Problem Set 3 Solutions

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1 Kinds of Formulas in PL

For each of the sentences below, state whether it is atomic, truth-functional, or quantified. If it is truth-functional or quantified, circle the main logical operator.

1. Quantified



2. Truth-functional



3. Quantified



- 4. Atomic
- 5. Truth-functional

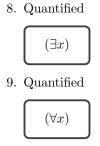
$$\lor$$

6. Truth-functional



7. Truth-functional





10. Atomic

2 Translations into PL

Translate the following English sentences into sentences of PL using the following symbolization key:

UD: The set of all books and all people Px: x is a person
Bx: x is a book
Rxy: x reads y
Uxy: x understands y
Lxy: x likes y
g: Green Eggs and Ham
a: Alice in Wonderland
j: Joe Biden

- 1. Joe Biden likes Green Eggs and Ham. Ljg
- 2. Everyone who reads Alice in Wonderland reads Green Eggs and Ham. $(\forall x)((Px \& Rxa) \supset Rxg)$
- 3. If Joe Biden reads Alice in Wonderland, everyone likes him. $Rja \supset (\forall x)(Px \supset Lxj)$
- 4. No one who reads Alice in Wonderland understands it. $\sim (\exists x)(Px \& (Rxa \& Uxa))$
- 5. Joe Biden does not understand himself. $\sim Ujj$
- 6. If someone understands Alice in Wonderland, then every body does. $(\exists x)(Px \& Uxa) \supset (\forall y)(Py \supset Uya)$
- 7. Someone likes Green Eggs and Ham. $(\exists x)(Px \& Lxg)$

- 8. Some people like Green Eggs and Ham but not Alice in Wonderland. $(\exists x)(Px \& (Lxg \& \sim Lxa))$
- 9. It's not the case that Joe Biden likes every book. $\sim (\forall x)(Bx \supset Ljx)$
- Everyone who reads either Green Eggs and Ham or Alice in Wonderland likes Joe Biden. (∀x)((Px & (Rxg ∨ Rxa)) ⊃ Lxj)

3 Translations into English

Translate the following sentences of PL into sentences of English using the same symbolization key as 2 above.

- 1. $(\forall x)(Px \supset (Lxj \lor Rxa))$ Everyone either likes Joe Biden or reads Alice in Wonderland.
- 2. $\sim (\exists y)(By \& Py)$ Nothing is a book and a person.
- 3. $(\forall x)((Px \& Lxx) \supset (\exists y)Lxy)$ Everyone who likes themself likes someone.
- 4. ~ $(\exists x)(Px \& (\forall y)(By \supset Uxy))$ No one understands every book.
- 5. $Ljg \supset (\exists x)(Px \& Uxg)$ If Joe Biden likes Green Eggs and Ham, then no one understands it.
- 6. $\sim (\exists x)(Px \& \sim (\exists y)(By \& Lxy))$ No one has no book they like. / No one likes no books. / Everyone likes some book.
- 7. $\sim (\forall z)(Pz \supset (\exists y)(By \& Uzy))$ Not everyone understands at least one book. / It's not the case that everyone understands some book or another.
- 8. $Ljj \& \sim (\exists x)(Px \& Ujx)$ Joe Biden likes himself and understands nobody.
- 9. $(\forall x)(Bx \supset Ujx)$ Joe Biden understands every book.
- 10. $[(\exists x)(Px \& Lxg) \& (\exists y)(Py \& Lya)] \& \sim (\exists z)(Pz \& (Lza \& Lzg))$ Some people like Green Eggs and Ham, and some people like Alice in Wonderland, but no one likes both of them.