Math 321

Set theory. (New toys: set "New" Rules)

Def: Set: "collection of unordered objects" (elements or members)

Notation: (normally) upper case is for set names
lower case is for element names
if an element is in a set use $\in$
if an element is not in a set use $\notin$

(ex) Mark $\in$ Teachers Mark $\notin$ good teachers

represent sets

① roster or list method (just write all the elements)

$A = \{ \bigcirc, \ddot{\smile}, \Delta, \text{Mark}, \int x dx \}$

$B = \{ \boxed{\{\}}, \boxed{\{a,b\}}, \boxed{7} \}$ (boxed: elements)

$C = \{ a, b, \ldots, z \}$

② Set builder notation $A = \{ e \mid P(e) \}$ (such that)

e: element variable; P(e): propositional function of e

ex $A = \{ x \mid x \text{ is an int} \wedge x \geq 3 \wedge x < 6 \}$

$A = \{ 3, 4, 5 \}$

$S = \{ p \mid p \text{ is a person} \wedge \text{“}p \text{ runs faster than Mark”} \}$

Naive Set theory (our definition of a set)

b/c our def can lead to issues we call it Naive set theory

“paradox”

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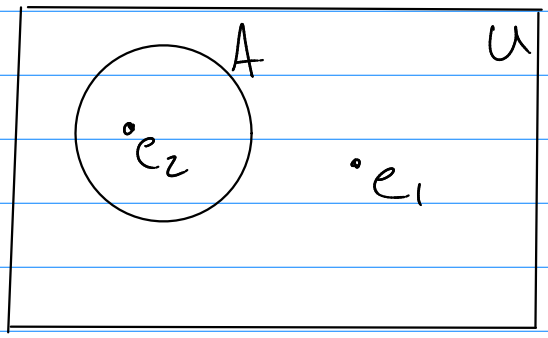
③ Venn Diagram

two special sets $U = \{$ set of all elements $\&$ U.D. $\}$

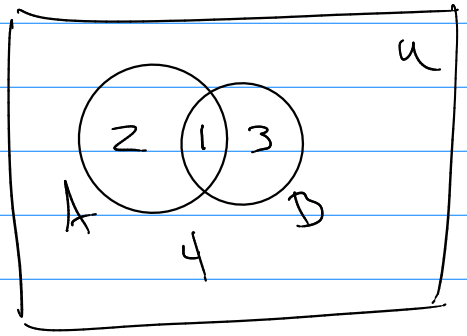
$\emptyset = \{\}$ set of no elements



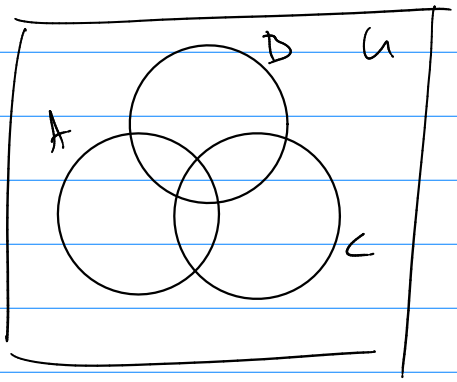
$e_1 \notin A$

$e_2 \in A$

2 sets



3 sets



Membership table

A	B
1	1 ←
1	0 ←
0	1 ←
0	0

Sets to know

① $\mathcal{U}$

② $\emptyset$

Number sets $\mathbb{N} = \{0, 1, 2, \dots\}$

$\mathbb{Z} = \{\dots, -2, -1, 0, 1, 2, \dots\}$

$\mathbb{Z}^+ = \{1, 2, 3, \dots\}$

$\mathbb{Q} = \{ a/b \mid a, b \in \mathbb{Z} \wedge b \neq 0 \wedge a, b \text{ have no common factors} \}$

$\mathbb{R} = \{ n \mid n \text{ can be written as a decimal} \}$

$3.124000\ldots$

$3.121212\ldots$

terminates or repeats

$\in \mathbb{Q}$

not term and not repeat

$0.12112111211112\ldots \notin \mathbb{Q}$

$\sqrt{2} = 1.\ldots$

$\to \mathbb{Q}$: irrational

Rules for our toys — sets

1st Comparisons

① Cardinality. $|S|$ = number of unique elements in S.

$\to |\{9, 9, 1, 2, 3, \ddot{\smile}, \ddot{\smile}\}| = 5$

Note: b/c unique is important don't write multiple elements.