Name: ______________________________ CompID: ______________

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

Quiz 03

problem 1 *Symbolizing*

For each of the following, convert from text to symbolic logic. The first one is done for you.

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

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

1. Something is F. Nothing is G. So: Something is not G

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

2. Some P is Q. All Q are R. So: Some P is R

$\exists x \,.\, P(x) \wedge Q(x)$
$\forall x \,.\, Q(x) \to R(x)$
$\therefore\ \exists x \,.\, P(x) \wedge R(x)$

3. All P are Q. No Q are P. So: Nothing is P

$\forall x \,.\, P(x) \to Q(x)$
$\forall x \,.\, Q(x) \to \neg P(x)$
$\therefore\ \nexists x \,.\, P(x)$

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.

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

4. No monkey is an alligator.

$\forall x \,.\, M(x) \rightarrow \neg A(x)$

— *or* —

$\nexists x \,.\, M(x) \wedge A(x)$

5. Slick loves every alligator that loves Howler.

$\forall x \,.\, (A(x) \wedge L(x,h)) \rightarrow L(s,x)$

6. Every animal in the zoo has an animal they love that loves them back.

$\forall x \,.\, \exists y \,.\, Z(x) \rightarrow (L(x,y) \wedge L(y,x))$

You have enough to worry about memorizing without keeping dozens of symbols in your head at once. We intend to provide this table for your reference during every in-class evaluation.

Concept	Java/C	Python	This class	Bitwise	Other
true	`true`	`True`	$\top$ or 1	`-1`	T, tautology
false	`false`	`False`	$\bot$ or 0	`0`	F, contradiction
not P	`!p`	`not p`	$\neg P$ or $\overline{P}$	`~p`	
P and Q	`p && q`	`p and q`	$P \wedge Q$	`p & q`	PQ, $P \cdot Q$
P or Q	`p || q`	`p or q`	$P \vee Q$	`p | q`	$P + Q$
P xor Q	`p != q`	`p != q`	$P \oplus Q$	`p ^ q`	$P \veebar Q$
P implies Q			$P \rightarrow Q$		$P \supset Q$, $P \Rightarrow Q$
P iff Q	`p == q`	`p == q`	$P \leftrightarrow Q$		$P \Leftrightarrow Q$, P xnor Q

Concept	Symbol	Meaning
equivalent	$\equiv$	"$A \equiv B$" means "$A \leftrightarrow B$ is a tautology"
entails	$\models$	"$A \models B$" means "$A \rightarrow B$ is a tautology"
provable	$\vdash$	"$A \vdash B$" means "A proves B"; it means both "$A \models B$" and "I know B is true because A is true"
		"$\vdash B$" (i.e., without A) means "I know B is true"
therefore	$\therefore$	"$\therefore A$" means both "the lines above this $\vdash A$"
		"$\therefore A$" also connotes "A is the thing we wanted to show"