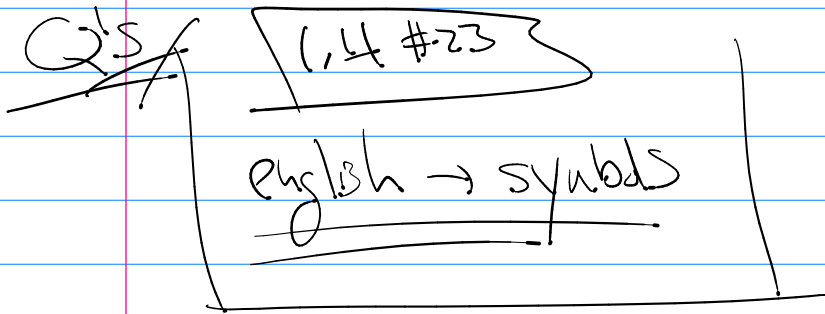


Math 321



Symbols \rightarrow English

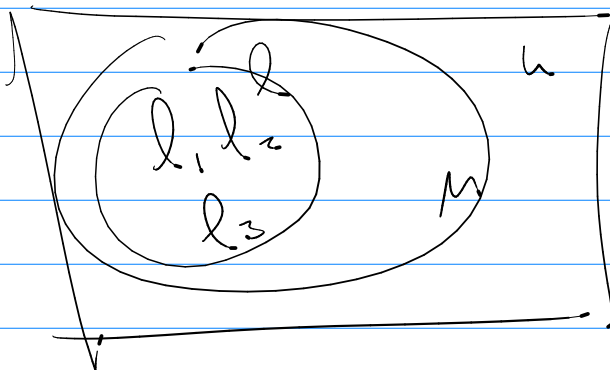
$l(p)$: "p speaks English"

$m(q)$: "q has passed a math class"

u.d. of both p, q students in this room

① $\forall x (l(x) \rightarrow m(x))$

For every student in this class if they speak English, then they have passed a math class.



Every English speaker has passed a math class.

$$\forall x (l(x) \wedge m(x))$$

$$\exists x (m(x) \rightarrow l(x))$$

$$\textcircled{\$} \exists x (M(x) \wedge l(x))$$

$\textcircled{22}$ $\textcircled{23}$ Someone in this class can speak Hindi:

Hindi(r): "r speaks Hindi"

u.d for r to be all students in this class

$$\rightarrow \exists c \text{ Hindi}(c)$$

lang(p, l): "p speaks l"

u.d for p is all students @ WSU

u.d for l is all languages

Math321(s): "s is in Math 321"

u.d for s is all students @ WSU

Someone in this class can speak Hindi:

$$\exists w (Math321(w) \wedge lang(w, Hindi))$$

All students in this class speak Hindi

$\forall x (\text{Math321}(x) \rightarrow \text{lang}(x, \text{Hindi}))$

Note:

Scope

$R(x)$: "x is a rabbit" } UD for both is
 $H(x)$: "x hops" } all animals

$\exists y (\neg R(y)) \wedge \forall y (R(y) \rightarrow H(y))$

Same as

$\exists z (\neg R(z)) \wedge \forall p (R(p) \rightarrow H(p))$

UD all
animals

UD all
animals.

you should read and do HW

1.4 (46-51)

Scoping

(ex) $\forall x (P(x) \vee q) \equiv \forall x (P(x)) \vee q$

(ex) $\forall x (q \rightarrow P(x)) \equiv q \rightarrow \forall x P(x)$

$\boxed{\forall x P(x)} \wedge \boxed{\forall x Q(x)} \neq \forall x (P(x) \wedge Q(x))$

(1.5) $f: \text{U.D.}(S) \rightarrow \{\text{True} \oplus \text{False}\}$

1 object variable (ex) $\text{Love}(x)$; "x loves milk"

2 object vars (ex) $\text{Love}(a,b)$; "a loves b"
 UD of a is people
 UD of b is food

to make propositions I need to bind all object variables..

(ex) $\forall x \exists y \text{Love}(y,x)$

\uparrow \uparrow \uparrow \uparrow
 all foods have someone who loves them.

f_1 f_2 f_3	\rightarrow x \vee x x
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\rightarrow People

$\exists y \forall x \text{ Loves}(y, x)$

Someone loves all Gods

Mix \forall, \exists
order matters

$\forall x \forall y \text{ Loves}(x, y) \equiv \forall y \forall x \text{ Loves}(x, y)$

$\exists x \exists y \text{ Loves}(x, y) \equiv \exists y \exists x \text{ Loves}(x, y)$

Negation:

$\neg \forall x \exists y \forall z \forall q P(q, z, x, y)$

$(\exists x \forall y \exists z \exists q \neg P(q, z, x, y))$
