Family Set Operations

1 Why

Family set operations are common. TODO: this works for infinite stuff too

2 Definition

We define the set whose elements are the objects which are contained in at least one family member the *family union*. We define the set whose elements are the objects which are contained in all of the family members the *family intersection*.

2.1 Notation

We denote the family union by $\cup_{\alpha \in I} A_\alpha$. We read this notation as "union over alpha in I of A sub-alpha." We denote family intersection by $\cap_{\alpha \in I} A_\alpha$. We read this notation as "intersection over alpha in I of A sub-alpha."

2.2 Results

Proposition 1. *For an indexed family $\{A_\alpha\}_{\alpha \in I}$ in S, if $I = \{i, j\}$ then*

$$\cup_{\alpha \in I} A_\alpha = A_i \cup A_j$$

and

$$\cap_{\alpha \in I} A_\alpha = A_i \cap A_j.$$

Proposition 2. *For an indexed family* $\{A_\alpha\}_{\alpha\in I}$ *in* S*, if* $I = \varnothing$*, then*

$$\cup_{\alpha\in I} A_\alpha = \varnothing$$

and

$$\cap_{\alpha\in I} A_\alpha = S.$$

Proposition 3. *For an indexed family* $\{A_\alpha\}_{\alpha\in I}$ *in* S*.*

$$C_S(\cup_{\alpha\in I} A_\alpha) = \cap_{\alpha\in I} C_S(A_\alpha)$$

and

$$C_S(\cap_{\alpha\in I} A_\alpha) = \cup_{\alpha\in I} C_S(A_\alpha).$$