MATH 381 Section 2.2

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Set Operations

Definition Let A and B be two sets.

Union:	$A \cup B = \{x \mid x \in A \vee x \in B\}$
Intersection:	$A \cap B = \{x \mid x \in A \wedge x \in B\}$
Difference:	$A - B = \{x \mid x \in A \wedge x \notin B\}$
Complement:	$\bar{A} = \{x \in U \mid x \notin A\}$

Theorem 0.1 *Let A, B be finite sets.*

$$|A \cup B| = |A| + |B| - |A \cap B|$$

$$A \cup B - B = A \cap \bar{B}$$

Definition Two sets A and B are disjoint if $A \cap B = \emptyset$
The union between two disjoint sets i.e. disjoint union is denoted by $A \sqcup B$.

Remark Let $A_1, A_2, \ldots, A_n$ be sets.

$$\bigcup_{i=1}^{n} A_i = A_1 \cup A_2 \cup \cdots \cup A_n$$

$$\bigcap_{i=1}^{n} A_i = A_1 \cap A_2 \cap \cdots \cap A_n$$

Example

$$i \in \mathbb{N}$$

$$A_i = \{i, i+1, i+2, \dots, \infty\} = \{n \in \mathbb{N} \mid n \geq i\}$$

$$\begin{aligned} A_1 &= \{1, 2,3, \dots, \infty\} \\ A_2 &= \{2,3, 4, \dots, \infty\} \\ A_3 &= \{3, 4, 5, \dots, \infty\} \end{aligned}$$

$$A_1 \supset A_2 \supset A_3 \supset \cdots \supset A_n$$

1.

$$\bigcup_{i=1}^{n} A_i = A_1 \cup A_2 \cup \cdots \cup A_n = A_1$$

$$\bigcap_{i=1}^{n} A_i = A_1 \cap A_2 \cap \cdots \cap A_n = A_n$$

2.

$$\bigcup_{i=1}^{\infty} A_i = A_1 = \mathbb{N}$$

$$\bigcap_{i=1}^{\infty} A_i = \emptyset$$