MGF /

# Symbolic Translation of Conditional and Biconditional Statements – Advanced

You will be asked to translate statements in descriptive form (wording) to symbolic form (symbols) and vice versa.

The symbols needed for this topic and their descriptions are as follows.

*Write the symbols for each operator below in your notes if you haven't already done so.*

Let *m* and *n* represent two statements:

**Negation:** ~ *m*: Not *m*. It is not the case that *m*. It is not true that *m*. It is false that *m*.

**Conditional:** $m \rightarrow n$: If *m*, then *n*.

If *m*, *n*. (Sometimes "then" is not written but implied.)

*n* if *m*.

*m* only if *n*.

*m* is sufficient for *n*.

*n* is necessary for *m*.

**Biconditional:** $m \leftrightarrow n$: *m* if and only if *n*.

*m* iff *n*. (Note: "iff" is an abbreviation for "if and only if.")

*m* is necessary and sufficient for *n*.

EXAMPLE 1

If the statements are in descriptive form, translate to symbolic form and if the symbolic form is given, translate into descriptive form. Consider the two statements:

*p*: The truck is a Tundra.

*q*: The truck is a Toyota.

| *Descriptive Form* | *Symbolic Form* |
|---|---|
| The truck is a Tundra only if it is a Toyota. | |
| If the truck is a Tundra, then the truck is a Toyota. | |
| | $\sim q \leftrightarrow \sim p$ |

Solution

| *Descriptive Form* | *Symbolic Form* |
|---|---|
| The truck is a Tundra only if it is a Toyota. | $p \rightarrow q$ |
| If the truck is a Tundra, then the truck is a Toyota. | $p \rightarrow q$ |
| **The truck is not a Toyota if and only if the truck is not a Tundra.** | $\sim q \leftrightarrow \sim p$ |

EXAMPLE 2

If the statements are in descriptive form, translate to symbolic form and if the symbolic form is given, translate into descriptive form. Consider the two statements:

*p*: NaCl is salt.

*q*: Salt is an essential element for life.

| *Descriptive Form* | *Symbolic Form* |
|---|---|
| NaCl is not salt if and only if salt is an essential element for life. | |
| NaCl is salt if salt is not an essential element for life. | |
| | $\sim q \rightarrow \sim p$ |

Solution

| *Descriptive Form* | *Symbolic Form* |
|---|---|
| NaCl is not salt if and only if salt is an essential element for life. | $\sim p \leftrightarrow q$ |
| NaCl is salt if salt is not an essential element for life. | $\sim q \rightarrow p$ |
| **If salt is not an essential element for life, then NaCl is not salt.** | $\sim q \rightarrow \sim p$ |

In the second row, note that it is written in the form "*n* if *m*", which is similar to "If *m*, then *n*."

#Logic