Topic 1: Sets

Ch2.1 Sets

> A set is countable when it is finite *or* has the same size as the set of positive integers.

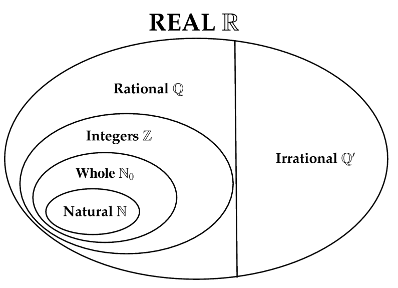
$\rightarrow$ The set of rational numbers is countable, the set of real numbers is not (bc there can be infinite 0.1, 0.01, 0.001…)

🗣️ A *set* is an unordered collection of objects, called *elements* or *members* of the set. $a \in A$: a is an element of the set A; $a \notin A$: a is not an element of the set A.

Roster Method (Listing Method)

- Listing the elements inside braces, i.e. {2, 4, 6, 8}

N= {0, 1, 2, 3,…}, the set of **natural numbers**
Z = {…, −2, −1, 0, 1, 2,…}, the set of **integers**
Z^+ = {1, 2, 3,…}, the set of **positive integers**
Q = {p/q | p ∈ Z, q ∈ Z, and q "= 0}, the set of **rational numbers**
R, the set of **real numbers**
R^+, the set of **positive real numbers**
C, the set of **complex numbers**



$[a, b]$ is called the **closed interval** (include); (a, b) is called the **open interval** (not include)

🗣️ $A \subseteq B$: The set A is a subset of B *iff* every element of A is also an element of B; $A \subset B$: A is a subset of B, but $A \neq B$ (proper subset)

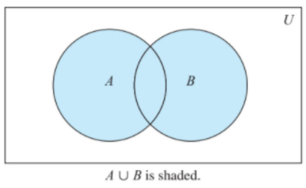
🗣️ Two sets are *equal iff* they have the same elements. A and B are equal *iff* $\forall x(x \in A \leftrightarrow x \in B)$. To show that two sets A and B are equal, show that $A \subseteq B$ and $B \subseteq A$.

💡 For every set S, $(i)\ \emptyset \subseteq S$ and $(ii)\ S \subseteq S$

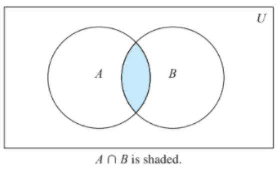
🗣️ $|S|$: the cardinality of S, distinct elements in S. $\mathcal{P}(S)$: the power set of S, the set of all subsets of S.

🗣️ $A \times B$: is the set of all ordered pairs (a,b), where $a \in A$ and $b \in B$. $A \times B \neq B \times A$ unless $A = \emptyset$ or $B = \emptyset$ or $A = B$.

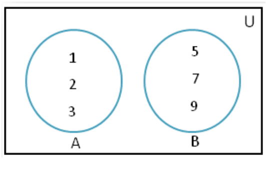
Ch2.2 Set Operations



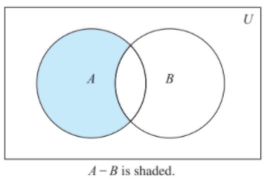
Union $A \cup B$



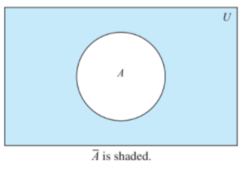
Intersection $A \cap B$



Disjoint $A \cap B = \emptyset$



Difference $A - B$



Complement $\overline{A}$

The principle of inclusion-exclusion (PIE)

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

Important Set identities

$A - B = A \cap \overline{B}$

Full table of Set Identities in Apendix A.