Propositional Logic

Boolean values — True/False.

Def'n A proposition is a declarative statement
that can be true or false.
eg. "Washington, DC is the capital of the US." (true)
      "Toronto is the capital of Canada." (false)
      "10 is even." (true).
non-examples:
        6
        "Please hold this."

We will typically use p, q, r, s, P, Q, R, S to stand for
arbitrary propositions.

Negation

Def'n Let p be a proposition. The negation of p is
written $\neg p$ or $\bar{p}$ and pronounced "not p", or
"It is not the case that p".

we can make a truth table showing the value of
$\neg p$ for each possible value of p:

p	$\neg p$
T	F
F	T

Conjunction (AND)

Defn The conjunction of two propositions p, q is written $p \wedge q$ and pronounced "p and q". It is true when both p and q are true.

p	q	$p \wedge q$
T	T	T
T	F	F
F	T	F
F	F	F

eg. Make a truth table for $(p \wedge q) \wedge (\neg r)$.

p	q	r	$p \wedge q$	$\neg r$	$(p \wedge q) \wedge (\neg r)$
T	T	T	T	F	F
T	T	F	T	T	T
T	F	T	F	F	F
T	F	F	F	T	F
F	T	T	F	F	F
F	T	F	F	T	F
F	F	T	F	F	F
F	F	F	F	T	F

Disjunction (OR)

Def'n The disjunction of Propositions p, q is written

$p \lor q$ and pronounced "p or q". It is false when both p and q are false, and true otherwise.

P	q	$P \lor q$
T	T	T
T	F	T
F	T	T
F	F	F

← inclusive OR —
ok for both to be true.

(exclusive OR — exactly one has to be true).

Note:

$$\neg a \land b \quad \text{means} \quad (\neg a) \land b$$

$$\neg (a \land b) \quad \text{requires parentheses.}$$