Logic I: Lecture 03

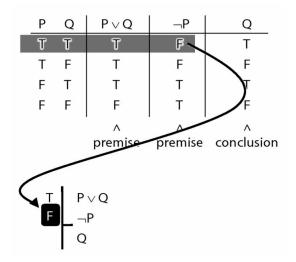
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Readings refer to sections of the course textbook, *Language, Proof and Logic*.

1. Logical Validity and Truth Tables

Reading: §4.3

Truth tables can be used to show that an argument is valid. To illustrate ...



To establish that an argument is valid:

- 1. Create truth tables for each premise and the conclusion.
- 2. Check whether there is a row of the truth table where all premises are true and the conclusion is false.
- 3. If not, the argument is valid.

2. Translating a Simple Argument

Reading: §3.2

3. Formal Proof: ∧Elim and ∧Intro

Reading: §5.1, §6.1

Conjunction Introduction (\lambda Intro)

$$\begin{vmatrix} P_1 \\ \psi \\ P_n \\ \vdots \\ P_1 \wedge \ldots \wedge P_n \end{vmatrix}$$

Conjunction Elimination $(\land Elim)$

$$\begin{vmatrix} P_1 \wedge \dots \wedge P_i \wedge \dots \wedge P_n \\ \vdots \\ P_i \end{vmatrix}$$

4. Rules of Proof for Identity

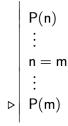
Reading: §2.2

Identity Introduction (= Intro)

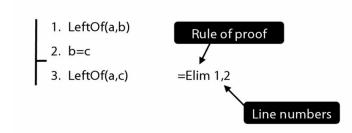
$$\triangleright \mid \mathsf{n} = \mathsf{n}$$

Identity Elimination

(= Elim)

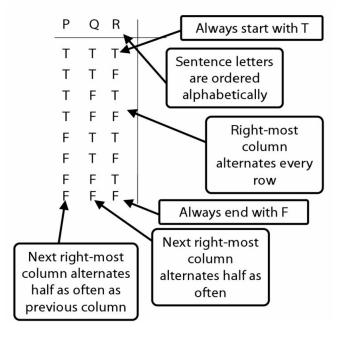


5. How to Write Proofs



6. Complex Truth Tables

Reading: §3.3, §3.5



Complex truth table example:

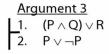
Р	Q	R	(P ∧ Q) ∨ R
Т	Т	Т	
Т	Т	F	
Т	F	Т	
Т	F	F	
F	Т	Т	
F	Т	F	
F	F	Т	
F	F	F	

7. Logic Makes Me Die Inside

Reading: §2.1

8. Tautologies and Contradictions

Reading: §4.1, §4.2



Argument 4

1.
$$P \land \neg P$$

2. $(P \land Q) \lor R$

 $P \lor \neg P$ is a logical truth logical truth defined p. 568 $P \lor \neg P$ is a contradiction contradiction defined p. 564

9. Exercises

These exercises will be discussed in seminars the week after this lecture. The numbers below refer to the numbered exercises in the course textbook, e.g. '1.1' refers to exercise 1.1. on page 39 of the second edition of *Language*, *Proof and Logic*.

5.1-5.4

6.1

3.12, 3.13

4.4-4.7

4.12-14

4.1, 4.2