Set Algebra

1 Why

We want to form a new set from two sets; we survey three useful operations.

2 Basic Operations

We call the set whose elements consist of those objects which are elements of either the first set or the second set as the **union** of the first and second set. We call the set whose elements consist of those objects which are elements of both the first set and the second set **intersection** of the first and second set. We call the set whose elements consist of those elements which are elements of the union of the sets but not the intersection sets as the **symmetric difference** of the first and second set. If the first set is a subset of the second set, then we call the symmetric difference the **complement** of the first set in the second set.

2.1 Notation

We denote the union of the set A with the set B by $A \cup B$. We read the notation $A \cup B$ aloud as "A union B." We denote the intersection of the set A with the set B by $A \cap B$. We read the notation $A \cap B$ aloud as "A intersect B." We denote the symmetric difference of the set A with the set B by $A \Delta B$. We read the notation $A \Delta B$ aloud as "the symmetric difference of A and B." We denote the complement of A in B by $C_B(A)$. We read the notation $C_B(A)$ aloud as "the complement of A in B." Alternatively, we denote the complement of A in B by $B - A$. We read the notation $B - A$ aloud as "B minus A".

2.2 Results

Proposition 1 *For sets A, B: (a) $A \cup B = B \cup A$, (b) $A \cap B = B \cap A$, and (c) $A \Delta B = B \Delta A$.*

Proposition 2 *For sets $A, B \subset S$,*

$$\begin{aligned} &\textit{(1)} \quad C_S(A \cup B) = C_S(A) \cap C_S(B) \\ &\textit{(2)} \quad C_S(A \cap B) = C_S(A) \cup C_S(B) \end{aligned}$$