Logic

COMP 1805

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Understanding how statements work. Foundations are known as propositions (a declarative sentence that is either true or false). Math equations involving variables are not propositions(within reason).

1 Operations

1.1 Negation

Negation: if p is a proposition.

Negation of p, denoted by $\neg p$ is statement: It is not the case that p

P	$\neg p$
T	F
F	T

1.2 AND

If p and q are propositions. Proposition p and q are denoted by $p \wedge q$, os a statement which is true if both p and q are true, otherwise false. "$\wedge$" is called conjunction

P	Q	$p \wedge q$
T	T	T
T	F	F
F	T	F
F	F	F

1.3 OR

if p and q are propositions. Disjunction of p and q, denoted by $p \vee q$ is the proposition p or q.

P	Q	$p \vee q$
T	T	T
T	F	T
F	T	T
F	F	F

XOR is the same as OR, only that both cannot be True (if they are both the same bool then False). Denoted by $p \oplus q$

1.4 Implication

If p and q are two propositions. Proposition $p \to q$ is statement of "if p then q" and its truth value is False if p is True and q is False, otherwise True.

P	Q	$p \to q$
T	T	T
T	F	F
F	T	T
F	F	T

Converse of $p \to q$: $q \to p$
Contraposition of $p \to q$: $q \to \neg p$
Reverse of $p \to q$: $\neg p \to \neg q$

Definition 1. When two compound propositions have the same truth value for each assignment of values to the atomic proposition we say they are equivalent.

1.5 Bi-implication (if and only if)

if p and q are two propositions. Proposition $p \longleftrightarrow q$ is statement of "p if and only if$q$" and its truth value is true if p and q have same truth value, otherwise false.

P	Q	$p \longleftrightarrow q$
T	T	T
T	F	F
F	T	F
F	F	T

1.6 Priorties (like bedmas)

1. $\neg$
2. $\wedge$
3. $\vee$
4. $\oplus$
5. $\leftarrow$
6. $\longleftrightarrow$