

PHI251 - Logic

Grant Griffiths

Spring 2012

Contents

1	Fundamental Concepts and Truth-Functional Analysis	2
1.1	Introduction	2
1.2	Truth-Functional Representation	3
1.3	Truth-Functional Analysis	3
1.4	Conditionals	3
1.5	Truth Tables	4
2	Derivations and Models	5
2.1	Inference Rules	5
2.2	Equivalence Rules	5
2.3	Conditional Proof and Indirect Proof	5
3	Quantificational Logic	6
3.1	The Language	6
3.2	Derivations	6
3.3	Predicate Logic Truth-Trees	6
3.4	Unrestricted Quantification	6
3.5	English Arguments	6
3.6	Identity, Definite Descriptions, and Function Symbols	6
3.7	Quantifier Semantics	6

Chapter 1: Fundamental Concepts and Truth-Functional Analysis

Lesson 1.1: Introduction

- **Argument:** When reasons are given to justify a belief
- **Argument Indicator Words:** indicate that an conclusion is being presented
 - So
 - Hence
 - Thus
 - Therefore
 - It must be that
- **Premise Indicator Words:** indicate that a premise is being presented
 - For
 - Since
 - Because
 - Due to the fact that
- **Validity**
 - In a valid argument, if the premises were all true, the conclusion would also be true
 - In a valid argument, it is not possible for the conclusion to be false when all the premises are true
- **Invalidity**
 - When the premises are true and the conclusion is false.
 - When an argument's premises do not truly prove it's conclusion.
- **Soundness:** A sound argument is an argument with both of the following features:
 - It is valid
 - All of its premises are true
- **Validity and Consistency**
 - Any argument is valid if and only if it would be inconsistent to assert all of it's premises but deny it's conclusion.
- **Considering the possibilities**
 - To establish that an argument is valid , it seems that we must somehow show that no possible situation exists in which the premises are true with the conclusion false.
 - Need just one possible situation to show invalidity

Lesson 1.2: Truth-Functional Representation

- **Conjunction**
 - First conjunct, Conjunct, Second Conjunct
 - $A \wedge B = \text{AND}$
- **Disjunction**
 - First Disjunct, Disjunct, Second Disjunct
 - $A \vee B = \text{OR}$
- **Formulas**
 - We use formulas to represent sentences
 - if P is any formula, then so is $\neg P$
 - if P and Q are formulas, then $P \wedge Q$ is a formula
 - if P and Q are any formulas, then $P \vee Q$ is a formula
- **Advantages of Formulas**
 - Formulas can be very complex
 - They can express complex claims clearly and compactly
 - English sentences can be long
- **Major connective**
 - The logical connector used last in the process of constructing the formula out of its parts
- **Sentence Forms**
 - Patterns or structural frameworks, for sentences
 - Look like formulas

Lesson 1.3: Truth-Functional Analysis

	Shown by Considering Every Possible Case	Shown by Example
Argument	Valid: In every possible case, if premises are true, conclusion is also true.	Invalid: In at least one possible case, premises are true, conclusion is false.
Set of Sentences	Inconsistent: In every possible case, at least one is false.	Consistent: In at least one possible case, all are true
Pair of Sentences	Equivalent: In every possible case, they have the same truth-value.	Not equivalent: In at least one possible case, they have different truth-values.
Sentence	Tautologous: In every possible case, true Contradictory: In every possible case, false.	Contingent: True in at least one possible case and false in at least one possible case

Lesson 1.4: Conditionals

- False ONLY when the antecedent is true and the consequent is false.
- For this outline, I've represented false as 0 and true as 1.

Lesson 1.5: Truth Tables

- Conjunction (AND)

P	Q	$P \wedge Q$
0	0	0
0	1	0
1	0	0
1	1	1

- Disjunction (OR)

P	Q	$P \vee Q$
0	0	0
0	1	1
1	0	1
1	1	1

- Conditional (If/then)

P	Q	$P \Rightarrow Q$
0	0	1
0	1	1
1	0	0
1	1	1

Chapter 2: Derivations and Models

Lesson 2.1: Inference Rules

Lesson 2.2: Equivalence Rules

Lesson 2.3: Conditional Proof and Indirect Proof

Chapter 3: Quantificational Logic

Lesson 3.1: The Language

Lesson 3.2: Derivations

Lesson 3.3: Predicate Logic Truth-Trees

Lesson 3.4: Unrestricted Quantification

Lesson 3.5: English Arguments

Lesson 3.6: Identity, Definite Descriptions, and Function Symbols

Lesson 3.7: Quantifier Semantics

Bibliography

Book used: Modern Formal Logic (Second Edition)

Professor: Notes from Dr. Mark Brown's Spring 2012 course