Subject 24.241. Logic I. Homework due Thursday, Dec. 8.

I. Let $\mathfrak{I}$ be an interpretation whose domain consists of the nine planets of the Solar System, with $\mathfrak{I}$("F") = {<x,y>: x is a planet that is farther from the sun than planet y}, $\mathfrak{I}$("L") = {<x,y>: x and y are planets and x is larger than y}, $\mathfrak{I}$("I") = {the inner planets}, $\mathfrak{I}$("=") = {<x,x>: x is a planet}, $\mathfrak{I}$("e') = Earth, and $\mathfrak{I}$("s") = Saturn. Let σ be the variable assignment with σ("v") = Venus, σ("x") = Mars, and σ(every other variable) = Neptune. Which of the following formulas are satisfied by σ in $\mathfrak{I}$? Explain you answers:

a) $(Fxv \leftrightarrow Lvx)$
b) $(\neg(Ix \wedge Lxv) \wedge (\exists x)(Ix \wedge Lxv))$
c) $((\exists y)(Iy \leftrightarrow Fyx) \rightarrow Iy)$
d) $(\exists x)(\exists y)(\forall z)(Fez \leftrightarrow (z = x \vee z = y))$
e) $(\exists x)(\exists y)(\forall z)(Lzs \leftrightarrow (z = x \vee z = y))$

Note: In order of increasing distance from the sun, the planets are Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune, and Pluto; the first four of these are the inner planets. In order of increasing size, the planets are Pluto, Mercury, Mars, Venus, Earth, Neptune, Uranus, Saturn, and Jupiter.

II. Translate the following sentences, taking the domain to be the set of human beings, and using "c" to translate "Consuela," "r" to translate "Ruben," "g" to translate "Gregor," "Jxy" to translate "x wears y's jacket," "Wxy" to translate "x can wear y's cape," "Txy" to translate "x is taller than y," "Mx" to translate "x is a man," "Wx" to translate "x is a woman,' and "Cx" to translate "x is a child."

a) If Consuela wears her own jacket, Ruben can wear Consuel's cape.
b) Consuela wears her own jacket, while Ruben wears Gregor's jacket.
c) If Gregor is shorter than Consuela, he can wear her cape, but otherwise he will wear his own jacket.
d) Gregor can wear Consuela's cape only if she wears her own jacket.
e) Unless Consuela wears her own jacket, Gregor cannot wear Consuela's cape.
f) Everyone wears her own jacket.
g) No one can wear Consuela's cape.
h) No one but Consuela can wear Consuela's cape.
i) Every man is taller than Consuela.
j) Not every man is taller than Consuela.
k) Some men are taller than Consuela.
l) No men are taller than Consuela.
m) Consuela is at least as tall as Ruben.
n) Gregor is taller than some women, but not all.
o) Some children are taller than some women, but there is no child taller than every woman.
p) Every child who is taller than every woman is taller than at least one man.
q) There are at least two children taller than Gregor.
r) There are exactly two children taller than Gregor.
s) Not every woman who is taller than every child shorter than Gregor is taller than Gregor.