Syntax & Semantics (Simple)

Topic 1 Section 1

Propositions & Basic
Set Theoretic Symboles

Contents

1 What Are Propositions?

A *proposition* is a declarative statement that is either true or false, but not both.

Propositional logic focuses on the relationships between these propositions and how they can be combined using logical operators.

2 Logical Operators

Symbol	**What is Means**	**Notes**
$\neg P$	Not P	
$P \wedge Q$	P and Q	$\wedge$ looks like a capital A for 'and'.
$P \vee Q$	P or Q (inclusive)	If either one or both of are true, the statement $P \vee Q$ is true.
$P \to Q$	P implies Q	
$P \longleftrightarrow Q$	P is true if, and only if, Q is true. $(P \to Q) \wedge (Q \to P)$ $(P \wedge Q) \vee (\neg P \wedge \neg Q)$	'If and only if' is commonly shortened to 'iff'.

This table will be expanded and improved overtime.

3 Set-theoretic Symbols

Symbol	Meaning	Example
$\forall$	For all values of x	$\forall x(x \in \mathbb{R} \to x^2 \in \mathbb{R})$
$\exists$	There exists at least one value	$\exists x(x \in \mathbb{R} \land x^2 = 4)$
$\in$	Is an element of	$5 \in \{3, 5, 7\}$
$\notin$	Is not an element of.	$4 \notin \{3, 5, 7\}$
$\subseteq$	Is a subset of $S \subseteq T \longleftrightarrow \forall x(x \in S \to x \in T)$	$\{3, 7\} \subseteq \{3, 5, 7\}$ $\{3, 5, 7\} \subseteq \{3, 5, 7\}$
$\nsubseteq$	Is not a subset of $S \nsubseteq T \longleftrightarrow \exists x(x \in S \land x \notin T)$	$\{1, 2, 3\} \nsubseteq \{1, 3, 5, 7, 9\}$
$\subset$	Is a strict subset of $S \subset T \longleftrightarrow (S \subseteq T \land S \neq T)$	$\{1, 3, 5\} \subset \{1, 3, 5, 7, 9\}$
$\not\subset$	Is not a strict subset of $S \not\subset T \longleftrightarrow (S \nsubseteq T \lor S = T)$	$\{3, 5, 7\} \not\subset \{3, 5, 7\}$
$\cup$	Union $S \cup T = \{x : x \in S \lor x \in T\}$	$\{1, 3\} \cup \{5, 7\} = \{1, 3, 5, 7\}$
$\cap$	Intersection $S \cap T = \{x : x \in S \land x \in T\}$	$\{1, 2, 3\} \cap \{2, 3, 4\} = \{2, 3\}$ $\{1, 2, 3\} \cap \{4, 5, 6\} = \emptyset$
$\setminus$	Set difference $S \setminus T = \{x : x \in S \land x \notin T\}$	$\{1, 2, 3, 4\} \setminus \{2, 3\} = \{1, 4\}$

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