1.4 Set Operations

Let A and B be sets:

(I) The **intersection** of A and $B = A \cap B = \{x : x \in A$ and $x \in B\}$
think of "$\cap$" for "i$\cap$tersection".

e.g., Let $A_1 = \{1, 2, 5, 8, 9\}$, $A_2 = \{0, 2, 4, 6, 8\}$
$A_3 = \{2, 7\}$, $A_4 = \{3, 6\}$

$A_1 \cap A_2 =$, $A_2 \cap A_3 =$
$A_1 \cap A_4 =$
$A_1 \cap A_2 \cap A_3 =$

$\mathbb{N} \cap \mathbb{Z} =$
$\mathbb{Q} \cap \mathbb{R} =$

$\langle Def \rangle$ $A \cap B = \varnothing \Longleftrightarrow A$ and B are **disjoint**.

e.g.,

(II) The **union** of A and $B = A \cup B = \{x : x \in A$ or $x \in B\}$
think of "$\cup$" for "$\cup$nion".

$\langle Note \rangle$ $A \cap B \subseteq A \cup B$

e.g., $A_1 \cup A_3 =$
$A_2 \cup A_3 \cup A_4 =$
$\mathbb{N} \cup \mathbb{Z} =$
$\mathbb{Q} \cup I =$

(1.4 cont.)

(III) The **difference** $A - B = A \backslash B = \{x : x \in A \text{ and } x \notin B\}$

e.g., $A_2 - A_3 =$
$A_3 - A_4 =$
$\mathbb{R} - \mathbb{Q} =$

$\langle Def \rangle$ Let U be the universal set (i.e., all sets being discussed are subsets of U). Then the **complement** of a set A is the set of elements of U not belonging to A.

i.e., $\overline{A} = A^c = U - A = \{x : x \in U \text{ and } x \notin A\}$.

e.g., $U = A_1 \Longrightarrow \overline{A_3} =$
$U = \mathbb{Z} \Longrightarrow \overline{\mathbb{N}} =$
$U = \mathbb{R} \Longrightarrow \overline{\mathbb{Q}} =$

$\langle Note \rangle$ $A - B$ is sometimes called the **relative complement of** B **in** A.
$A - B = A \cap \overline{B}$

Standard Venn diagram for 3 sets A, B, C :

Practice Venn diagrams @
http://www.ship.edu/~deensl/DiscreteMath/flash/ch3/sec3_1/venntwoset.html
http://www.ship.edu/~deensl/DiscreteMath/flash/ch3/sec3_1/vennthreeset.html