

# 1 Basic Connectives and Truth Tables

## 1.1 Definition

### 1.1.1 Logic

It is the science dealing with the methods of reasoning

### 1.1.2 Propositions

- It is a statement, which in a given context, can be to either true or false, but not both
- Proposition are usually denoted by small letters such as  $p, q, r, s, \dots$
- **Example**  
 $p$  : Bangalore is in Karnataka  
 $q$  : 2 is a prime number

### 1.1.3 Truth value

- The truth or falsity of a proposition is called it's truth value
- If a proposition is true, we will indicate the truth value by **1** and if it is false denoted by the value **0**
- **Example**  
 $p$  : 3 is a prime number (The value for  $p$  is 1)  
 $q$  : Every rectangle is a square (The value for  $q$  is 0)

## 1.2 Logical connectives & Truth tables

- Words or phrases like **not**, **and**, **or**, **if then** and **if and only if** are called Logical Connectives
- The new propositions obtained by the use of connectives are called Compound Propositions
- The original propositions, from which a compound proposition is obtained are called Components or Primitives of the compound propositions
- Proposition, which do not contain any logical connectives are called Simple Propositions

### 1.2.1 Negation ( $\neg$ )

- A proposition obtained by inserting the word **not** at an appropriate place in a given proposition is called negation of the given proposition
- It is denoted by  $\neg$  read as not  $p$
- If the truth value of proposition  $p$  is 1, then truth table value of it's negation is 0 and if the truth value of  $p$  is 0, then the truth value of it's negation is 1

Truth Table

$p$	$\neg p$
1	0
0	1

- **Example**  
 $p$  : 3 is a prime number  
 $q$  : 3 is **not** a prime number

### 1.2.2 Conjunction ( $\wedge$ )

## 2 Logic Equivalence – The Laws of Logic

## 3 Logical Implication – Rules of Inference

## 4 The Use of Quantifiers

## 5 Quantifiers

## 6 Definitions and the Proofs of Theorems