Feb 8 Slides

1. Union, Intersection, Difference
2. Power Sets
3. Disjoint Sets
4. Set-builder Notation
5. Properties/Laws of sets

[More practice]

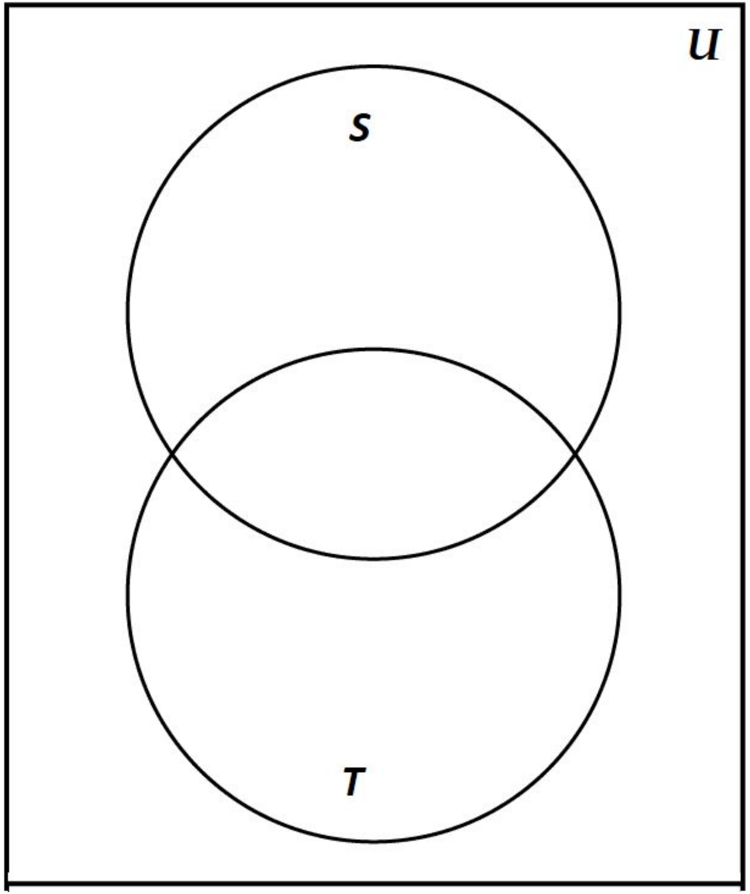
$\cup$, $\cap$, $\setminus$, **C**

$\cup$ **"union"**

$\cap$ **"intersect"**

$\setminus$ **"difference"**

In mathematics, the **intersection** of two sets S and T, denoted by S ∩ T, is the set containing all elements of S that also belong to T (or equivalently, all elements of T that also belong to S)



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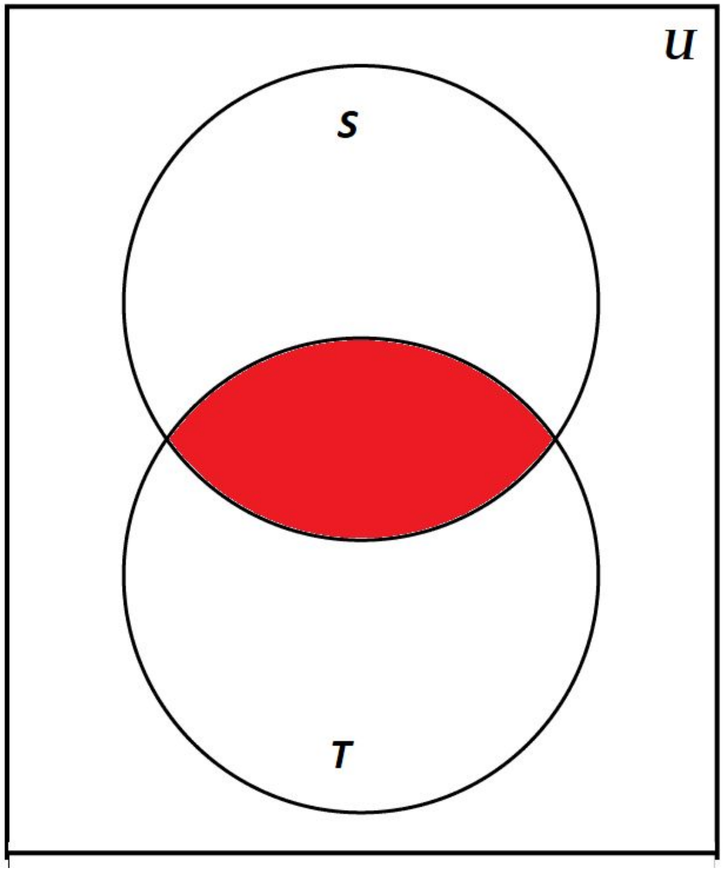
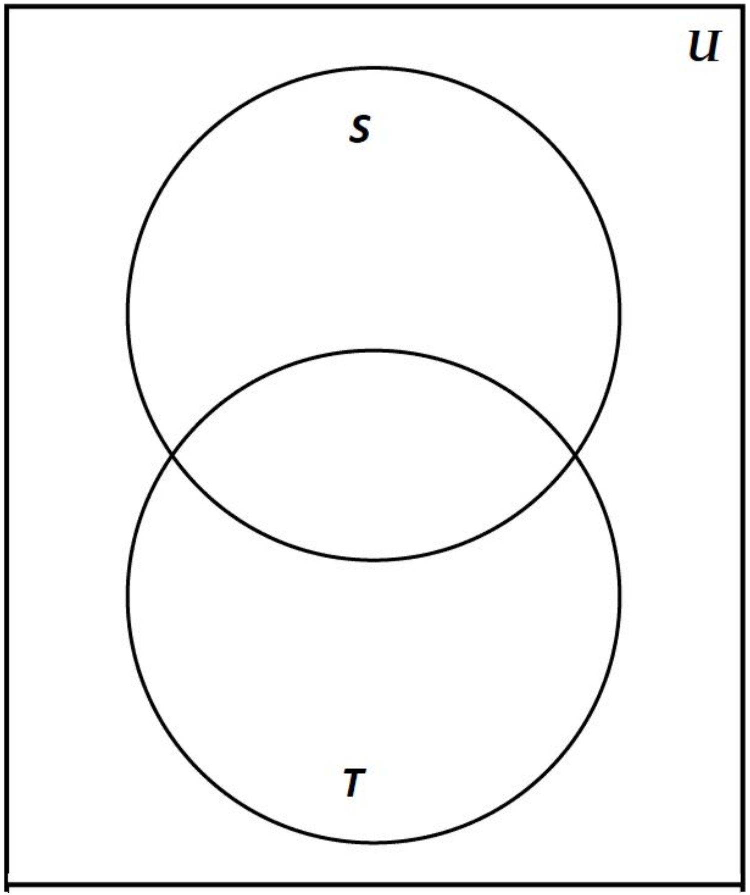


Difference $S \setminus T$: the elements that belong to S but not to T.



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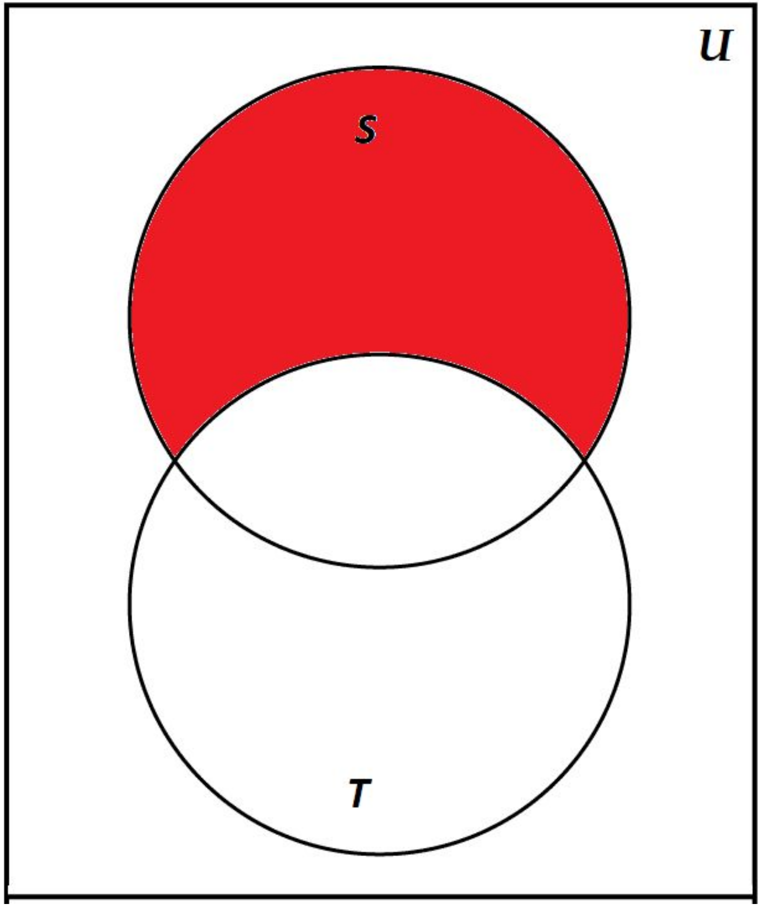
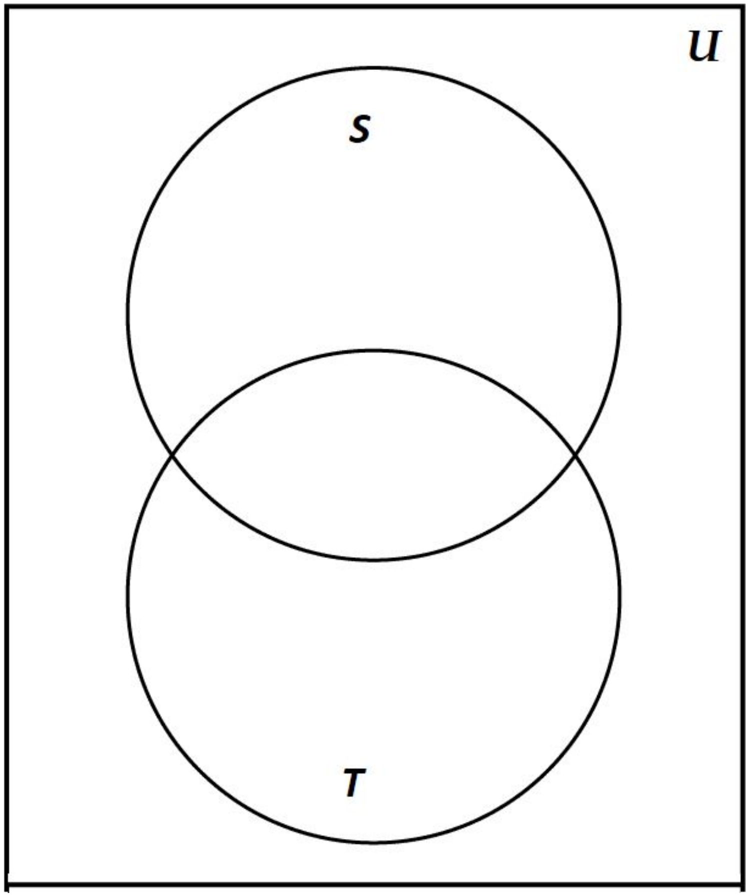
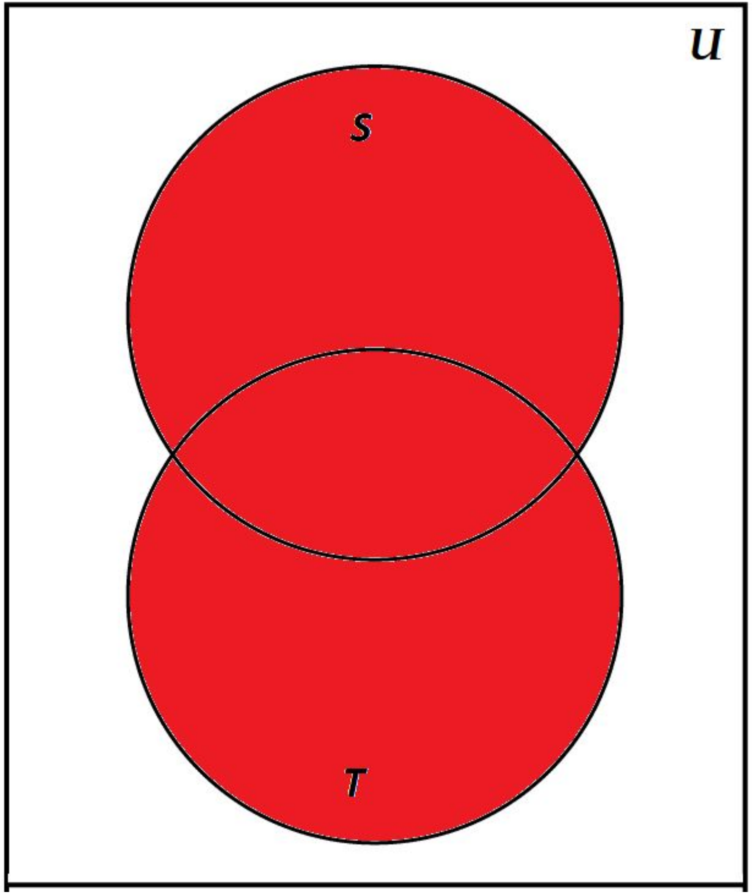


Union:



Union: A set that contains all the elements of both S and T.



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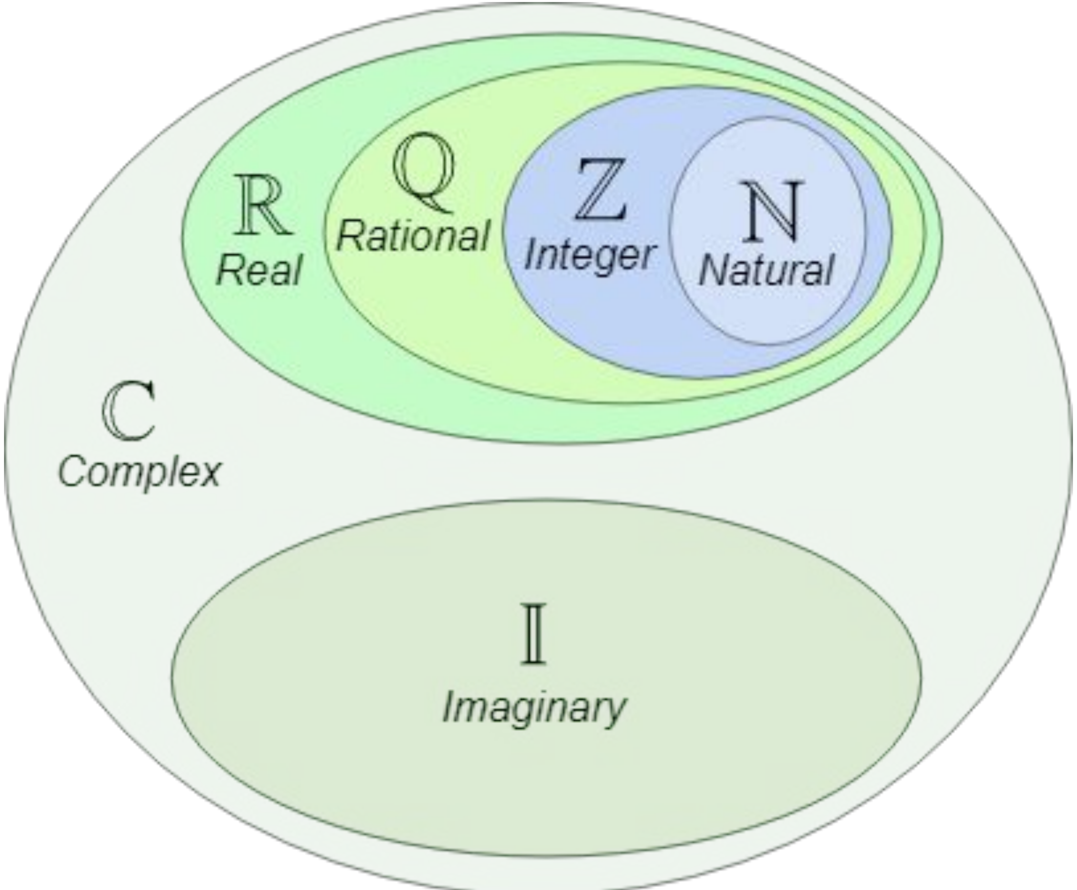
Cardinality

Q: Compute each cardinality.

1. $|\{1, -13, 4, -13, 1\}|$
2. $|\{3, \{1,2,3,4\}, \varnothing\}|$
3. $|\{\}|$
4. $|\{ \{\}, \{\{\}\}, \{\{\{\}\}\} \}|$

Useful Infinite Sets



4.1.1 Some Popular Sets

Mathematicians have devised special symbols to represent some common sets.

symbol	**set**	**elements**
$\emptyset$	the empty set	none
$\mathbb{N}$	nonnegative integers	$\{0, 1, 2, 3, \ldots\}$
$\mathbb{Z}$	integers	$\{\ldots, -3, -2, -1, 0, 1, 2, 3, \ldots\}$
$\mathbb{Q}$	rational numbers	$\frac{1}{2},\ -\frac{5}{3},\ 16,$ etc.
$\mathbb{R}$	real numbers	$\pi,\ e,\ -9,\ \sqrt{2},$ etc.
$\mathbb{C}$	complex numbers	$i,\ \frac{19}{2},\ \sqrt{2} - 2i,$ etc.

A superscript "$^+$" restricts a set to its positive elements; for example, $\mathbb{R}^+$ denotes the set of positive real numbers. Similarly, $\mathbb{Z}^-$ denotes the set of negative integers.

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Select $\mathbb{Z}^-$ from the choices given here

A: {0,1,2,3....} B: {1,2,3....} C: {....-3, -2, -1} D: {....-3, -2, -1, 0} E: None of the Above

What are these??!

$\cup$:

$\cap$:

$\setminus$:

$\in$:

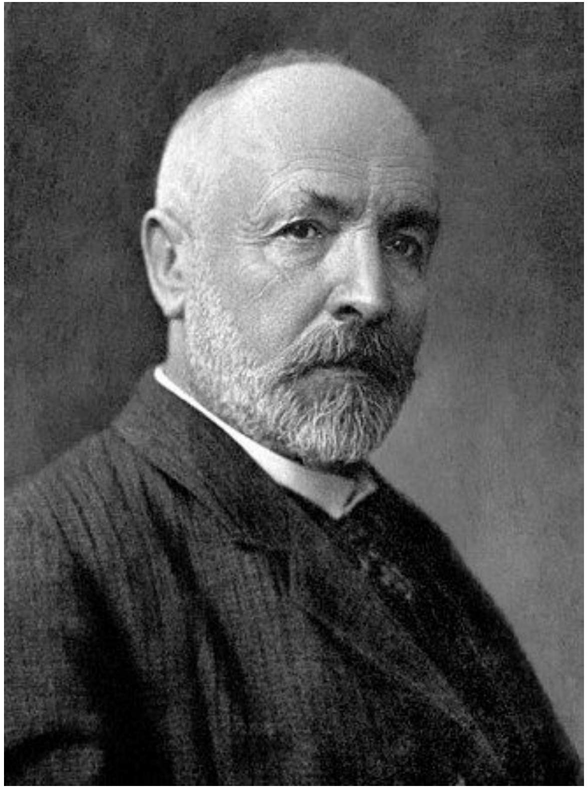
$\subseteq$:

$\supseteq$:

$\subset$:

$\supset$:

Georg Ferdinand Ludwig Philipp Cantor ... was a German mathematician. **He created set theory,** which has become a fundamental theory in mathematics. Cantor] defined infinite and well-ordered sets, and proved that the real numbers are more numerous than the natural numbers. In fact, Cantor's method of proof of this theorem implies the existence of an infinity of infinities.



Cantor's work is of great philosophical interest, a fact he was well aware of. **Cantor's theory of transfinite numbers was originally regarded as so counter-intuitive – even shocking** – that it encountered resistance from mathematical contemporaries such as Leopold Kronecker and Henri Poincaré[3] and later from Hermann Weyl and L. E. J. Brouwer, while Ludwig Wittgenstein raised philosophical objections. Cantor, a devout Lutheran, **believed the theory had been communicated to him by God.**

The objections to Cantor's work were occasionally fierce: Leopold Kronecker's public opposition and personal attacks included describing Cantor as a **"scientific charlatan", a "renegade" and a "corrupter of youth".**

Reminder: Subset Definition

Set A is a ***subset*** of set B

$A \subseteq B$

If & only if **all elements of A are also in B**

Power sets

4.1.3 Power Set

The set of all the subsets of a set, A, is called the *power set*, $\text{pow}(A)$, of A. So

$$B \in \text{pow}(A) \quad \text{IFF} \quad B \subseteq A.$$

For example, the elements of $\text{pow}(\{1, 2\})$ are $\emptyset$, $\{1\}$, $\{2\}$ and $\{1, 2\}$.

Power sets -- Break-outs

1.) What is the power-set of {}?

2.) What is the power set of {a, b, c}

3.) What is the power set of { W, X, Y, Z }

Can we see a rule/pattern to determine the cardinality of a powerset?

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$$|\mathcal{P}(X)| = 2^{|X|}$$

Other Notations

$$\mathcal{P}(X)$$

$$\mathcal{P}(X)$$

$$\mathscr{P}(X)$$

$$\wp(X)$$