Math 213: Introduction to Discrete Mathematics

213-X1

Lecture: MWF 12:00-12:50pm
Engineering Hall 106B1

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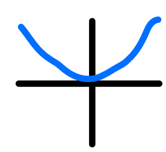
Textbook: Discrete Mathematics and its Applications, 7th Edition
By Kenneth H. Rosen

For now:

- Bookmark the course website
  andyhardt.github.io/213_F24/course_page.html
- Join the Gradescope course (see email for entry code)
- Obtain the textbook, and read Section 2.1
- First homework will be posted soon

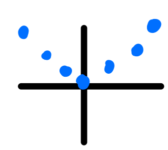
Today: Overview, course policies, sets and elements

Discrete: Individually separate and distinct



cont.

Think: "the opposite of continuous"



discrete

Why learn about discrete structures in mathematics?

They help us any concept where discreteness is relevant

e.g. logic, discrete probability, data structures, algorithms, graph theory, discrete geometry, game theory

(Think about how continuous functions help us understand changing systems, regardless of context)

Topics:

1) Sets and functions
2) Algorithms
3) Induction
4) Enumeration
5) Probability
6) Relations
7) Graphs and trees

Course policies: go through syllabus

§2.1: Sets:

Def: A <u>set</u> is a collection of <u>elements</u>

e.g. $A = \{a, b, c\}$ ← curly braces denote a set

$B = \{1, 2, 3\}$

elements

$x \in A$ means x is an element of A

$x \notin A$ means x isn't an elt. of A

Sets are equal if they have the same elements

Each element can only count <u>once</u> in a set

$\{a,b,c\} = \{c,a,b\} = \{a,a,b,c\} \neq \{a,b,c,d\}$

Important sets:

- $\mathbb{Z}$ = the set of integers $= \{\ldots, -2, -1, 0, 1, 2, 3, \ldots\}$
- $\mathbb{N}$ = the set of natural numbers $= \{0, 1, 2, 3, \ldots\}$
- $\mathbb{R}$ = the set of real numbers
- ϕ = the empty set $= \{\}$

Roster notation: list all elements

Set builder notation: all possible elements with a given property

e.g. $A = \{x \mid x \text{ is an odd integer}\}$

$= \{\ldots, -5, -3, -1, 1, 3, 5, 7, \ldots\}$

$B = \{x \in \mathbb{Z} \mid -2 \leq x \leq 3\} = \{-2, -1, 0, 1, 2, 3\}$

Class activity: List all elements of the following sets

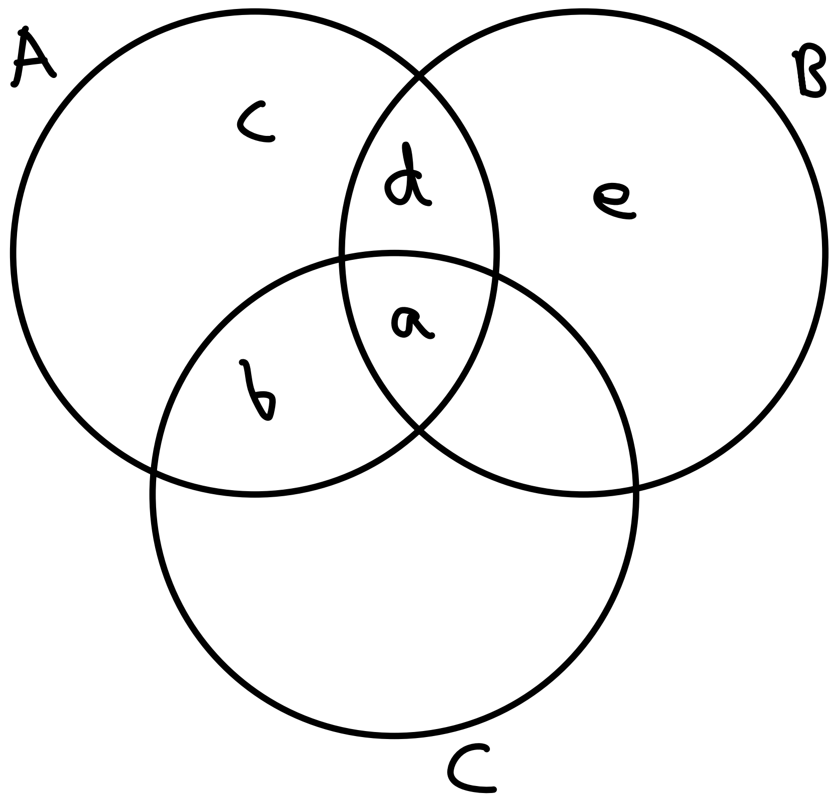
$C = \{x \in \mathbb{Z} \mid x \notin A \text{ and } x \in B\}$

$D = \{x \mid x \in \emptyset\}$

$E = \{A, \emptyset, \{\pi, e\}\}$

Venn diagrams:

$A = \{a, b, c, d\}$ $\quad B = \{a, d, e\}$ $\quad C = \{a, b\}$



Def: A is a suset of B, $A \subseteq B$ if every elt. of A is an elt. of B.

e.g. above, $C \subseteq A$ $\quad A \nsubseteq C$ $\quad A \nsubseteq B$ $\quad B \nsubseteq A$

$A \subseteq A$

$\phi \subseteq A$

always true!

If $A \subseteq B$ and $B \subseteq A$, then $A = B$

If $A \subseteq B$ but $B \nsubseteq A$, then A is a <u>proper</u> subset of B and we write $A \subsetneq B$

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