CS 2102 - DMT1 - Spring 2020 — Luther Tychonievich
Practice exercise in class friday february 7, 2020

Practice 03

problem 1 *Symbolizing*

For each of the following, convert from text to symbolic logic. Some are known, named truths (we included the name for fun); others are false. The first one is done for you.

Celarent No G are F. All H are G. So: No H are F

$\nexists x \,.\, G(x) \wedge F(x)$ *or* $\forall x \,.\, G(x) \rightarrow \neg F(x)$, *or* $\forall x \,.\, \neg\big(G(x) \wedge F(x)\big)$, *or equivalent*

$\forall x \,.\, H(x) \rightarrow G(x)$ *or equivalent*

$\therefore\ \nexists x \,.\, H(x) \wedge F(x)$ *or equivalent*

Barbara All G are F. All H are G. So: All H are F

$\forall x \,.\, G(x) \rightarrow F(x)$
$\forall x \,.\, H(x) \rightarrow G(x)$
$\therefore\ \forall x \,.\, H(x) \rightarrow F(x)$

Ferio No G are F. Some H is G. So: Some H is not F

$\nexists x \,.\, G(x) \wedge F(x)$
$\exists x \,.\, H(x) \wedge G(x)$
$\therefore\ \exists x \,.\, H(x) \wedge \neg F(x)$

(false) All G are F. No H is not G. So: Some H is not F

$\forall x \,.\, G(x) \rightarrow F(x)$
$\nexists x \,.\, H(x) \wedge \neg G(x)$
$\therefore\ \exists x \,.\, H(x) \wedge \neg F(x)$

- No G are F. All H are G. So: No H are F

$\nexists x \,.\, G(x) \wedge F(x)$
$\forall x \,.\, H(x) \rightarrow G(x)$
$\therefore\ \nexists x \,.\, H(x) \wedge F(x)$

- No G are F. Everything is F. So: Nothing is G

  $\nexists x \,.\, G(x) \wedge F(x)$ *or* $\forall x \,.\, G(x) \rightarrow \neg F(x)$ *or* $\forall x \,.\, \neg\big(G(x) \wedge F(x)\big)$

  $\forall x \,.\, F(x)$ *or* $\nexists x \,.\, \neg F(x)$

  $\therefore\ \nexists x \,.\, G(x)$ *or* $\forall x \,.\, \neg G(x)$

- All G are F. Something is G. So: Some G is F

  $\forall x \,.\, G(x) \rightarrow F(x)$ *or* $\nexists x \,.\, G(x) \wedge \neg F(x)$ *or* $\forall x \,.\, \neg G(x) \vee F(x)$

  $\exists x \,.\, G(x)$

  $\therefore\ \exists x \,.\, G(x) \wedge F(x)$

Want more practice? Try Practice exercises $\forall x$ 22.A (pages 187–188)

PROBLEM 2 *Symbolizing with a Key*

Using this symbolization key:

domain: all animals
$A(x)$: $\_\_\__x$ is an alligator
$M(x)$: $\_\_\__x$ is a monkey
$Z(x)$: $\_\_\__x$ lives at the zoo
$L(x,y)$: $\_\_\__x$ loves $\_\_\__y$
f: Fluffy
s: Slick
h: Howler

Symbolize each of the following sentences; the first one is done for you.

If both Slick and Howler are alligators, then Fluffy loves them both.

$\big(A(s) \wedge A(h)\big) \rightarrow \big(L(f,s) \wedge L(f,h)\big)$

Any animal that lives at the zoo is either a monkey or an alligator.

$\forall x \,.\, Z(x) \rightarrow \big(M(x) \vee A(x)\big)$

Howler loves a monkey.

$\exists x \,.\, M(x) \wedge L(h,x)$

All the monkeys that Fluffy loves love Fluffy.

$\forall x \,.\, \big(L(f,x) \wedge M(x)\big) \rightarrow L(x,f)$

Everyone Slick loves loves some animal other than Slick.

$\forall x \,.\, L(s,x) \rightarrow \big(\exists y \,.\, (y \neq s) \wedge L(x,y)\big)$

Every animal in the zoo's love is outside the zoo, and vice versa.

$\forall x,y \,.\, L(x,y) \rightarrow \big(Z(x) \oplus Z(y)\big)$

If both Slick and Howler are alligators, then Fluffy loves them both.

$\big(A(s) \wedge A(h)\big) \rightarrow \big(L(f,s) \wedge L(f,h)\big)$

There are no monkeys at the zoo.

$\forall x \,.\, Z(x) \rightarrow \neg M(x)$
— or —
$\nexists x \,.\, Z(x) \wedge M(x)$

Slick loves every animal that loves Slick.

$\forall x \,.\, L(x,s) \rightarrow L(s,x)$

Fluffy and Howler don't love any of the same animals.

$\forall x \,.\, \neg L(f,x) \vee \neg L(h,x)$
— or —
$\forall x \,.\, L(f,x) \rightarrow \neg L(h,x)$
— or —
$\nexists x \,.\, L(f,x) \wedge L(h,x)$

Slick loves exactly one animal.

$\exists x \,.\, \forall y \,.\, x \neq y \rightarrow L(s,x) \wedge \neg L(s,y)$

Want more practice? Try Practice exercises $\forall x$ 22.B (page 188) and $\forall x$ 23.A–F (pages 199–203).