

## Steps involved in “Translation” from Natural Language into the Formal Language for Sentential Logic:

1. Identify Atomic sentences and create translation scheme if one is not provided.
2. Identify each *stylistic variant* of the logical connectives present in the sentence to be “translated.”
3. Identify which connective operates over the whole sentence, i.e. which is the main connective.
4. After identifying the main connective, break down the sentence or sentences joined by that connective. If the sentence(s) are Atoms, simply represent them with Sentence letters corresponding to the Atoms according to the translation scheme. If the sentence(s) are compound, then repeat the process of identifying the main connective of each sub-sentence of the complete sentence.
5. (Optional) After completely breaking down the sentence, double check your parentheses and verify your work by reversing the process and “translating” back into the natural language.

Example:

Al will pass the exam if and only if he studies for it and seeks help if he needs it.

### Step one:

It appears that we have four atomic sentences present.

P – Al will pass the exam  
S – Al studies for the exam  
H – Al seeks help  
N – Al needs help

### Step two:

Identify all stylistic variants of the logical connectives:

Al will pass the exam *if and only if* he studies for it *and* seeks help *if* he needs it.

### Step three:

Here it appears that it is the “if and only if” that operates over the largest portions of the sentence:

(Al will pass the exam) *if and only if* (he studies for it and seeks help if he needs it).

Thus this sentence is a *Biconditional* and the main connective is the double arrow:  $\leftrightarrow$

((Al will pass the exam)  $\leftrightarrow$  (he studies for it and seeks help if he needs it))

#### Step Four:

Once we have identified the main connective, then it is necessary to translate the sentences operated on by that connective, i.e. in this case the sentences “Al will pass the exam” and “he studies for it and seeks help if he needs it.” “Al will pass the exam” is an atomic sentence and is easy. So tackle that side first:

$$(P \leftrightarrow (\text{he studies for it and seeks help if he needs it}))$$

Next we will tackle the right hand side, but it is a compound statement. It has an *if...then* statement and an *and* statement. Of the two, the *and* seems to be the one which ties it all together, so that side will have an & as the main connective inside the inner parentheses above:

$$(P \leftrightarrow ((\text{he studies for it}) \& (\text{seeks help if he needs it})))$$

The “he studies for it” is an atomic sentence, symbolized by “S” as defined by the translation scheme above:

$$(P \leftrightarrow (S \& (\text{seeks help if he needs it})))$$

The “[Al] seeks help *if* he needs it” is a conditional statement, and the statement immediately behind the *if* (please don’t confuse it with *only if*) is the antecedent, which makes the statement “[Al] seeks help” the consequent. Thus the final translation into our formal language should look like this:

$$(P \leftrightarrow (S \& (N \rightarrow H)))$$

#### Step Five:

Check your parentheses:

$$(P \leftrightarrow (S \& (N \rightarrow H) ) )$$

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And try translating back to double-check your work. Given the translation scheme above, we get:

(Al will pass the exam *if and only if* (Al studies for it *and* (*if* Al needs help, *then* Al seeks help)))

With the substitution of the appropriate pronouns, it looks like we did a fair job of converting this into our formal language.