Logic I: Fast Lecture 01

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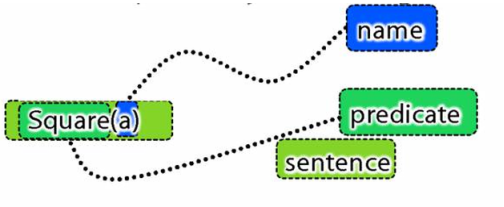
Readings refer to sections of the course textbook, *Language, Proof and Logic*.

1. Terminology



2. Logically Valid Arguments

Reading: §2.1

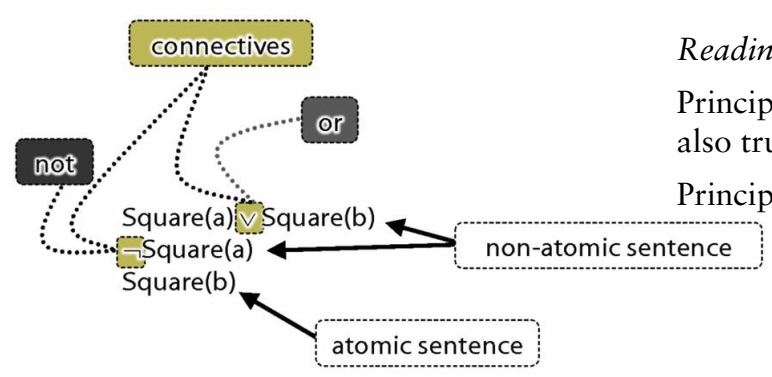
An argument is *logically valid* just if there's no possible situation in which the premises are true and the conclusion false

A *connective* joins one or more sentences to make a new sentence. E.g. 'because', '¬'. The sentences joined by a connective are called *constituent sentences*.

E.g. in 'P ∨ Q',

∨ is the connective

P, Q are the constituent sentences



3. Sentence Letters

Square(a) ∨ Square(b)
¬Square(a)
Square(b)

P ∨ Q
¬P
Q

4. Counterexamples

Reading: §2.5

A *counterexample* to an argument is a possible situation in which its premises are T and its conclusion F.

There are no counterexamples to a logically valid argument.

If an argument is not valid, then there is a counterexample to it.

To show that an argument is not logically valid, we specify a counterexample to it.

5. Identity

Reading: §2.2

Principle: If b=c then whatever is true of b is also true of c.

Principle: a=a is never false

LeftOf(a,b)
b=c
LeftOf(a,c)

6. Truth Tables

Reading: §3.1, §3.2, §3.3

Rough guide:

'∧' means and

'∨' means or

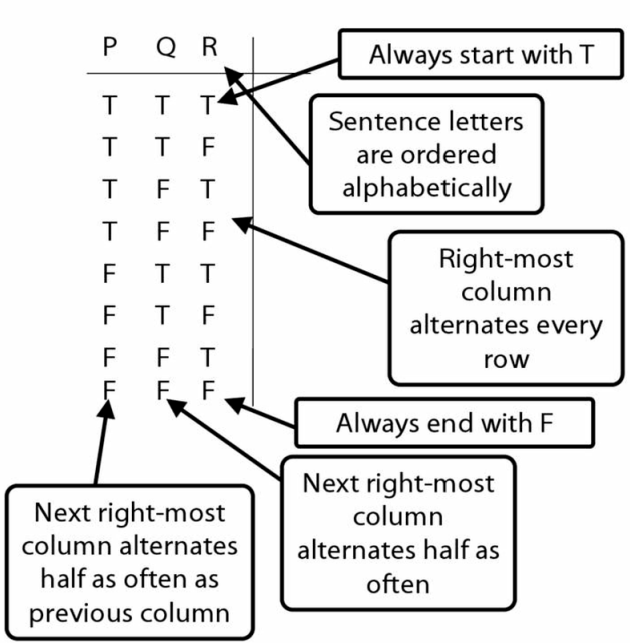
'¬' means not

A	B	A ∨ B	A ∧ B
T	T	T	T
T	F	T	F
F	T	T	F
F	F	F	F

A	¬A
T	F
F	T

7. Complex Truth Tables

Reading: §3.3, §3.5



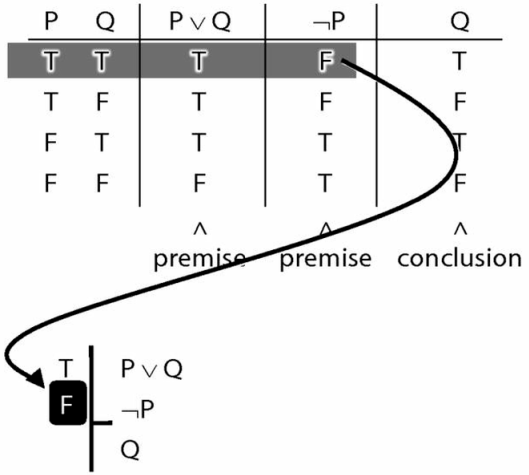
Complex truth table example:

P	Q	R	(P ∧ Q) ∨ R
T	T	T	
T	T	F	
T	F	T	
T	F	F	
F	T	T	
F	T	F	
F	F	T	
F	F	F	

8. 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.

9. Tautologies and Contradictions

Reading: §4.1, §4.2 P ∨ ¬P is a *logical truth*

logical truth defined p. 568

P ∨ ¬P is a *contradiction*

contradiction defined p. 564

10. 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*.

2.8, 2.10, 2.12, 2.21

3.1, 3.3

3.5, 3.7

3.14, 3.15

4.1, 4.2

4.12–4.16