1.1

logic is a study of formal reasoning

proposition is either true or false for answer

compound proposition: individual proposition + logical operation

conjuction: $\wedge$ and

truth table: 只存在于两个变量的时候.

p	q	$p \wedge q$
T	T	T
T	F	F
F	T	F
F	F	F

} conjunction

expressing conjunction: 1. p, and h

有理解方法? 2. p, but h → 明显对比

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

⊕ → symbol 表示

XOR

inclusive or

1. p is true, q is true

In python:

$\wedge$ → and

$\neg$ → not

$\vee$ → or

negation: $\neg p$ → not p

1.2

执行顺序：1. not ¬
2. and ∧
3. or ∨

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

从最右边有variable开始填，顺序 1. TFTF... T×2 F×2 1×1=1

2. TTFF... T×2 F×2 1×2=2

3. TTTTFFFF... T×4 F×4 2×2=4

1.3

conditional operation: denote with symbol →

$p \to q$ "if p then q"

p	q	p → q
T	T	T
T	F	F
F	T	T
F	F	T

$\neg p \vee q$

conditional proposition: compound proposition uses conditional operation

conditional statement: conditional statement in English

p → q

p: hypothesis

q: conclusion

in python: $p <= q$ 等于 $p \to q$

python consider false to be less then true.

express $p \to q$ in English:

1. if p, then q
2. if p, q
3. q if p
4. p implies q
5. p only if q
6. p is sufficient for q.
7. q is necessary for p.

proposition: $p \to q$

converse: $q \to p$

contrapositive: $\neg q \to \neg p$

inverse: $\neg p \to \neg q$

bi conditional 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

iff

$p \leftrightarrow q$

1.4

tautology: the compound proposition is always true

contradiction: compound proposition is always false

proposition ↓

	p	$\neg p$	$p \vee \neg p$
tautology	T	F	T
	F	T	T

	p	$\neg p$	$p \wedge \neg p$
contradiction	T	F	F
	F	T	F

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.

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

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