

Subject 24.241. Logic I. Homework due in LEC #17.

Let A be an interpretation with these properties:

$|A|$ = the set of U.S. Presidents, Washington through Clinton

$A("l")$ = Abraham Lincoln

$A("k")$ = John F. Kennedy

$A("r")$ = Ronald Reagan

$A("R")$ = {Republican presidents}

$A("L")$ = {presidents born in log cabins}

$A("E")$ = $\{ \langle x, y \rangle : x \text{ and } y \text{ are presidents and } x \text{ first took office earlier than } y \}$

Let σ be the variable assignment with

$\sigma("x")$ = Kennedy

$\sigma("y")$ = Lincoln

$\sigma(\text{every other president})$ = Jefferson

Note: Washington, who took office in 1789, was the first president. Jefferson took office in 1801. Lincoln, the first Republican, took office in 1861. Kennedy (who wasn't a Republican) took office in 1961. Reagan, who was a Republican, took office in 1981.

I. Symbolize the following sentences:

1. Lincoln and Reagan were Republicans, but Kennedy was not.
2. There were no Republican presidents earlier than Lincoln.
3. Every president born in a log cabin was earlier than Kennedy.
4. Lincoln and some but not all of the presidents earlier than Lincoln were born in log cabins.

II. Explain your answers to the following questions:

1. Does σ satisfy $(Lx \dot{\cup} \neg Ly)$?
2. Does σ satisfy $(\$x)(Exy \dot{\cup} Ry)$?
3. Does σ satisfy $(\$y)(Exy \dot{\cup} Ry)$?
4. Does σ satisfy $(\$x)(\$y)(Exy \dot{\cup} Ry)$?

III. Derive the conclusions of the following arguments from the premisses:

1. $(\$x)(Exk \dot{\cup} Rx)$
 $(\text{"}x\text{")(Rx @ Lx)$
 $\setminus (\$x)(Exk \dot{\cup} (Rx \dot{\cup} Lx))$
2. $(\$x)(\$y)(Exy \dot{\cup} Ry)$
 $\setminus (\$x)(\$y)(Eyx \dot{\cup} Rx)$

$$3. (\forall x)(\forall y)(\exists xy \wedge (Lx \wedge \neg Ly)) \\ \wedge ((Ll \vee Lk) \wedge (\forall x)((\exists x1 \vee \exists k) \wedge Lx))$$