List of logic symbols

In logic, a set of symbols is commonly used to express logical representation. The following table lists many common symbols, together with their name, pronunciation, and the related field of mathematics. Additionally, the third column contains an informal definition, the fourth column gives a short example, the fifth and sixth give the Unicode location and name for use in HTML documents.[1] The last column provides the LaTeX symbol.

Contents

Basic logic symbols

Symbol	Name	Read as	Category	Explanation	Examples	Unicode value (hexadecimal)	HTML value (decimal)	
⇒ → ⊃	material implication	implies; if ... then	propositional logic, Heyting algebra	$A \Rightarrow B$ is false when A is true and B is false but true otherwise.[2] → may mean the same as ⇒ (the symbol may also indicate the domain and codomain of a function; see table of mathematical symbols). ⊃ may mean the same as ⇒ (the symbol may also mean superset).	$x = 2 \Rightarrow x^2 = 4$ is true, but $x^2 = 4 \Rightarrow x = 2$ is in general false (since x could be −2).	U+21D2 U+2192 U+2283	⇒ → ⊃	⇒ → ⊃
⇔ ≡ ↔	material equivalence	if and only if; iff; means the same as	propositional logic	$A \Leftrightarrow B$ is true only if both A and B are false, or both A and B are true.	$x + 5 = y + 2 \Leftrightarrow x + 3 = y$	U+21D4 U+2261 U+2194	⇔ ≡ ↔	⇔ &equiv ↔
¬ ~ !	negation	not	propositional logic	The statement $\neg A$ is true if and only if A is false. A slash placed through another operator is the same as ¬ placed in front.	$\neg(\neg A) \Leftrightarrow A$ $x \neq y \Leftrightarrow \neg(x = y)$	U+00AC U+02DC U+0021	¬ ˜ !	¬ &tilde !
$\mathbb{D}$	Domain of discourse	Domain of predicate	Predicate (mathematical logic)		$\mathbb{D}:\mathbb{R}$	U+1D53B	𝔻	𝔻
∧ · &	logical conjunction	and	propositional logic, Boolean algebra	The statement $A \wedge B$ is true if A and B are both true; otherwise, it is false.	$n < 4 \wedge n > 2 \Leftrightarrow n = 3$ when n is a natural number.	U+2227 U+00B7 U+0026	∧ · &	∧ &middo &
∨ + ∥	logical (inclusive) disjunction	or	propositional logic, Boolean algebra	The statement $A \vee B$ is true if A or B (or both) are true; if both are false, the statement is false.	$n \geq 4 \vee n \leq 2 \Leftrightarrow n \neq 3$ when n is a natural number.	U+2228 U+002B U+2225	∨ + ∥	∨ &plus &para
⊕ ⩒ ≢	exclusive disjunction	xor; either ... or	propositional logic, Boolean algebra	The statement $A \oplus B$ is true when either A or B, but not both, are true. $A \veebar B$ means the same.	$(\neg A) \oplus A$ is always true, and $A \oplus A$ always false, if vacuous truth is excluded.	U+2295 U+22BB U+2262	⊕ ⊻ ≢	&oplus &veeb &nequ
⊤ T 1	Tautology	top, truth	propositional logic, Boolean algebra	The statement $\top$ is unconditionally true.	$\top(A) \Rightarrow A$ is always true.	U+22A4	⊤	⊤
⊥ F 0	Contradiction	bottom, falsum, falsity	propositional logic, Boolean algebra	The statement $\bot$ is unconditionally false. (The symbol ⊥ may also refer to perpendicular lines.)	$\bot(A) \Rightarrow A$ is always false.	U+22A5	⊥	⊥
∀	universal quantification	for all; for any; for each	first-order logic	∀ x: $P(x)$ or (x) $P(x)$ means	$\forall n \in \mathbb{N} : n^2 \geq n.$	U+2200	∀	&foral

()				$P(x)$ is true for all x.				
∃	existential quantification	there exists	first-order logic	∃ x: $P(x)$ means there is at least one x such that $P(x)$ is true.	$\exists n \in \mathbb{N} : n$ is even.	U+2203	&#8707;	&exist
∃!	uniqueness quantification	there exists exactly one	first-order logic	∃! x: $P(x)$ means there is exactly one x such that $P(x)$ is true.	$\exists! n \in \mathbb{N} : n + 5 = 2n.$	U+2203 U+0021	∃ !	&exist
:= ≡ :⇔	definition	is defined as	everywhere	$x := y$ or $x \equiv y$ means x is defined to be another name for y (but note that ≡ can also mean other things, such as congruence). $P :\Leftrightarrow Q$ means P is defined to be logically equivalent to Q.	$\cosh x := \frac{e^x + e^{-x}}{2}$ A XOR $B :\Leftrightarrow$ $(A \vee B) \wedge \neg(A \wedge B)$	U+2254 (U+003A U+003D) U+2261 U+003A U+229C	≔ (: =) ≡ ⊜	&colon &equi &hArr
( )	precedence grouping	parentheses; brackets	everywhere	Perform the operations inside the parentheses first.	$(8 \div 4) \div 2 = 2 \div 2 = 1$, but $8 \div (4 \div 2) = 8 \div 2 = 4$.	U+0028 U+0029	( )	(&rpar
⊢	turnstile	proves	propositional logic, first-order logic	$x \vdash y$ means x proves (syntactically entails) y	$(A \to B) \vdash (\neg B \to \neg A)$	U+22A2	&#8866;	&vdash
⊨	double turnstile	models	propositional logic, first-order logic	$x \models y$ means x models (semantically entails) y	$(A \to B) \models (\neg B \to \neg A)$	U+22A8	&#8872;	&vDash

Advanced and rarely used logical symbols

These symbols are sorted by their Unicode value:

- U+0305 ◌̅ COMBINING OVERLINE, used as abbreviation for standard numerals (Typographical Number Theory). For example, using HTML style "4̅" is a shorthand for the standard numeral "SSSS0".
  - Overline is also a rarely used format for denoting Gödel numbers: for example, "$\overline{A \vee B}$" says the Gödel number of "(A ∨ B)".
  - Overline is also an outdated way for denoting negation, still in use in electronics: for example, "$\overline{A \vee B}$" is the same as "¬(A ∨ B)".
- U+2191 ↑ UPWARDS ARROW or U+007C | VERTICAL LINE: Sheffer stroke, the sign for the NAND operator (negation of conjunction).[4]
- U+2193 ↓ DOWNWARDS ARROW Peirce Arrow, the sign for the NOR operator (negation of disjunction).[4]
- U+2299 ⊙ CIRCLED DOT OPERATOR the sign for the XNOR operator (negation of exclusive disjunction).
- U+2201 ∁ COMPLEMENT
- U+2204 ∄ THERE DOES NOT EXIST: strike out existential quantifier, same as "¬∃"[4]
- U+2234 ∴ THEREFORE: Therefore[4]
- U+2235 ∵ BECAUSE: because[4]
- U+22A7 ⊧ MODELS: is a model of (or "is a valuation satisfying")[4]
- U+22A8 ⊨ TRUE: is true of
- U+22AC ⊬ DOES NOT PROVE: negated ⊢, the sign for "does not prove", for example $T \nvdash P$ says "P is not a theorem of T"[4]
- U+22AD ⊭ NOT TRUE: is not true of
- U+2020 † DAGGER: Affirmation operator (read 'it is true that ...')
- U+22BC ⊼ NAND: NAND operator.
- U+22BD ⊽ NOR: NOR operator.
- U+25C7 ◇ WHITE DIAMOND: modal operator for "it is possible that", "it is not necessarily not" or rarely "it is not provable not" (in most modal logics it is defined as "¬□¬")[4]
- U+22C6 ⋆ STAR OPERATOR: usually used for ad-hoc operators
- U+22A5 ⊥ UP TACK or U+2193 ↓ DOWNWARDS ARROW: Webb-operator or Peirce arrow, the sign for NOR. Confusingly, "⊥" is also the sign for contradiction or absurdity.[4]
- U+2310 ⌐ REVERSED NOT SIGN
- U+231C ⌜ TOP LEFT CORNER and U+231D ⌝ TOP RIGHT CORNER: corner quotes, also called "Quine quotes"; for quasi-quotation, i.e. quoting specific context of unspecified ("variable") expressions;[5] also used for denoting Gödel number;[6] for example "⌜G⌝" denotes the Gödel number of G. (Typographical note: although the quotes appears as a "pair" in unicode (231C and 231D), they are not symmetrical in some fonts. And in some fonts (for example Arial) they are only symmetrical in certain sizes. Alternatively the quotes can be rendered as ⌈ and ⌉ (U+2308 and U+2309) or by using a negation symbol and a reversed negation symbol ⌐ ¬ in superscript mode.)

- U+25FB □ WHITE MEDIUM SQUARE or U+25A1 □ WHITE SQUARE: modal operator for "it is necessary that" (in modal logic), or "it is provable that" (in provability logic), or "it is obligatory that" (in deontic logic), or "it is believed that" (in doxastic logic); also as empty clause (alternatives: $\emptyset$ and $\bot$).
- U+27DB ⊣⊢ LEFT AND RIGHT TACK: semantic equivalent

The following operators are rarely supported by natively installed fonts.

- U+27E1 ⟡ WHITE CONCAVE-SIDED DIAMOND
- U+27E2 ⟢ WHITE CONCAVE-SIDED DIAMOND WITH LEFTWARDS TICK: modal operator for was never
- U+27E3 ⟣ WHITE CONCAVE-SIDED DIAMOND WITH RIGHTWARDS TICK: modal operator for will never be
- U+27E4 ⟤ WHITE SQUARE WITH LEFTWARDS TICK: modal operator for was always
- U+27E5 ⟥ WHITE SQUARE WITH RIGHTWARDS TICK: modal operator for will always be
- U+297D ⥽ RIGHT FISH TAIL: sometimes used for "relation", also used for denoting various ad hoc relations (for example, for denoting "witnessing" in the context of Rosser's trick) The fish hook is also used as strict implication by C.I.Lewis $p \strictif q \equiv \Box(p \to q)$, the corresponding LaTeX macro is \strictif. See here (https://www.fileformat.info/info/unicode/char/297d/index.htm) for an image of glyph. Added to Unicode 3.2.0.
- U+2A07 ⩇ TWO LOGICAL AND OPERATOR

Usage in various countries

Poland and Germany

As of 2014 in Poland, the universal quantifier is sometimes written $\bigwedge$, and the existential quantifier as $\bigvee$.[7][8] The same applies for Germany.[9][10]

Japan

The ⇒ symbol is often used in text to mean "result" or "conclusion", as in "We examined whether to sell the product ⇒ We will not sell it". Also, the → symbol is often used to denote "changed to", as in the sentence "The interest rate changed. March 20% → April 21%".

See also

- Józef Maria Bocheński
- List of notation used in Principia Mathematica
- List of mathematical symbols
- Logic alphabet, a suggested set of logical symbols
- Logic gate § Symbols
- Logical connective
- Mathematical operators and symbols in Unicode
- Non-logical symbol
- Polish notation
- Truth function
- Truth table
- Wikipedia:WikiProject Logic/Standards for notation

References

1. "Named character references" (http://www.w3.org/html/wg/drafts/html/master/syntax.html#named-character-references). *HTML 5.1 Nightly*. W3C. Retrieved 9 September 2015.
2. "Material conditional" (https://en.wikipedia.org/wiki/Material_conditional).
3. Although this character is available in LaTeX, the MediaWiki TeX system does not support it.
4. "Comprehensive List of Logic Symbols" (https://mathvault.ca/hub/higher-math/math-symbols/logic-symbols/). *Math Vault*. 2020-04-06. Retrieved 2020-08-20.
5. Quine, W.V. (1981): *Mathematical Logic*, §6
6. Hintikka, Jaakko (1998), *The Principles of Mathematics Revisited* (https://books.google.com/books?id=JHBnE0EQ6VgC&pg=PA113), Cambridge University Press, p. 113, ISBN 9780521624985.
7. "Kwantyfikator ogólny" (https://pl.wikipedia.org/w/index.php?title=Kwantyfikator_og%C3%B3lny&oldid=50508538). 2 October 2017 – via Wikipedia.
8. "Kwantyfikator egzystencjalny" (https://pl.wikipedia.org/w/index.php?title=Kwantyfikator_egzystencjalny&oldid=44737850). 23 January 2016 – via Wikipedia.
9. "Quantor" (https://de.wikipedia.org/w/index.php?title=Quantor&oldid=173159978). 21 January 2018 – via Wikipedia.
10. Hermes, Hans. Einführung in die mathematische Logik: klassische Prädikatenlogik. Springer-Verlag, 2013.

Further reading

- Józef Maria Bocheński (1959), *A Précis of Mathematical Logic*, trans., Otto Bird, from the French and German editions, Dordrecht, South Holland: D. Reidel.

External links

- Named character entities (http://www.w3.org/TR/WD-html40-970708/sgml/entities.html) in HTML 4.0
