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

   $(\forall w)$

2. Truth-functional

   $\equiv$

3. Quantified

   $(\forall x)$

4. Atomic
5. Truth-functional

   $\vee$

6. Truth-functional

   $\&$

7. Truth-functional

   $\supset$

8. Quantified

   $(\exists x)$

9. Quantified

   $(\forall x)$

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 everybody 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.
$\sim (\forall x)(Bx \supset Ljx)$

10. Everyone who reads either Green Eggs and Ham or Alice in Wonderland likes Joe Biden.
$(\forall x)((Px \,\&\, (Rxg \vee Rxa)) \supset Lxj)$

3 Translations into English

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

1. $(\forall x)(Px \supset (Lxj \vee Rxa))$
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. $\sim (\exists x)(Px \,\&\, (\forall y)(By \supset Uxy))$
No one understands every book.

5. $Ljg \supset \sim (\exists x)(Px \,\&\, Uxg)$
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.