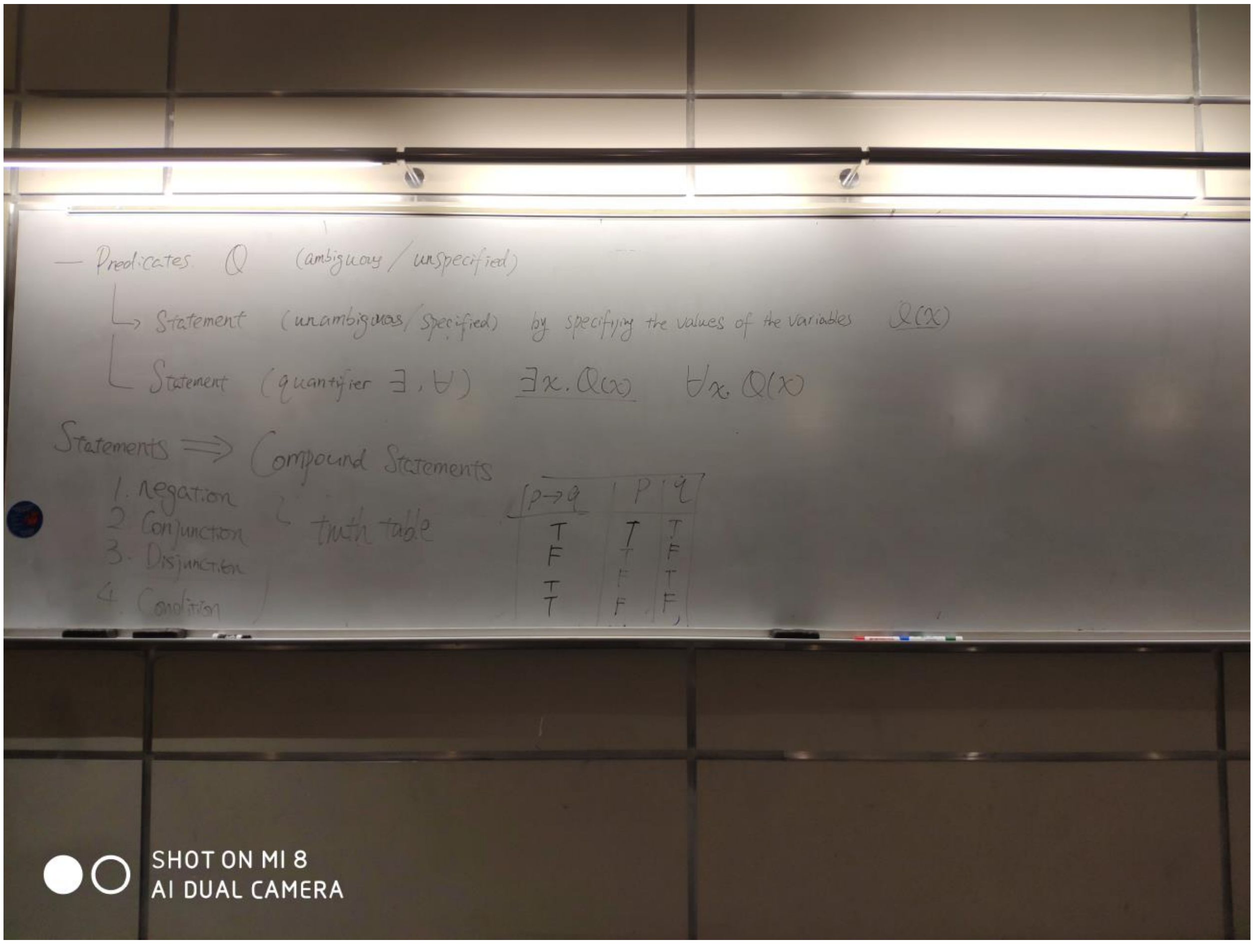

— Predicates Q (ambiguous / unspecified)
↳ Statement (unambiguous / specified) by specifying the values of the variables Q(x)
└ Statement (quantifier ∃, ∀) ∃x. Q(x) ∀x. Q(x)
Statements ⟹ Compound Statements
1. negation
2. Conjunction
3. Disjunction
4. Condition
truth table
p→q | p | q
T | T | T
F | T | F
T | F | T
T | F | F
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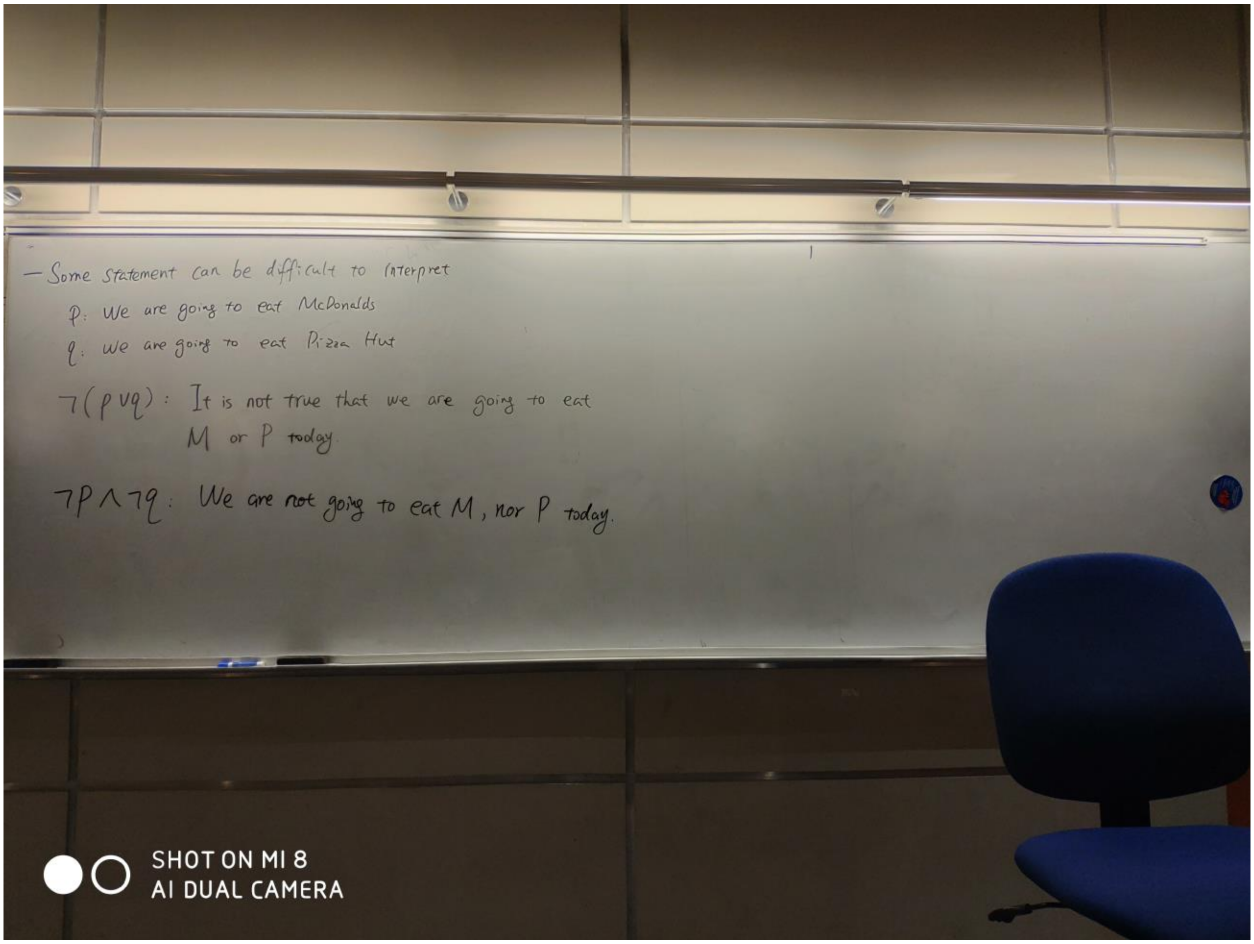
– Some statement can be difficult to interpret
p: We are going to eat McDonalds
q: we are going to eat Pizza Hut
¬(p ∨ q): It is not true that we are going to eat M or P today.
¬p ∧ ¬q: We are not going to eat M, nor P today.
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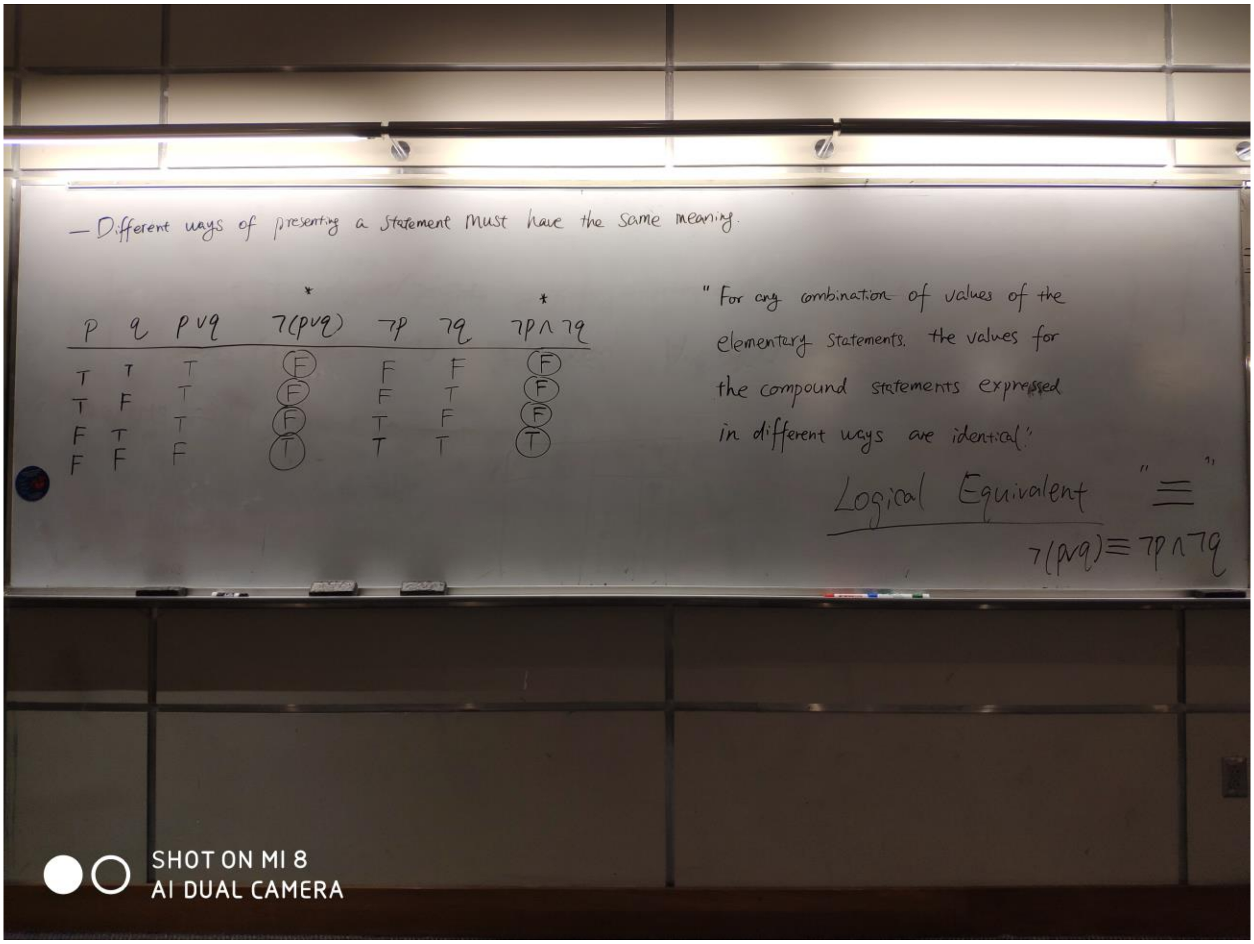
— Different ways of presenting a statement must have the same meaning.
p q p∨q ¬(p∨q) ¬p ¬q ¬p∧¬q
T T T F F F F
T F T F F T F
F T T F T F F
F F F T T T T
" For any combination of values of the elementary statements, the values for the compound statements expressed in different ways are identical."
Logical Equivalent "≡"
¬(p∨q) ≡ ¬p∧¬q
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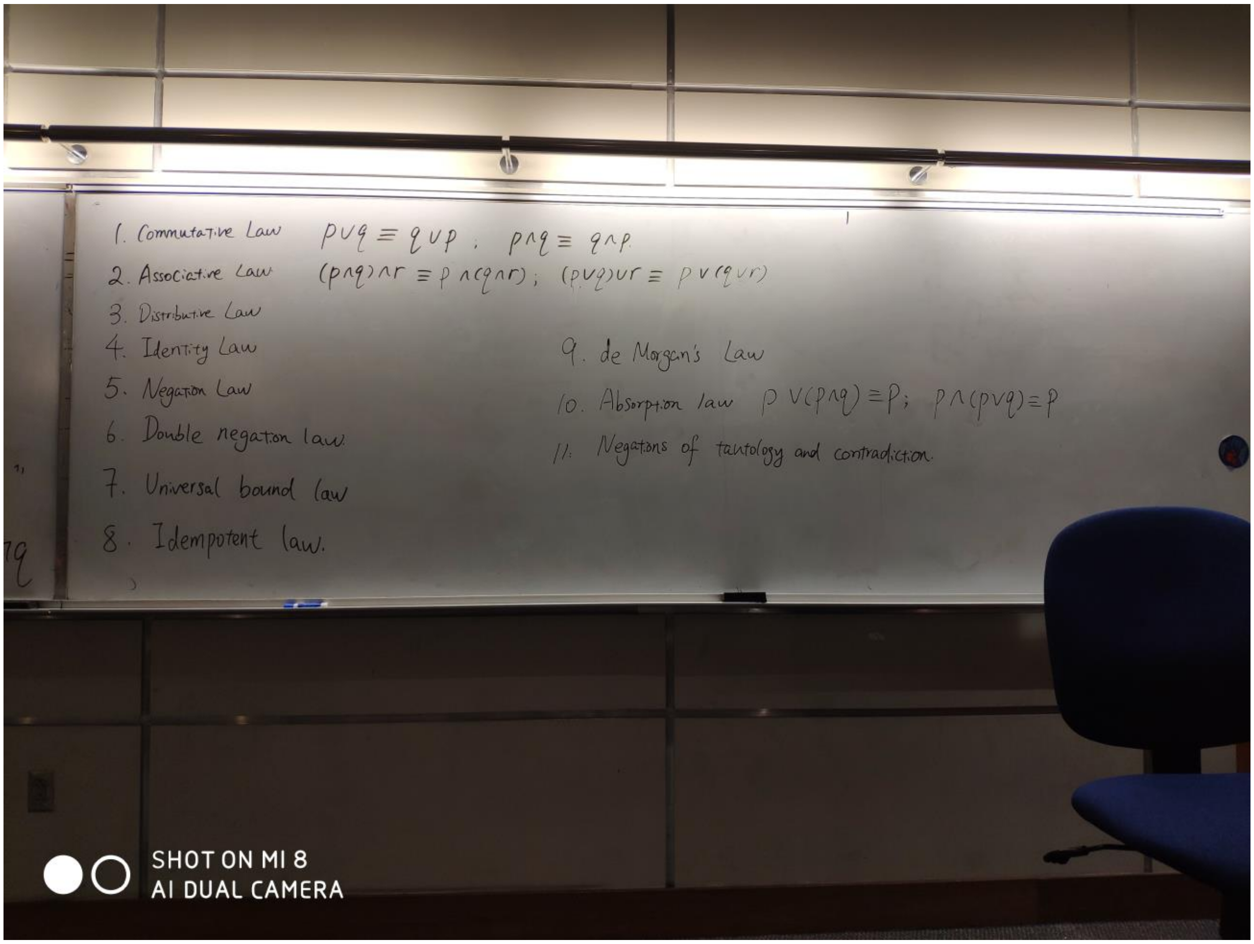
1. Commutative Law p∨q ≡ q∨p ; p∧q ≡ q∧p.
2. Associative Law (p∧q)∧r ≡ p∧(q∧r); (p∨q)∨r ≡ p∨(q∨r)
3. Distributive Law
4. Identity Law
5. Negation Law
6. Double negation law
7. Universal bound law
8. Idempotent law.
9. de Morgan's Law
10. Absorption law p∨(p∧q) ≡ p; p∧(p∨q) ≡ p
11. Negations of tautology and contradiction.
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– Statements

Predicates Q $\approx$ Statement form $Q \wedge P$

$\downarrow$ (parameters / quantifiers)

"de-parameterize"

Statements $Q(x)$ $\xrightarrow{\neg,\ \vee,\ \wedge,\ \rightarrow}$ Compound Statements $Q(x) \wedge P(x)$

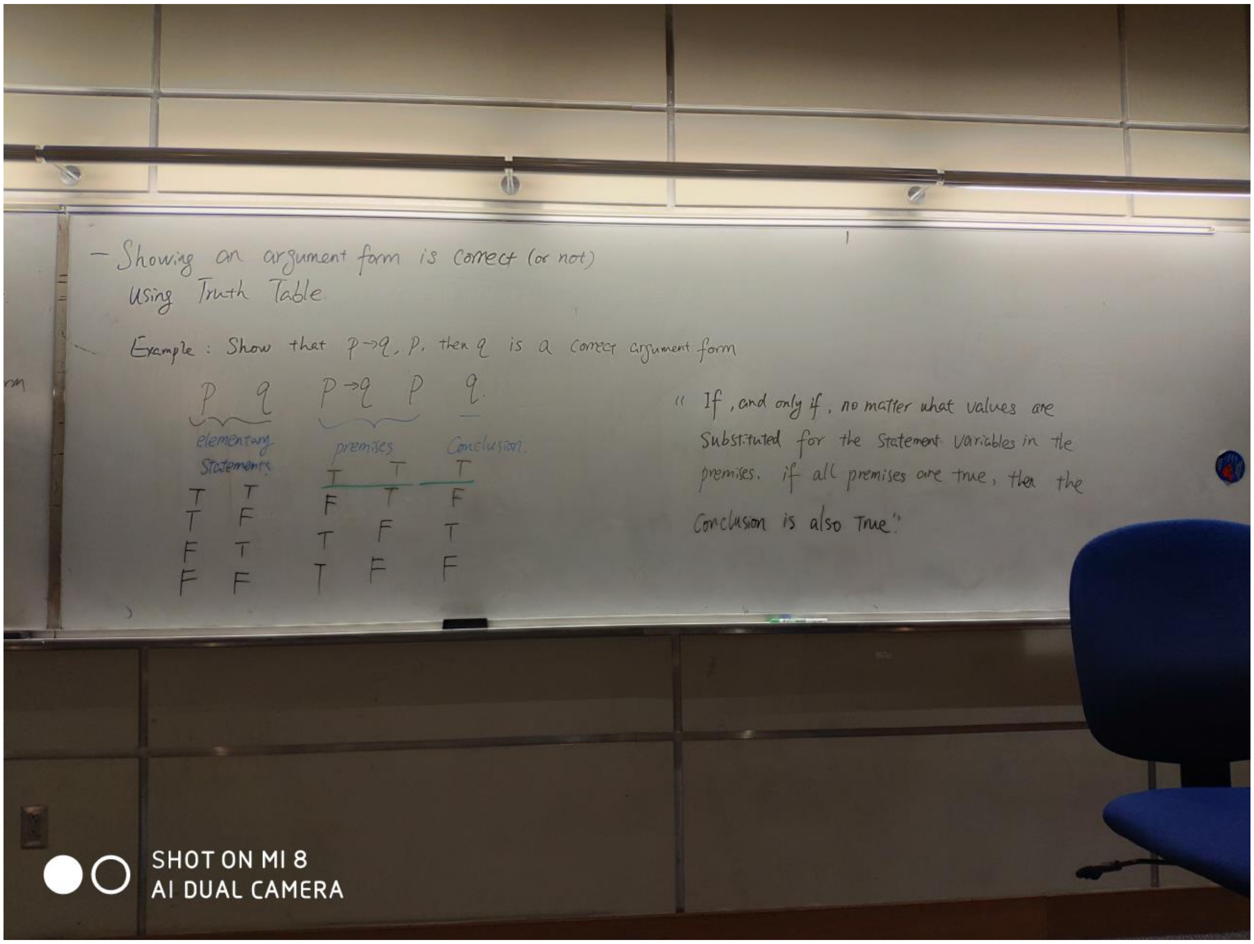
?

Argument form: a sequence of Statement form.

Premise: all Statement / Statement forms in argument except the last one.

Conclusion: The last Statement / Statement form in an argument.

$\underset{p}{p \rightarrow q}$, $\underset{p}{q \rightarrow r}$, $\underset{p}{p}$, $\underset{p}{\text{there } q}$, $\underset{p}{q}$, $\underset{c}{\text{therefor } r}$.


– Showing an argument form is correct (or not)
Using Truth Table
Example : Show that p→q, p, then q is a correct argument form
p q
elementary statements
p→q p
premises
q.
conclusion.
T T T T T
T F F T F
F T T F T
F F T F F
" If, and only if, no matter what values are Substituted for the Statement Variables in the premises, if all premises are true, then the Conclusion is also True".
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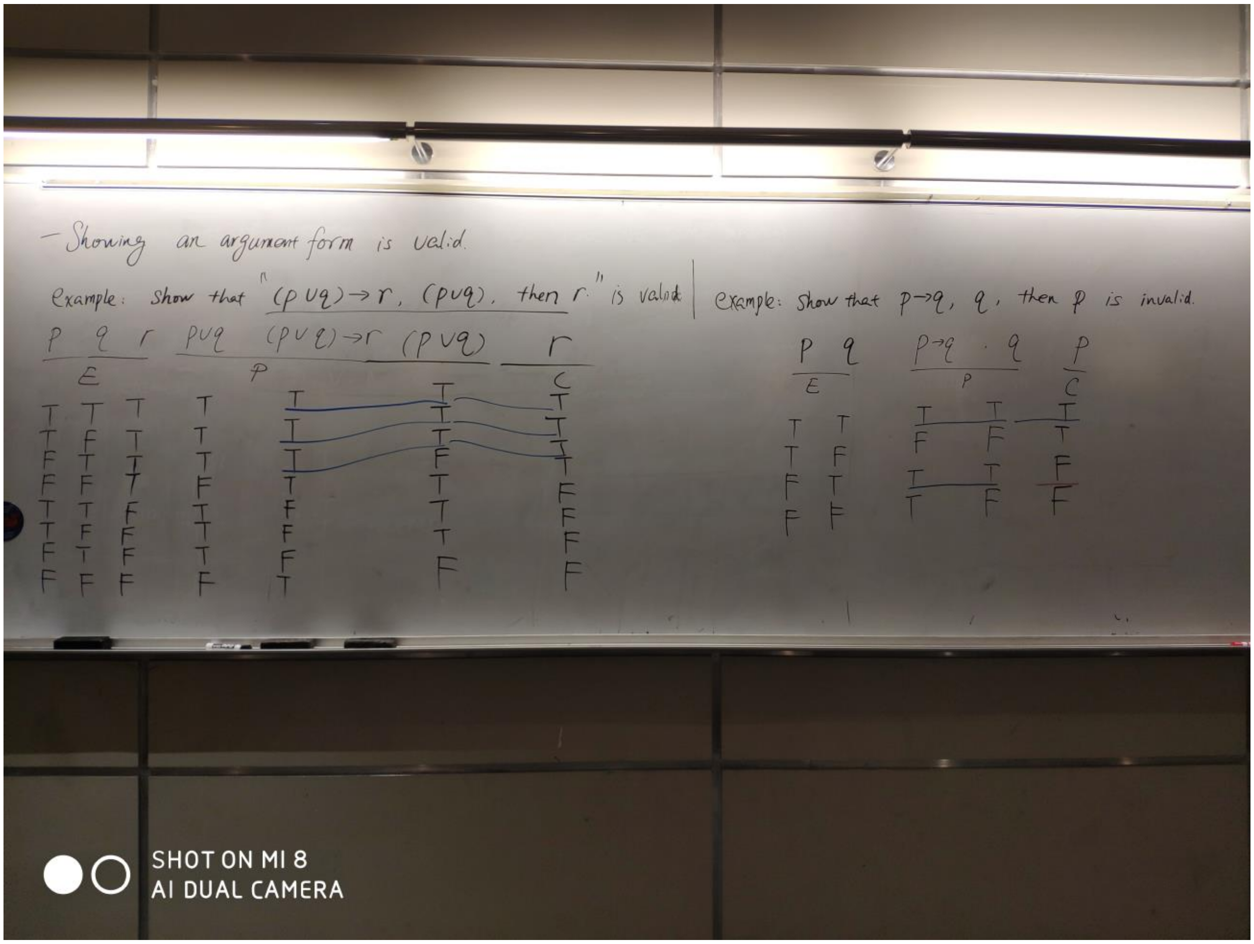

- Showing an argument form is valid.
example: Show that "(p ∨ q) → r, (p ∨ q), then r." is valid
p q r p∨q (p∨q)→r (p∨q) r
E
P
C
T T T T T T T
T F T T T T T
F T T T T T T
F F T F T F T
T T F T F T F
T F F T F T F
F T F T F T F
F F F F T F F
example: Show that p→q, q, then p is invalid.
p q p→q q p
E
P
C
T T T T T
T F F F T
F T T T F
F F T F F
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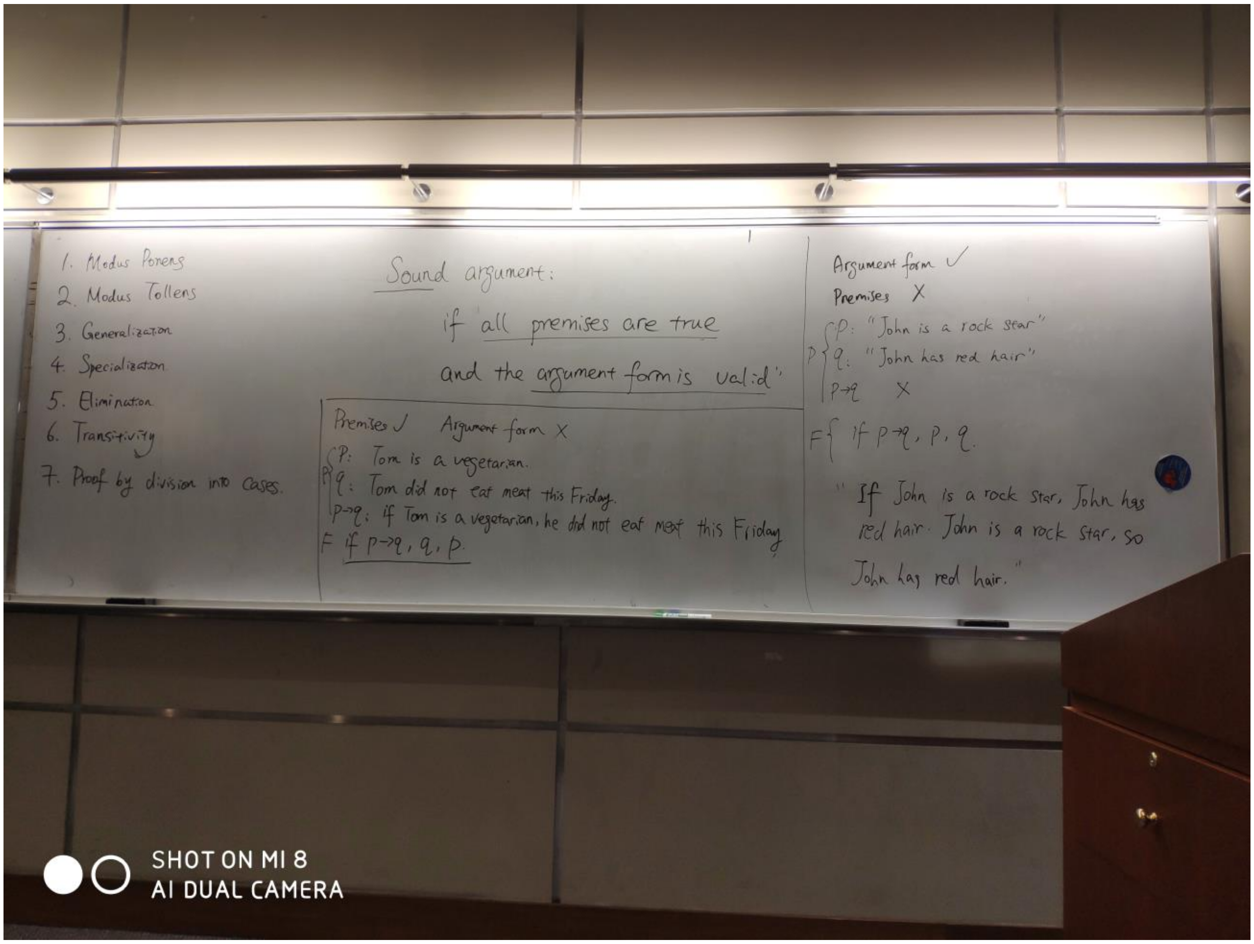
1. Modus Ponens
2. Modus Tollens
3. Generalization
4. Specialization
5. Elimination
6. Transitivity
7. Proof by division into cases.
Sound argument:
if all premises are true
and the argument form is valid"
Premises ✓ Argument form X
P: Tom is a vegetarian.
q: Tom did not eat meat this Friday.
p→q: if Tom is a vegetarian, he did not eat meat this Friday
F if p→q, q, p.
Argument form ✓
Premises X
p: "John is a rock star"
q: "John has red hair"
p→q X
F{ if p→q, p, q.
"If John is a rock star, John has red hair. John is a rock star, so John has red hair."
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