only if” (Sam is a man if and only if Chris is a woman), and “not” (Sam is not a man). The first four are called **binary connectives** (because they connect two statements) while “not” is an example of a **unary connective** (since it applies to a single statement).

Which connective we use to modify statement(s) will determine the **truth value** of the molecular statement (that is, whether the statement is true or false), based on the truth values of the statements being modified. It is important to realize that we do not need to know what the parts actually say, only whether those parts are true or false. So to analyze logical connectives, it is enough to consider **propositional variables** (sometimes called **sentential variables**), usually capital letters in the middle of the alphabet: P, Q, R, S, . . . . These are variables that can take on one of two values: T or F. We also have symbols for the logical connectives: ∧, ∨, →, ↔, ¬.

### Logical Connectives

- **P ∧ Q** means P and Q, called a **conjunction**.
- **P ∨ Q** means P or Q, called a **disjunction**.
- **P → Q** means if P then Q, called an **implication** or **conditional**.
- **P ↔ Q** means P if and only if Q, called a **biconditional**.
- **¬P** means not P, called a **negation**.

The **truth value** of a statement is determined by the truth value(s) of its part(s), depending on the connectives:

### Truth Conditions for Connectives

- **P ∧ Q** is true when both P and Q are true
- **P ∨ Q** is true when P or Q or both are true.
- **P → Q** is true when P is false or Q is true or both.
- **P ↔ Q** is true when P and Q are both true, or both false.
- **¬P** is true when P is false.

Note that for us, **or** is the **inclusive or** (and not the sometimes used **exclusive or**) meaning that **P ∨ Q** is in fact true when both P and Q are true. As for the other connectives, “and” behaves as you would expect, as does negation. The biconditional (if and only if) might seem a little strange, but you should think of this as saying the two parts of the statements are **equivalent**. This leaves only the conditional **P → Q** which has a slightly different meaning in