Contents

1 Chapter 1

1.1 Boolean Algebra

A	**B**	$\mathbf{A} \wedge \mathbf{B}$	$\mathbf{A} \vee \mathbf{B}$	$\mathbf{A} \oplus \mathbf{B}$
T	T	T	T	F
T	F	F	T	T
F	T	F	T	T
F	F	F	F	F

1.2 Quantifiers

- For all: $\forall$
- There exist(s): $\exists$

1.3 Sets

$$\mathbb{N} : \{0, 1, 2, 3, \cdots\}$$
$$\mathbb{Z} : \{0, \pm 1, \pm 2, \cdots\}$$
$$\mathbb{Q} : \frac{a}{b} \mid b \neq 0 \mid a, b \in \mathbb{Z}$$
$$\mathbb{R} : x^2 = 2, x =?$$
$$\mathbb{C} : x^2 = -1, x =?$$

1.4 Truth Tables

For $p \implies q$, $P \implies Q$

Prove by truth table that

$$(p \implies q) \iff (\neg q \implies \neg p)$$

p	q	$p \implies q$
T	T	T
T	F	F
F	T	T
F	F	T

p	q	$\neg p$	$\neg q$	$\neg p \implies \neg q$
T	T	F	F	T
T	F	F	T	F
F	T	T	F	T
F	F	T	T	T

1.4.1 1.30

Show that

$$(p \vee q) \wedge (\neg p \vee r) \implies (q \vee r)$$

is a tautology.

p	q	r	$\neg p$	$p \vee q$	$\neg p \vee r$	$(p \vee q) \wedge (\neg p \vee r)$	$q \vee r$	$(p \vee q) \wedge (\neg p \vee r) \implies (q \vee r)$
T	T	T	F	T	T	T	T	T
T	T	F	F	T	F	F	T	T
T	F	T	F	T	T	T	T	T
T	F	F	F	T	F	F	F	T
F	T	T	T	T	T	T	T	T
F	T	F	T	T	T	T	T	T
F	F	T	T	F	T	F	T	T
F	F	F	T	F	T	F	F	T

1.4.2 Logical Equivalence Proof

Prove

$$p \implies q \equiv \neg q \implies \neg p$$

by case analysis.

Case 1 p is true

Subcase 1 q is true

- Then $p \implies q$ is true
- $\neg q$ is false $\implies \neg p \implies \neg p$ is true