# Discrete Mathematics

### Max Kasperowski

## December 12, 2017

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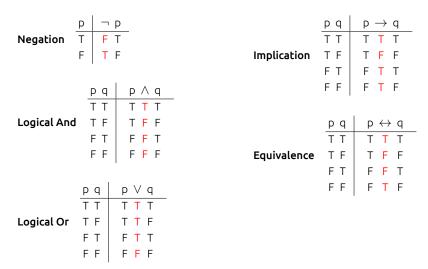
#### 1 Propositional Logic

In propositional logic, propositions are denoted by letters (p,q) and are formed by connecting other propositions using logical connectives. Propositions can either be true (T) or false (F).

#### 1.1 Logical Connectives

The logical connectives listed below are the basic connectives available in propositional logic in order of their precedence. Below are the truthtables corresponding to each of the connectives.

- 1. ¬, not
- 2.  $\wedge$ , and
- 3. V, or
- 4.  $\rightarrow$ ,  $\Rightarrow$ , implies (only if)
- 5.  $\leftrightarrow$ ,  $\Leftrightarrow$ , is equivalent to (if and only if, iff)



#### 1.2 Definitions

When given the proposition  $p \to q$ ,  $q \to p$  is its converse,  $\neg q \to \neg p$  is its contrapositive and  $\neg p \to \neg q$  is its inverse. The contrapositive is equivalent to the original proposition and the converse and inverse are also equivalent.

**Tautology** A proposition that is always true  $(p \lor \neg p)$ .

**Contradiction** A proposition that is always false  $(p \land \neg p)$ .

**Contingency** A proposition that is neither a tautology nor a contradiction.

 $\textbf{Logical Equivalence} \quad p \text{ and } q \text{ are logically equivalent if } p \leftrightarrow q \text{ is a tautology}. \text{ The notation for equivalence is typically } \equiv.$