



## SET DECOMPOSITIONS

### Why

Let  $E$  denote a set and let  $A$  denote a set with  $A \subset E$ .  $A$  and  $C(A)$  as breaking  $E$  into two pieces which do not overlap.

### Discussion for complements

To make this precise, let us say that by “breaking  $E$  into two pieces” we mean that these two pieces are all of  $E$ . In other words, every element of  $E$  is contained either in  $A$  or  $C(A)$ . We use the language of set unions (*Pair Unions*).

**Proposition 1** (Breaking).  $A \cup C(A) = E$

Next, let us say that “do not overlap” means that no element of  $A$  is an element of  $C(A)$  and vice versa. We use the language of set intersections (see *Pair Intersections*).

**Proposition 2** (Non-overlapping).  $A \cap C(A) = \emptyset$

### Definition

We call a pair  $\{A, B\}$  a *decomposition* of  $E$  if  $A \cap B = \emptyset$  and  $A \cup B = E$ . If  $A \cap B = \emptyset$  we say that  $\{A, B\}$  are *disjoint*. If we have a set of sets  $\mathcal{A}$  satisfying  $(A \in \mathcal{A} \wedge B \in \mathcal{A}) \longrightarrow (A \cap B = \emptyset)$  then we call  $\mathcal{A}$  *pairwise disjoint*.



