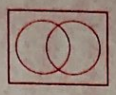
LOGICAL CONNECTIVES

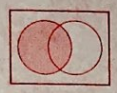
Contradiction (false)

Notation	Formulas	Truth table	Venn diagram	Example
$\bot$ "bottom"	$P \wedge \neg P$ Opq	P\Q: 0: 0 0; 1: 0 0		The moon is out and the moon is not out.

Tautology (true)

Notation	Formulas	Truth table	Venn diagram	Example
$\top$ "top"	$P \vee \neg P$ Vpq	P\Q: 0: 1 1; 1: 1 1		The moon is out or the moon is not out.

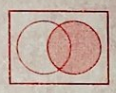
Proposition P

Notation	Formulas	Truth table	Venn diagram	Example
P	P Ipq	P\Q: 0: 0 0; 1: 1 1		The moon is out.

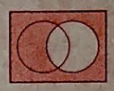
Negation of P

Notation	Formulas	Truth table	Venn diagram	Example
$\neg P$ $\sim P$	Np Fpq	P\Q: 0: 1 1; 1: 0 0		The moon is not out.

Proposition Q

Notation	Formulas	Truth table	Venn diagram	Example
Q	q Hpq	P\Q: 0: 0 1; 1: 0 1		I am awake.

Negation of Q

Notation	Formulas	Truth table	Venn diagram	Example
$\neg Q$ $\sim Q$	Nq Gpq	P\Q: 0: 1 0; 1: 1 0		I am not awake.

Conjunction

Notation	Formulas	Truth table	Venn diagram	Example
$P \wedge Q$ $P \& Q$ $P \cdot Q$ $P_{AND}\, Q$	$P \not\rightarrow \neg Q$ $\neg P \not\leftarrow Q$ $\neg P \downarrow \neg Q$ Kpq	P\Q: 0: 0 0; 1: 0 1		The moon is out and I am awake.

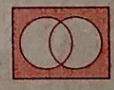
Alternative Denial

Notation	Formulas	Truth table	Venn diagram	Example
$P \uparrow Q$ $P \mid Q$ $P_{NAND}\, Q$	$P \rightarrow \neg Q$ $\neg P \leftarrow Q$ $\neg P \vee \neg Q$ Dpq	P\Q: 0: 1 1; 1: 1 0		The moon is not out if I am awake.

Disjunction

Notation	Formulas	Truth table	Venn diagram	Example
$P \vee Q$ $P_{OR}\, Q$	$P \leftarrow \neg Q$ $\neg P \rightarrow Q$ $\neg P \uparrow \neg Q$ $\neg(\neg P \wedge \neg Q)$ Apq	P\Q: 0: 0 1; 1: 1 1		The moon is out or I am awake.

Joint Denial

Notation	Formulas	Truth table	Venn diagram	Example
$P \downarrow Q$ $P_{NOR}\, Q$	$P \not\vee \neg Q$ $\neg P \not\wedge Q$ $\neg P \wedge \neg Q$ Xpq	P\Q: 0: 1 0; 1: 0 0		The moon is not out nor am I awake.

Material Nonimplication

Notation	Formulas	Truth table	Venn diagram	Example
$P \not\rightarrow Q$ $P \not\supset Q$	$P \wedge \neg Q$ $\neg P \downarrow Q$ $\neg P \not\vee \neg Q$ Lpq	P\Q: 0: 0 0; 1: 1 0		Just because the moon is out does not mean I am awake.

Material Implication

Notation	Formulas	Truth table	Venn diagram	Example
$P \rightarrow Q$ $P \supset Q$	$P \uparrow \neg Q$ $\neg P \vee Q$ $\neg P \leftarrow \neg Q$ Cpq	P\Q: 0: 1 1; 1: 0 1		If the moon is out then I am awake.

Converse Nonimplication

Notation	Formulas	Truth table	Venn diagram	Example
$P \not\leftarrow Q$ $P \not\subset Q$	$P \downarrow \neg Q$ $\neg P \wedge Q$ $\neg P \not\rightarrow \neg Q$ Mpq	P\Q: 0: 0 1; 1: 0 0		The moon is not out but I am awake.

Converse Implication

Notation	Formulas	Truth table	Venn diagram	Example
$P \leftarrow Q$ $P \subset Q$	$P \vee \neg Q$ $\neg P \uparrow Q$ $\neg P \rightarrow \neg Q$ Bpq	P\Q: 0: 1 0; 1: 1 1		The moon is out if I am awake.

Exclusive Disjunction

Notation	Formulas	Truth table	Venn diagram	Example
$P \not\leftrightarrow Q$ $P \not\equiv Q$ $P \oplus Q$ $P_{XOR}\, Q$	$P \leftrightarrow \neg Q$ $\neg P \leftrightarrow Q$ $\neg P \not\leftrightarrow \neg Q$ Jpq	P\Q: 0: 0 1; 1: 1 0		Either the moon is out or I am awake—never both.

Biconditional

Notation	Formulas	Truth table	Venn diagram	Example
$P \leftrightarrow Q$ $P \equiv Q$ $P_{XNOR}\, Q$ $P_{IFF}\, Q$	$P \not\leftrightarrow \neg Q$ $\neg P \not\leftrightarrow Q$ $\neg P \leftrightarrow \neg Q$ Epq	P\Q: 0: 1 0; 1: 0 1		The moon is out if and only if I am awake.