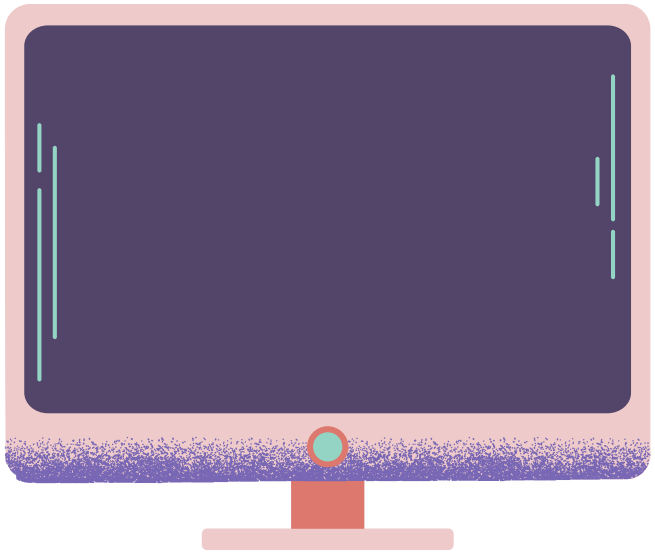
CMPSC 102 – Discrete Structures

ALLEGHENY COLLEGE

Agenda for today

- Introductions: Getting to know me
- Course overview and expectations
- Class Survey: Getting to know you

The basics



Instructor: Hang Zhao

Office: Quigley Hall 208 & Alden Hall 105

Email: hzhao@allegheny.edu

Office hours:

T/Th 11:00am-12:30pm. Location: Alden Hall 105

w 10:00am-1:00pm. Location: Virtual

By appointment at https://calendar.app.google/PD6Ku9PSCZ716K5D7

A little about me

Visiting Assistant Professor
- Dep of Computer Information Science

Education:
- **University of Connecticut**
- Doctor of Philosophy, Agricultural and Resource Economics
- **Boston University**
- Master of Science in Actuarial Science
- **University of Colorado**
- Bachelor of Arts, Major in Economics, Minor in Mathematics

Research Interests:
- Drug policies, the well-being of older adults, nutrition and health outcomes

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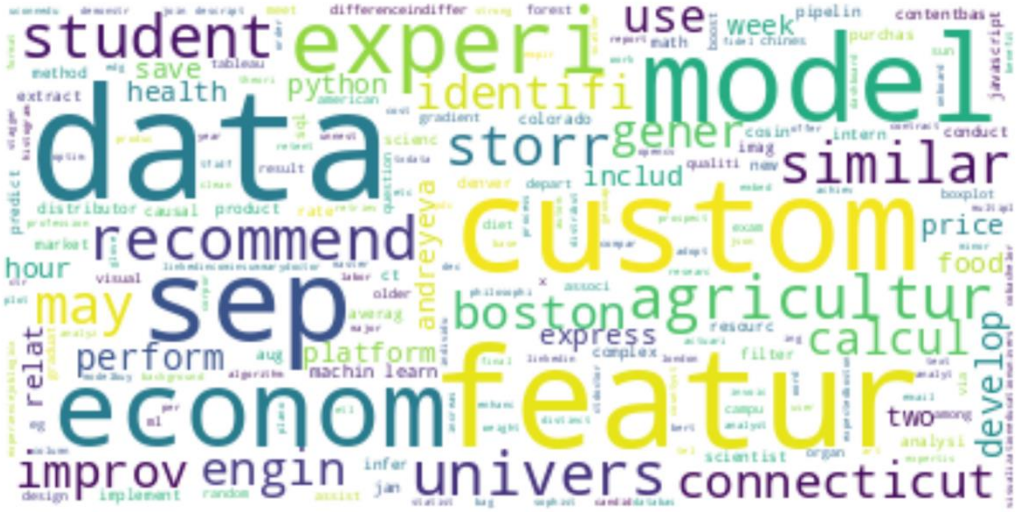
Resume



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OK

You Have A New Messages!

OK READ

OK

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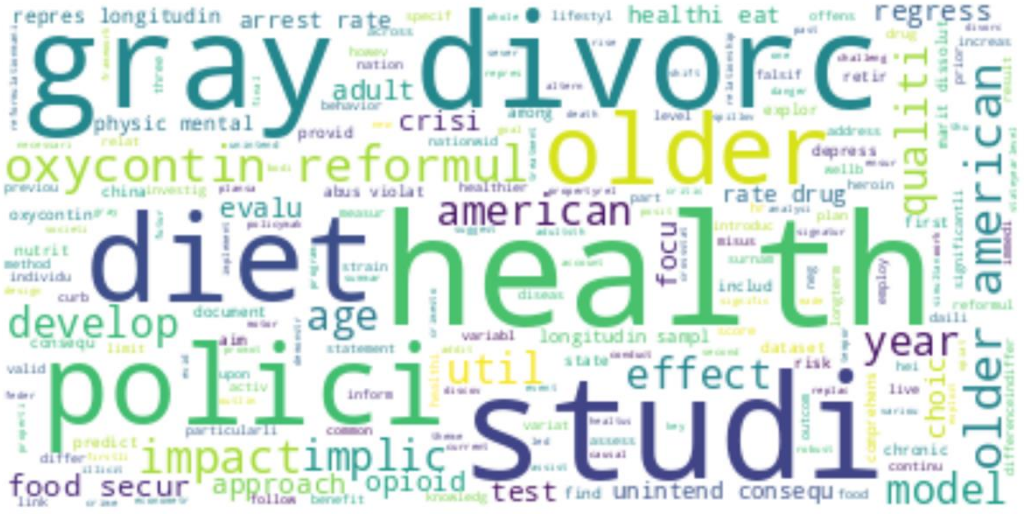
Research Statement



You Have A
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OK READ

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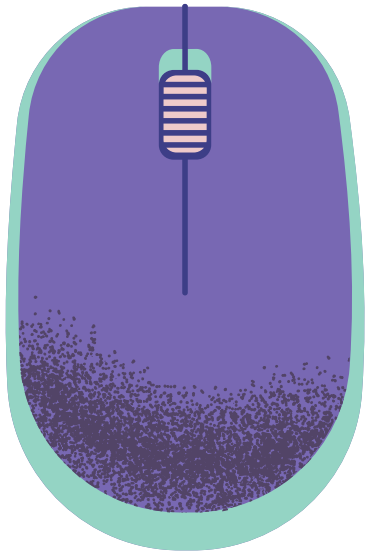
OK

OK



Course overview and expectations

Class structure

- Lectures
- Activities
- Lab Assignments

classDocs/

- First stop for all materials
- Syllabus
  - Attendance
  - Tokens Policy
  - Using Artificial Intelligence
- Lecture slides

Assessment

- Class Participation and Activities (20%)
- Exam (20%)
- Lab Assignments (40%)
- Final Project (20%)

Course grades will approximately fall into the following ranges: A (93%), A- (90%), B+ (87%), B (83%), B- (80%), C+ (77%), C (73%), C- (70%), D+ (67%), D (63%), F(60%).

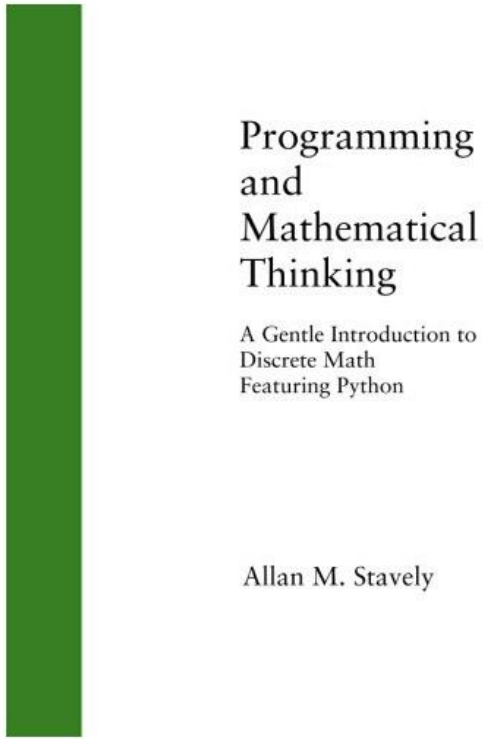
How to do well

- Attend lectures
- Come to office hours
- Study with your peers

Class Survey: Who are you?

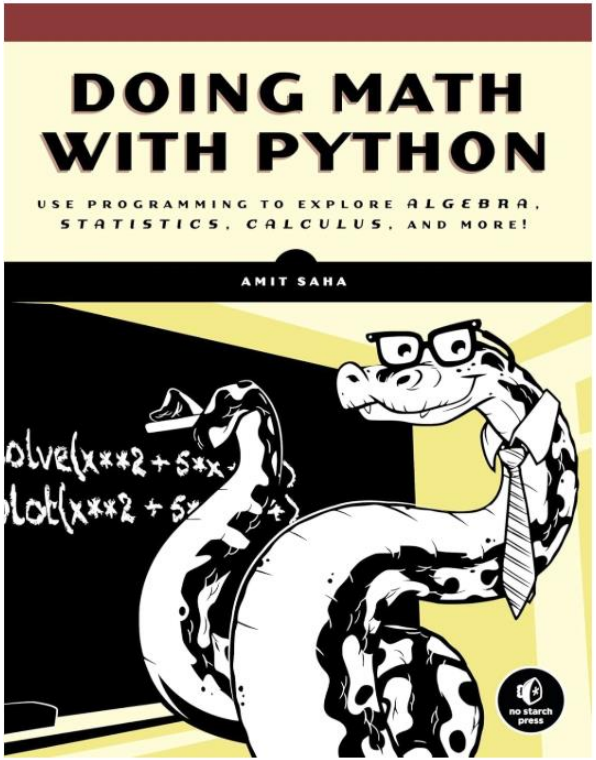
Class Survey

Textbook



Programming and Mathematical Thinking - A Gentle Introduction to Discrete Math Featuring Python by Allan M. Stavely; ISBN paperback 978-1-938159-00-8 and ISBN ebook: 978-1-938159-01-5

Textbook



Doing Math with Python by Amit Saha; ISBN paperback:1-59327-640-0

Key Question

How can I connect mathematical terminology (e.g., mapping, function, number, sequence, and set) to Python programming concepts, such as declaring and calling functions, as well as declaring and manipulating variables?

Learning Objectives

To remember and understand some of the discrete mathematics and Python programming concepts, setting the stage for the exploration of discrete structures.

This Thursday

- Set up GitHub & Discord
- Access your activity01.

Discrete Structures - In terms of programming

Discrete Structures = Math + Code

Discrete mathematics is composed of fundamental concepts such as:

- Symbols, character strings, and truth values.
- Objects and collections of these entities (e.g., stored in sets or tuples).

Specification (S) and Program (P)

- Specification (S): The detailed description and design of a computer program.
  - Define the input, output, and internal objects.
  - Use the vocabulary of discrete mathematics to formalize ideas.
- Program (P): The implementation of the specification in a programming language.
  - Translate the specification into code.
  - Implement and test the program.

Our goal: To implement a program P that meets a particular specification S

Discrete Structures - In terms of mathematics

"An introduction to the foundations of computer science with an emphasis on understanding the abstract structures used to represent discrete objects."

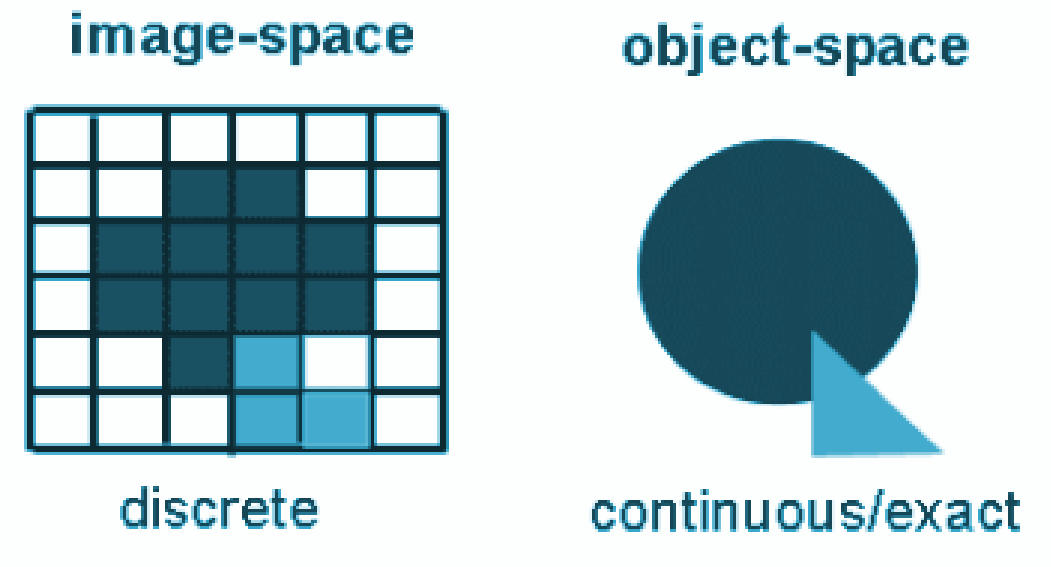
We keep using the word, discrete. What do we mean here?

- Discrete means separate, not continuous or not sharing any common space

Discrete and Countable Objects

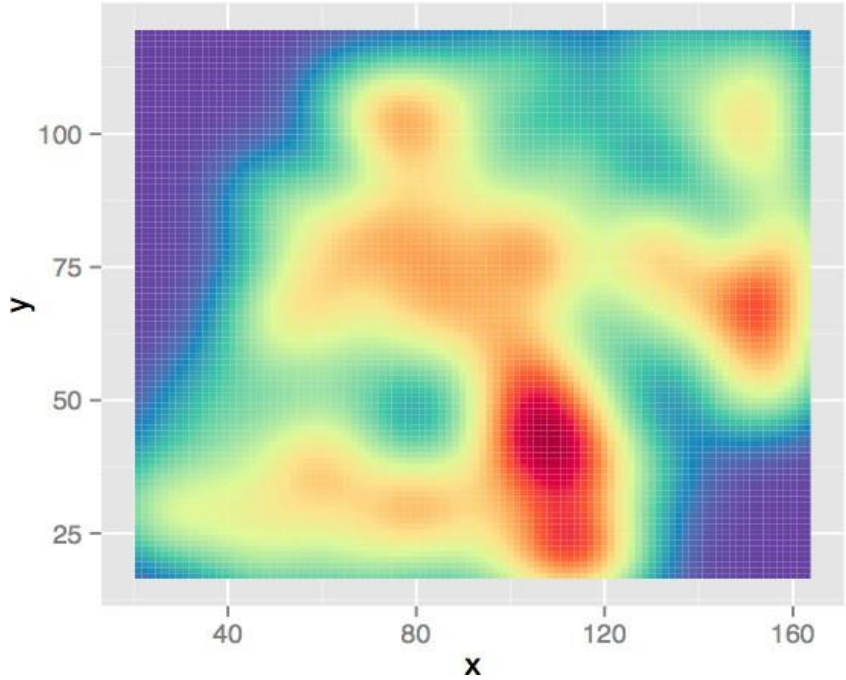
- *Discrete* means "countable" (can be listed in an order)
- We can count the number of animals.

Discrete and Countable Objects



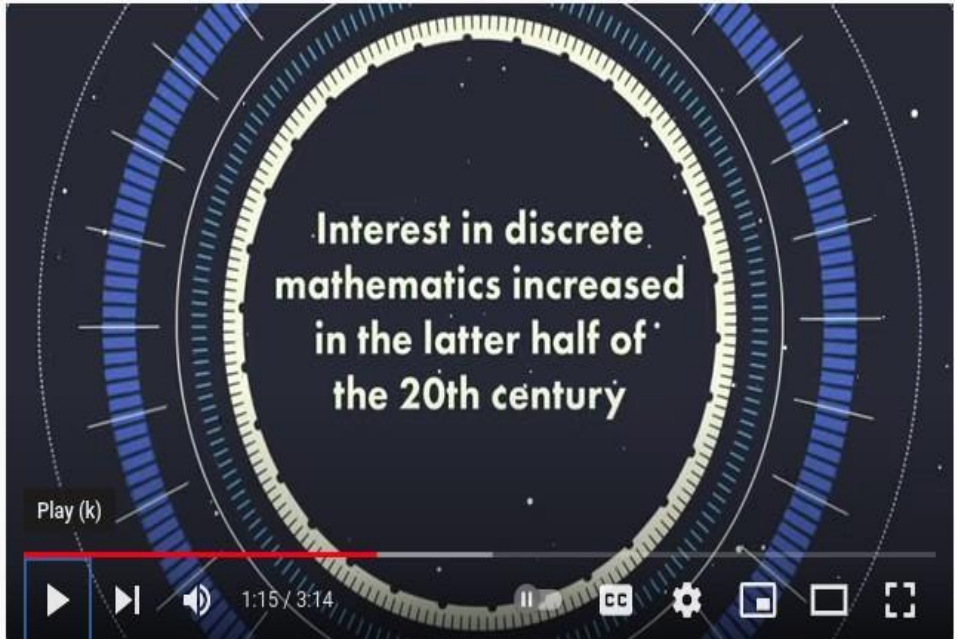
- Discrete mathematics involves being able to count (list) things individually.

Continuous Objects



- "Overlapping" objects cannot be counted (i.e., listed) separately.

Discrete Mathematics



- Discrete Mathematics for Computer Science (developed during the latter half of the 20th century!
- https://www.youtube.com/watch?v=q4L-wUF3yig

Non-Discrete and Un-Countable Objects

- Are the numbers of grains *un*countable (i.e., unlistable)?
- Is anything *un*countable at the beach?
- How do we count an uncountable object? Why?

Relationships to Computing - computer MUST be able to count to compute

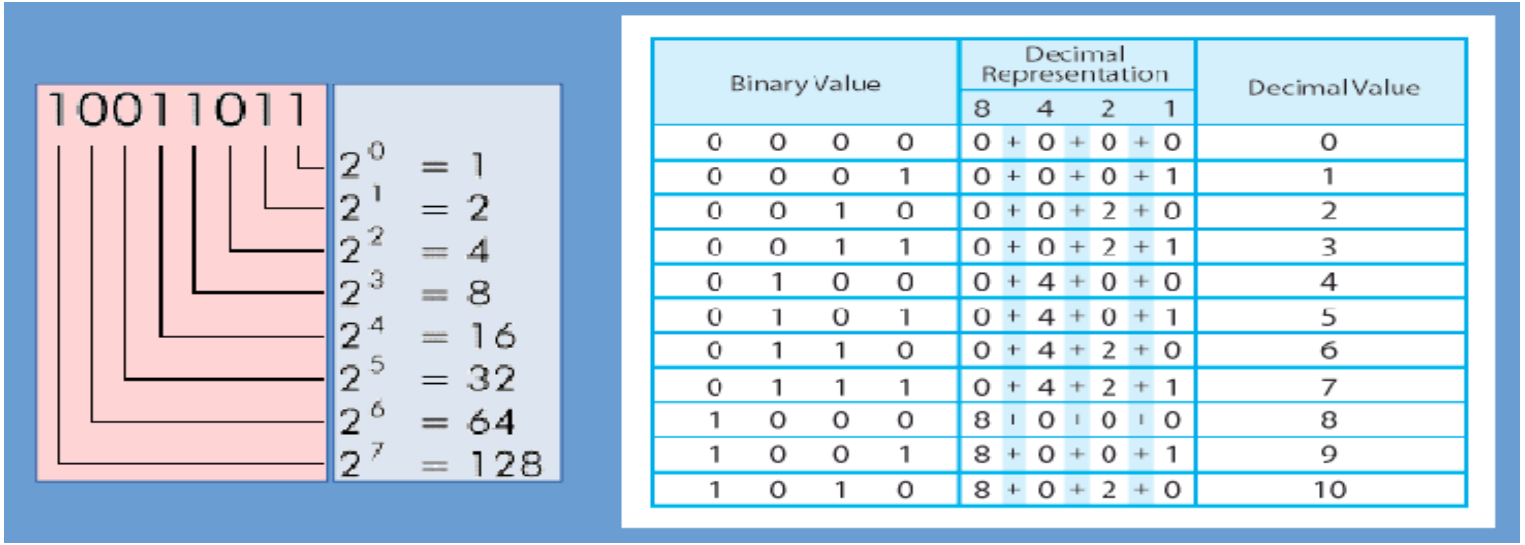
You will have to put uncountable stuff into a system that counts!!

Binary Numbers

In mathematics and digital electronics, a binary number is a number expressed in the base-2 numeral system or binary numeral system, which uses only two symbols: typically, 0 (False, zero) and 1 (True, one).

- Computers use binary to function
- Processes (i.e., memory, computation, networking) are broken down into binary-driven procedures

Binary Numbers



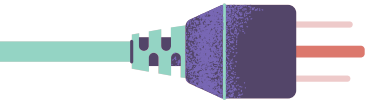
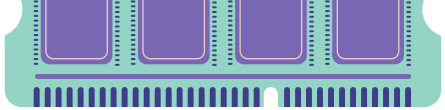
Binary Value				Decimal Representation				Decimal Value
				8	4	2	1	
0	0	0	0	0	0	0	0	0
0	0	0	1	0	0	0	1	1
0	0	1	0	0	0	2	0	2
0	0	1	1	0	0	2	1	3
0	1	0	0	0	4	0	0	4
0	1	0	1	0	4	0	1	5
0	1	1	0	0	4	2	0	6
0	1	1	1	0	4	2	1	7
1	0	0	0	8	0	0	0	8
1	0	0	1	8	0	0	1	9
1	0	1	0	8	0	2	0	10

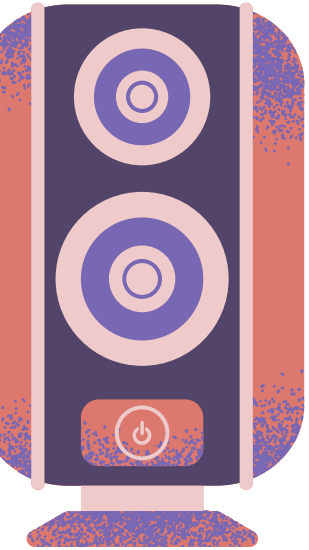
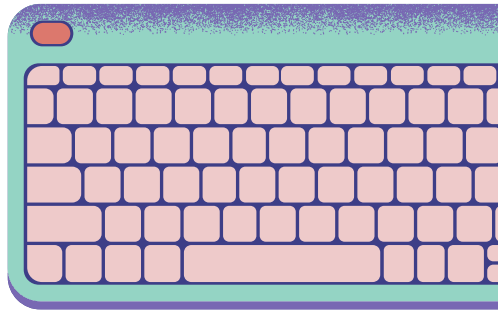
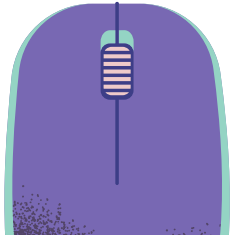
- Computing implies digital processing
- Computing binary values is a countable task.
- Can anything, or any number, that a computer computes be written in binary?

Countable and Not Countable?

What can be listed and what cannot be listed?

- Discuss with your neighbors!
- What are **countable** (i.e. *list-able*) objects? Can you give an example?
- Can you think of **un-countable** objects that cannot be listed? Give an example?
    - Can you think of types of numbers that may fit into each of these above groups?
    - Need a hint about such numbers? Check out Numberphile's video: https://www.youtube.com/watch?v=elvOZm0d4H0

THANKS