

Equivalence

1 Equivalence =

Let = denote equivalence

$$x_i = x_i \quad \forall i$$

2 Is equal to ==

$$\begin{aligned} == & [x_i, x_j] := \\ == & [x_i, x_j] \rightarrow \mathbb{T} \quad i = j \\ == & [x_i, x_j] \rightarrow \mathbb{F} \quad i \neq j \end{aligned}$$

2.1 Alternate Notation

$$x_i == x_j$$

3 Is not equal to !=

$$\begin{aligned} != & [x_i, x_j] := \\ != & [x_i, x_j] \rightarrow \mathbb{T} \quad i \neq j \\ != & [x_i, x_j] \rightarrow \mathbb{F} \quad i = j \end{aligned}$$

3.1 Alternate Notation

$$x_i != x_j$$

Set Theory

4 Element

Define element l

$$l = \{l\}$$

5 Identity

Define identity of element l

$$|l| := 1$$

6 Empty Set

Define Empty Set, the set containing no elements

$$\emptyset := \{\}$$

7 Null Identity

Define the null identity

$$|\emptyset| := 0$$

8 Union \cup

Define \cup the union of two elements

$$\begin{aligned}\cup[l_i, l_j] &= l_i \cup l_j = \{l_i\} \cup \{l_j\} := \\ &\cup[l_i, l_j] \rightarrow \{l_i\} \quad i = j \\ &\cup[l_i, l_j] \rightarrow \{l_i, l_j\} \quad i \neq j\end{aligned}$$

8.1 Translation

\cup is often read as "and"

8.2 Comma ,

In set notation the comma "," denotes union \cup

$$l_1 \cup l_2 = \{l_1\} \cup \{l_2\} = \{l_1, l_2\}$$

9 Intersection \cap

Define \cap , the intersection of two elements

$$l_1 \cap l_2 = \{l_1\} \cap \{l_2\}$$

$$\cap[l_i, l_j] \rightarrow \{l_i\} \quad i = j$$

$$\cap[l_i, l_j] \rightarrow \emptyset \quad i \neq j$$

10 Sets

10.1 Definition

Define set S as an ordered union of elements s_i

$$S := s_1 \cup s_2 \cup \dots \cup s_{n-1} \cup s_n = \{s_1, s_2, \dots, s_N\}$$

10.2 Alternate Notation

$$S := s_i \in S : i = 1, 2, \dots, N-1, N$$

$$S = \{s_1, s_2, \dots, s_{N-1}, s_N\}$$

10.3 Magnitude of a Set

$$|S| = |\{x_1, \dots, x_N\}| = N$$

10.4 Counting

$$1, 2, \dots, N = 1 : N$$

10.5 Definition Unordered Set

Set S is unordered if

$$S = \{x_1, x_2, \dots, x_n\} := \\ x_i, x_j \in S; \quad x_i = x_j; \quad \forall i, j \neq i$$

10.6 Definition of Unique Set

$$\begin{aligned} a_i, a_j &\in S \\ a_i &\neq a_j \quad \forall i, j \neq i \end{aligned}$$

10.7 Definition of Countable/Uncountable set

Potentially just a line?

10.8 Define line \mathbb{L}

Define line \mathbb{L}

$$\begin{aligned} \mathbb{L} &:= \{l_0, l_1, l_2, \dots, l_{N-1}, l_N, l_{N+1}, \dots \\ &\iff \exists l_i \in \mathbb{L} \quad \forall i \end{aligned}$$

11 Hierarchy of Elements to Sets

Every element is a set, but not all sets are elements

12 Universal Set

12.1 Definition

Define Universe, the "Universal Set" containing all elements

$$\Omega := s_i \in \Omega, \forall i$$

13 Definition of Span

A function mapping to every element of L?

14 Containment

14.1 Contains

14.2 Equals =

Define set equivalence =

$$S_1 \subseteq S_2; \quad S_2 \subseteq S_1 \iff S_1 = S_2$$

14.3 Subset

14.4 Proper Subset Citation

14.5 Definition of Complement

$$\begin{aligned} S &= \{s_1, s_2, \dots, s_N\} \\ S^C &:= \\ s_j &: \{s_j \in \Omega\} \cap \{s_j \notin S\}; \quad \forall j \end{aligned}$$

14.6 Alternate Notation

Wikipedia definition of complement

$$S^C = U - S = \{x \in \Omega : x \notin S\}$$

[https://en.wikipedia.org/wiki/Complement_\(set_theory\)](https://en.wikipedia.org/wiki/Complement_(set_theory))

Computational Functions

15 ← "Assignment"

15.1 Definition

16 Insertion

17 Append

18 "Deletion"

18.1 Definition

19 Iteration \mathbb{C}

19.1 Definition

Define iteration \mathbb{C}

Appendix

20 Proofs and Properties

1. $\Omega \subset \emptyset$
2. $\Omega \cap \Omega = \Omega$
3. $\Omega \cup \Omega = \Omega$
4. $\Omega \cup \emptyset = \Omega$
5. $\Omega \cap \emptyset = \emptyset$
6. $\Omega \cap S = S$
7. $\Omega \cup S = \Omega$
8. $\emptyset \not\subseteq \Omega$
9. $\emptyset \cup \emptyset = \emptyset$
10. $\emptyset \cap \emptyset = \emptyset$
11. $\emptyset \cap S = \emptyset$
12. $\emptyset \cup S = S$
13. $\emptyset = \emptyset$
14. $\emptyset = \Omega^C$
15. $\Omega \subseteq S$