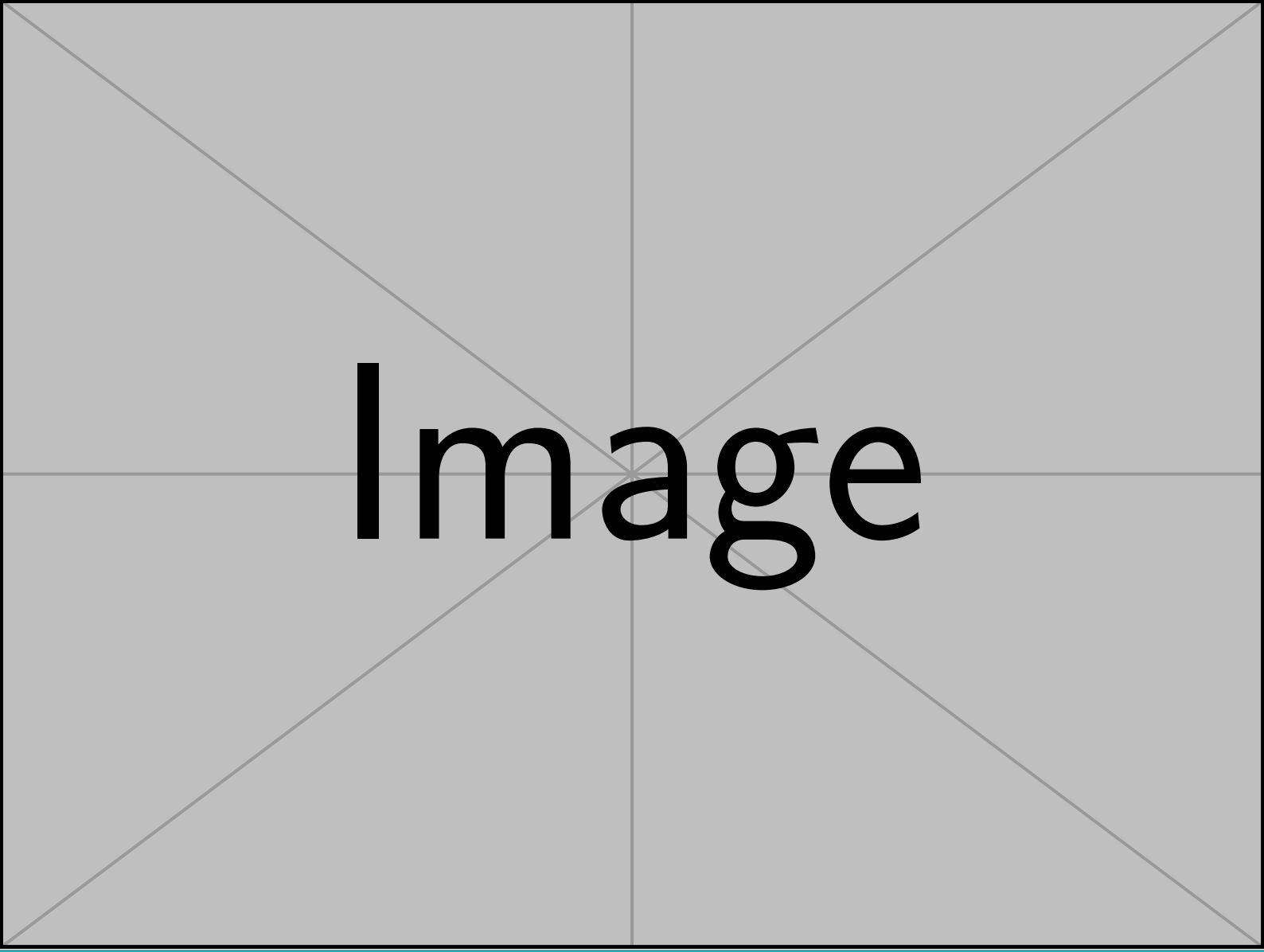

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Contents

Preface

This is the preface of the book…

Chapter 1 The Propositional Calculus

1.1 Propositional Connectives and Truth Tables

A proposition is a statement whose truth value can be determined (represented by 1 for true and 0 for false[1]), and a proposition is either true or false (within the framework of classical binary logic). We use lower-case letters such as $p, q, r \cdots$, to denote propositions.

There are five commonly used propositional connectives:

¶ Negation

If p is a proposition, then the **negation** of p is denoted by $\neg p$, which is true if and only if p is false. Its truth table is as follows:

p	$\neg p$
0	1
1	0

¶ Conjunction

The **conjunction** of two propositions p and q is denoted by $p \wedge q$, which is true if and only if both p and q are true. Its truth table is as follows:

p	q	$p \wedge q$
0	0	0
0	1	0
1	0	0
1	1	1

¶ Disjunction

The **disjunction** of two propositions p and q is denoted by $p \vee q$, which is true if and only if at least one of p or q is true. Its truth table is as follows:

p	q	$p \vee q$
0	0	0
0	1	1
1	0	1
1	1	1

¶ Implication

Proposition p **implies** q, namely "if p, then q", is denoted by $p \rightarrow q$, which is false if and only if p is true and q is false. Its truth table is as follows:

[1] The set of logical truth values can be represented in various ways, such as $\{T, F\}$, $\{\top, \bot\}$, or $\{\text{True}, \text{False}\}$. $\{0, 1\}$ is applied in this book for simplicity.

p	q	$p \to q$
0	0	1
0	1	1
1	0	0
1	1	1

¶ Biconditional

The **biconditional** of two propositions p and q is denoted by $p \leftrightarrow q$, which is true if and only if p and q have the same truth value. Its truth table is as follows:

p	q	$p \leftrightarrow q$
0	0	1
0	1	0
1	0	0
1	1	1

1.2 Propositional Calculus

Propositional calculus is a formal system $\mathcal{L} = (\mathrm{A}, \Omega, \mathrm{Z}, \mathrm{I})$, whose formulas are constructed as follows:

A The infinite set consisting of propositional variables or constants.

Ω The infinite set consisting of logical connectives[2].

Z The infinite set consisting of inference rules.

I The infinite set consisting of axioms(start point).

[2] It is divided into the following mutually disjoint subsets:

$$\Omega = \Omega_0 \cup \Omega_1 \cup \Omega_2 \cup \cdots \cup \Omega_m,$$

where Ω_j is the set of j-ary logical connectives(operators). In general, $\Omega_0 = \{0, 1\}$, $\Omega_1 = \{\neg\}$, $\Omega_2 = \{\wedge, \vee, \to, \leftrightarrow\}$.

Chapter 2 First-Order Logic

Chapter 3 Second-Order Logic

Bibliography

[1] 作者, Title1, Journal1, Year1. *This is an example of a reference.*

[2] Author2, Title2, Journal2, Year2. *This is another example of a reference.*