CSC165 **Arthur Gao**

LECTURE 1 (*January 11, 2022*)

What is a set?

$\boxed{\text{A set is a collection of "elements", "numbers", "items"}}$

- Must be distinct elements (no repeats)
- Example would be $\{3, 1, 2, 3\} = \{2, 1, 3\} = \{1, 2, 3\}$
- $\{\dots\}$ is a notation used to REFER to a set

Take the set $\{3, 1, 2, 3\}$ we can denote the "size" or "cardinality" as

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

Suppose $x, y \in \mathbb{R}$ then $1 \leq |\{x, y, x + y\}| \leq 3$ since x, y are not necessarily unique values. Therefore, if $x = 0, y = 0$ then size of the set is 1. If $x = 0, y = 1$ then size is 2, and if $x = 1, y = 2$, size is 3.

EXAMPLES:

$$\begin{aligned}
|\{2, 3, 1\}| &= 3 \\
|\{\}| = |\emptyset| &= 0 \\
|\{\mathbb{R}\}| &= \infty \\
|\{165, \text{dog}, :)\}| &= 3 \\
|\{\{2, 3, 1\}, \text{dog}, :), 165\}| &= 4 \\
|\{\emptyset\}| &= 1
\end{aligned}$$

Note that size of a finite set is always a natural number so $|s| \in \mathbb{N}$)

We use the notation $e \in S$: to say e is an ELEMENT of S

EXAMPLES:

$$\begin{aligned}
A &= \{\{a, b\}, c, \{d, e, f\}\} \\
\{a, b\} &\in A \\
c &\in A
\end{aligned}$$

We use the notation $B \subseteq C$: to say B is an SUBSET of C $e \in B$ then $e \in C$ where B, C can be equal.
We use the notation $B \subset C$: to say B is an SUBSET of C $e \in B$ then $e \in C$ where B, C cannot be equal.

EXAMPLES:

$$
\begin{aligned}
A = \{a, b, c\} \\
\emptyset \subset A \\
\{a\} \\
\{b\} \\
\{c\} \\
\{ab\} \\
\{ac\} \\
\{bc\} \\
\{a, b, c\}
\end{aligned}
$$

Note: For every set S, $\emptyset \subseteq S$ and therefore $\emptyset \subseteq \emptyset$