Supply semantic proofs for all of the following.

1. “(F(a) ∧ ∀x(F(x) → G(x)) → G(a)” is L-true.
2. “(F(a) ∧ ∀x(F(x) → G(x)) ∧ ¬G(a)” is L-false.
3. “(F(a) ∧ (a = b)) → F(b)” is L-true.
4. “((F(a) ∧ (a = b)) ∧ (b = c)) → F(c)” is L-true.
5. “(((a = b) ∧ (b = c) ∧ (c = d)) → (a = d)” is L-true.
6. “∀x(H(x,a) → K(a,x)) → (H(b,a) → K(a,b))” is L-true.

7. (F(a) ∧ ∀x(F(x) → G(x)) |= G(a)
8. F(a), G(a), (a = b) |= (F(b) → G(b))
9. (F(a) v F(b)), ∀x(F(x) → G(x)) |= (G(a) v G(b))
10. ∀x(F(x) → G(x)), ∀y(G(y) → H(y)), F(a) |= (H(a) v H(b))

11. “{ H(a), H(b), ∀x(H(x) → K(x)), ¬(K(a) v K(b)) }” is inconsistent.
12. “{ H(a), ∀x(H(x) → K(x)), (a = b), ¬K(b) }” is inconsistent.
13. “{ R(a,b), R(b,a), ∀x∀y (R(x,y) → (R(x,x) ∧ R(y,y)), ¬R(a,a) }” is inconsistent.
14. “{ F(a), F(b), F(c), ∀x(F(x) → ((x = a) v (x = b))), (c ≠ a), (b ≠ c ) }” is inconsistent.

15. “F(a) ∧ (a = b)” is semantically equivalent to “F(b) ∧ (a = b)”
16. “∀x(F(x) → G(x))” is semantically equivalent to “∀y(¬G(y) → ¬F(y))”
17. “R(a,b) ∧ R(b,a)” is semantically equivalent to “R(b,a) ∧ R(a,b)”
18. “∀x(a = x)” is semantically equivalent to “∀z(z = a)”

19. Construct a sentence that is true only in interpretations for which |D| = 4.
20. Construct a sentence that is true only in interpretations for which |D| ≥ 5.

Assignment (Due at the beginning of class Thursday, October 18) #4, #9, #14, #15 and #20 above.