CRITICAL THINKING

Workshop #5

Translating Natural Language & Creating Truth Tables

Professor David Emmanuel Gray

Explanation of Annotations for These Solutions

The problem is in black Futura Std type.

The solution is in red Garamond Premier Pro type.

Any commentary is in blue Futura Std type.

Please Note: When solving these types of problems for a quiz or an exam, you are expected to format your own solutions in a similar manner as I have done on these slides. Failure to do so may result in a small penalty for not following instructions or even a larger penalty because I do not understand your solution.

Part I Solutions

1. The **seniors** love logic. (S)

   S.

2. Either the **freshmen** or the **juniors** love logic. (F, J)

   $F \vee J$.

3. The juniors do not **hate** logic, but they **love** it. (H, L)

   $\sim H \,\&\, L$.

4. If the **seniors** do not love logic, then the logic **professor** is sad. (S, P)

   $\sim S \rightarrow P$.

Part I Solutions

5. The **freshmen** or the **seniors** love logic, and the logic **professor** is happy. (F, S, P)

(F ∨ S) & P.

Comment: Notice that the first conjunct is itself a disjunctive statement, so we put that disjunction inside parentheses to make that clear. The use of the comma helps communicate that in English.

Now if the statement is just written as J ∨ B & P, then it is unclear whether this statement is (J ∨ B) & P or J ∨ (B & P). Needless to say, these are two very different claims!

Part I Solutions

6. **Call** for help only if the logic professor **falls** and **hurts** his head. (C, F, H)

$C \rightarrow (F \,\&\, H)$.

Comment: Remember that "only if" indicates the consequent of a hypothetical statement, and notice that this consequent is itself a conjunctive statement, so we put that conjunction inside parentheses to make that clear.

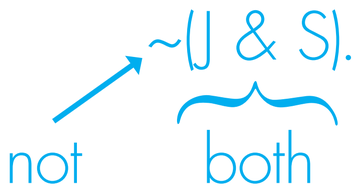
Now if the statement is just written as $C \rightarrow F \,\&\, H$, then it is unclear whether this statement is $(C \rightarrow F) \,\&\, H$ or $(C \rightarrow F \,\&\, H)$.

Part I Solutions

7. **Juniors** and **seniors** do not both love logic. (J, S)

~(J & S).

Comment: This is a common pattern. The easiest way to remember its logical structure is to just follow the flow of the English statement:



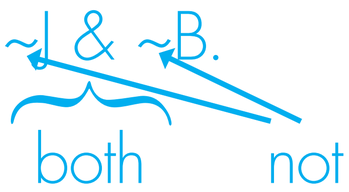
That is, overall there is negation ("not"), since it comes first in English. But within that, there is conjunction ("both"), since it comes second.

Part I Solutions

8. **Juniors** and **seniors** students both do not love logic. (J, S)

~J & ~S.

Comment: This is another common pattern. Again, remember its logical structure by following the flow of the English statement:



That is, overall there is conjunction ("both"), since it comes first in English. Within that, there is negation ("not"), since it comes second.

Part I Solutions

9. It is not the case that either **seniors** hate logic or **freshmen** hate calculus. (S, F)

~(S ∨ F).

Comment: The "either/or" groups the two disjuncts together. Since the negation ("not the case") comes before this disjunction, it negates the whole thing. The use of parentheses makes this clear.

Part I Solutions

10. Either it is not the case that **seniors** hate logic or **freshmen** hate calculus. (S, F)

~S ∨ F.

Comment: Usually you should treat anything between "either" and "or" as the first disjunct. Anything after "or" is the second disjunct. So for this statement the negation ("not the case") only applies to the first disjunct and not the second.

Part I Solutions

11. If the logic **professor** teaches well then **seniors** do not commit fallacies and **juniors** reason clearly. (P, S, J)

$P \rightarrow (\sim S \,\&\, J)$.

Comment: Unless there is punctuation (like a comma) indicating otherwise, usually everything following "then" is the consequent. So the entire consequent, which is conjunction ("and"), is put inside a set of parentheses.

Part I Solutions

12. If the logic **professor** teaches well then **seniors** do not commit fallacies, and **juniors** reason clearly. (P, S, J)

$(P \rightarrow \sim S) \,\&\, J.$

Comment: In this case, the comma tells us when the hypothetical is finished, so we can put it inside a set of parentheses. What follows is a second conjunct ("and"), making that hypothetical the first conjunct.

Part II Solutions

1. $\sim(p \vee \sim q)$.

p	q	$\sim q$	$p \vee \sim q$	$\sim(p \vee \sim q)$
T	T	F	T	**F**
T	F	T	T	**F**
F	T	F	F	**T**
F	T	T	T	**F**

A *contingent* statement. In certain cases (line 3) it is true, while in other cases (lines 1, 2, and 4) it is false. So this statement *may either be true or false*.

Part II Solutions

2. $(p \,\&\, q) \rightarrow (r \vee \sim r)$.

p	q	r	$\sim r$	$p \,\&\, q$	$r \vee \sim r$	$(p \,\&\, q) \rightarrow (r \vee \sim r)$
T	T	T	F	T	T	**T**
T	T	F	T	T	T	**T**
T	F	T	F	F	T	**T**
T	F	F	T	F	T	**T**
F	T	T	F	F	T	**T**
F	T	F	T	F	T	**T**
F	F	T	F	F	T	**T**
F	F	F	T	F	T	**T**

A *tautology*. No matter what, the statement is *always true*.

Part II Solutions

3. $(p \,\&\, \sim q) \rightarrow \sim p$.

p	q	$\sim q$	$\sim p$	$p \,\&\, \sim q$	$(\boldsymbol{p \,\&\, \sim q}) \rightarrow \boldsymbol{\sim p}$
T	T	F	F	F	**T**
T	F	T	F	T	**F**
F	T	F	T	F	**T**
F	F	T	T	F	**T**

A *contingent* statement. In certain cases (lines 1, 3, and 4) it is true, while in other cases (line 2) it is false. So this statement *may either be true or false.*

Next Class…

You will learn how to use truth tables to assess an argument's validity.

References

Simonkr. (2014, August 15). [Students helping each other]. [Online image]. iStock by Getty Images. Retrieved August 9, 2017 from http://www.istockphoto.com/photo/students-helping-each-other-gm507009331-45161826.