Intro to Math Reasoning HW 5a

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Problem 1

Problem: Prove that for all indexed collections of sets $(A_\alpha)_{\alpha\in J}$ and for all $\beta \in J$:

$$\left(\bigcap_{a\in J} A_a\right) \subseteq A_\beta$$

Solution: The definition of $\left(\bigcap_{a\in J} A_a\right)$ is the following:

$$\left(\bigcap_{a\in J} A_a\right) \equiv \{x \mid (\forall\alpha \in J)\ x \in A_\alpha\}$$

This is equivalent to the following:

$$x \in \left(\bigcap_{a\in J} A_a\right) \equiv (\forall\alpha \in J)\ x \in A_\alpha$$

Now, because $\beta \in J$ we can make the following statement:

$$(\forall\alpha \in J)\ x \in A_\alpha \implies x \in A_\beta$$

That's it, we have established that if an element is in $\left(\bigcap_{a\in J} A_a\right)$ then it is an element of A_β.

Problem 2

Problem: Prove that for all sets A, B, C, D that if A is disjoint from B and C is disjoint from D, then $A \cap B$ is disjoint from $C \cap D$

Solution: Here are the definitions of $A \cap B$ and $C \cap D$:

$$A \cap B \equiv \{x \mid x \in A \land x \in B\}$$
$$C \cap D \equiv \{x \mid x \in C \land x \in D\}$$

Problem 2

Problem:

Solution: