

# Math 321

$$\square \equiv \Delta$$

show?

① Show  $(\square \leftrightarrow \Delta)$  is a tautology with a table

② "Discussion"

either show  $\square, \Delta$  are false in exact same conditions

or show  $\square, \Delta$  are true in exact same conditions.

know?

table #6 (all)

table #7

distnb.

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

$$(p \rightarrow q) \equiv (\neg q \rightarrow \neg p)$$

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

table #8

$$p \leftrightarrow q \equiv (p \rightarrow q) \wedge (q \rightarrow p)$$

$$p \leftrightarrow q \equiv \neg p \leftrightarrow \neg q$$

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

To Do?

① Show them.  $\rightarrow$  table?

$\rightarrow$  discussion?

② Use them

Uses of  $\square \equiv \Delta$  ?

(1) restate compound propositions.

If it is sunny, then I go for a walk or I ride my bike.

Same as

$$\square \rightarrow \Delta \equiv \neg \square \vee \Delta$$

It's not sunny, I go for a walk, or I ride my bike.

(2) Negate this

$\neg$  (It's not sunny or I walk or I bike)

$\equiv$  It's sunny and I don't walk and I don't bike

1.4 Proposition: declarative statement (T or F)

"an object has a property"

from a set of elements from a universe of discourse. predicate

ex: Mark is in pain.  
object predicate

U.D. could be all people

We can make function by using a variable object

$\text{pain}(x)$ : "x is in pain"

Propositional function

$\text{pain}: \text{U.P.} \rightarrow \{T \oplus F\}$   
↑  
all people

① evaluation:

$\text{pain}(\text{Mark})$ : "Mark is in pain"

$\text{pain}(\text{Jane})$ : "Jane is in pain"

binds the variable object to a specific element

We have two more ways to bind the variable object

i) "all people are in pain"  
in my univ. & soc.

ii) "some one is in pain"  
in my univ. & soc.

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ex)  $\text{Stinky}(\Box)$ : " $\Box$  loves stinky cheese"  
U.D for  $\Box$  is people in this room.

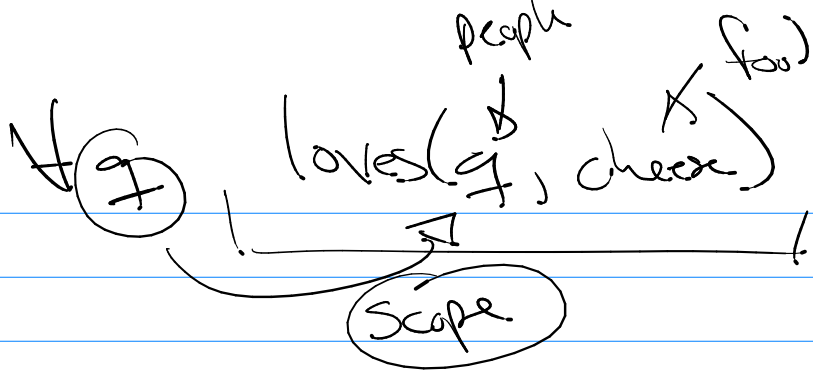
Bind

① evaluate:  $\text{Stinky}(\text{Mark})$

② "all" "all people love stinky cheese"

$\forall_p \text{Stinky}(p)$

universal quantification



(3) "Some" : "Someone loves sticky cheese"

↑  
there exists someone

$\exists x \text{ sticky}(x)$  existential quantification

if U.D. is finite.  $p_1, p_2, \dots, p_n$

$$\forall p \ f(p) \equiv f(p_1) \wedge f(p_2) \wedge \dots \wedge f(p_n)$$

$$\exists p \ f(p) \equiv f(p_1) \vee f(p_2) \vee \dots \vee f(p_n)$$

Negation

$$\neg \forall p \ f(p) \equiv \exists p \ \neg f(p)$$

$$\neg \exists p \ f(p) \equiv \forall p \ \neg f(p)$$


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