

1.1

logic is a study of formal reasoning

proposition is either true or false for answer

compound proposition: individual proposition + logical operation

conjunction: \wedge and

truth table:

P	q	$P \wedge q$
T	T	T
T	F	F
F	T	F
F	F	F

只存在于两个
变量的时候。

} conjunction

expressing conjunction: 1. p, and h

有理解方法? 2. p, but h \rightarrow 明显矛盾

有其他句式? 3. despite the fact that p, h

4. although p, h

disjunction: \vee or

exclusive or
1. p is true
2. q is false
 $\oplus \rightarrow$ symbol
或者

inclusive or
1. p is true, q is true

In python:

$\wedge \rightarrow$ and

$\neg \rightarrow$ not

$\vee \rightarrow$ or

XOR

negation: $\neg p \rightarrow$ not p

1.2

执行顺序: 1. not \neg
2. and \wedge
3. or \vee

num of variables & rows in truth table: 2^n

从最右边的 variable 开始填, 顺序 1. T F T F ... $T \times 1 \quad F \times 1 \quad 1 \times 1 = 1$
2. T T F F ... $T \times 2 \quad F \times 2 \quad 1 \times 2 = 2$
3. T T T T F F F F ... $T \times 4 \quad F \times 4 \quad 2 \times 2 = 4$

1.3

conditional operation: denote with symbol \rightarrow
 $P \rightarrow Q$ "if P then Q "

$\neg P \vee Q$

conditional proposition: compound proposition uses conditional operation
conditional statement: conditional statement in English

P	Q	$P \rightarrow Q$
T	T	T
T	F	F
F	T	T
F	F	T

$P \rightarrow Q$
 \uparrow hypothesis \uparrow conclusion

in python: $P \leq Q$
等于

$P \rightarrow Q$

python consider false to be less than true.

express $P \rightarrow Q$ in English: 1. if P , then Q

5. P only if Q

2. if P , Q

6. P is sufficient for Q .

3. Q if P

7. Q is necessary for P .

4. P implies Q

proposition: $P \rightarrow Q$

converse: $Q \rightarrow P$

contrapositive: $\neg Q \rightarrow \neg P$

inverse: $\neg P \rightarrow \neg Q$

biconditional operation: p if and only if q $p \leftrightarrow q$
 p is necessary and sufficient for q
 if p then q , and conversely
 iff, abbreviation for "if and only if" = p iff q

p	q	$p \leftrightarrow q$
T	T	T
T	F	F
F	T	F
F	F	T

in python:

$p == q$
 相等

$p \leftrightarrow q$

1.4

tautology: the compound proposition is always true

contradiction: compound proposition is always false

		proposition	
			↓
	p	$\neg p$	$p \vee \neg p$
tautology	$\left\{ \begin{array}{l} T \\ F \end{array} \right.$	$\left\{ \begin{array}{l} F \\ T \end{array} \right.$	$\left\{ \begin{array}{l} T \\ T \end{array} \right.$
	p	$\neg p$	$p \wedge \neg p$
contradiction	$\left\{ \begin{array}{l} T \\ F \end{array} \right.$	$\left\{ \begin{array}{l} F \\ T \end{array} \right.$	$\left\{ \begin{array}{l} F \\ F \end{array} \right.$

logically equivalent: have the same truth value regardless of the truth values of their individual proposition.

p	$\neg p$	$p \rightarrow \neg p$
T	F	F
F	T	T

$$\neg p \equiv p \rightarrow \neg p$$

for a table, you need to have each line be the same to form logical equivalence.

De Morgan's laws: how to correctly distribute a negation operation inside a parenthesized expression.

$$\neg(p \vee q) \equiv (\neg p \wedge \neg q)$$

$$\neg(p \wedge q) \equiv (\neg p \vee \neg q)$$