Submission 2.2

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1 Problems 2.8.3

1. Since $f(x) = ax^2+bx+c$ is a quadratic function, then $\frac{-b\pm\sqrt{b^2-4ac}}{2a} = x_0$ where $f(x_0) = 0$. $\frac{-b\pm\sqrt{b^2-4ac}}{2a} = x_0 = \pm1$, so $f(\pm1) = 0$.

2. The conclusion is stated as a premise.

3. S_{xy}: x is continuous at y
   f : our fcn
   c : the point in question (in this case, 0)
   C_{xy} : x converges to y

   $$\begin{aligned} S_{fc} &\iff \forall_x(C_{xc} \implies C_{f(x)f(c)}) && \text{Our definition of continuous.} \\ \neg S_{fc} &\iff \neg\forall_x(C_{xc} \implies C_{f(x)f(c)}) && \text{Our definition of not continuous.} \\ &\iff \exists_x\neg(\neg C_{xc} \vee C_{f(x)f(c)}) \\ &\iff \exists_x(C_{xc} \wedge \neg C_{f(x)f(c)}) \end{aligned}$$

   You have to find a sequence x, such that it converges to c, but $f(x)$ is not continuous at $f(c)$.

4. S_{xy}: x converges to y.
   x_n: x is a series.
   $\forall_{x_n}(S_{x_n3} \implies S_{x_n{}^2-1,3^2-1})$

2 Arguments in English 2.8.4

1. b Invalid
   Unsound

   d C_{xy}: x is caused by y
   1. $\forall_y\exists_x(C_{xy})$
   2. $\exists_y\forall_x(C_{xy})$

2. b Valid
   Invalid

   d H_{xy}: x hates y
   f: Fred
   a: Al

1. $\forall_x(H_{xa} \implies H_{fx})$	P_1
2. $\forall_x H_{ax}$	P_1
3. H_{aa}	UI(2)
4. $H_{aa} \implies H_{fa}$	UI(1)
6. H_{fa}	MP(3,4)
7. H_{af}	UI(2)
8. $H_{af} \wedge H_{fa}$	Conj(6,7)

3. b Valid
Soundness is difficult to determine

d L_x: x is large and hostile
I_x: x is impervious to pesticides
i: An insect in this house

1.	$\forall_i(L_i)$	P_1
2.	$\exists_i(I_i)$	P_2
3.	L_x	$UI(1)$
4.	I_x	$EI(2)$
5.	$L_x \wedge I_x$	$Conj(3,4)$
6.	$\exists_i(L_i \wedge I_i)$	EG(5)

4. b Valid
Sound

d S_x: x can succeed at the university
B_x: x is bright
M_x: x is mature
s: student

1.	$\exists_s \neg S_s$	P_1
2.	$(B_s \wedge M_x) \implies (S_s)$	P_2
3.	$\neg(S_s) \implies \neg(B_s \wedge M_x)$	CP(2)
4.	$\neg(S_s) \implies \neg B_s \vee \neg M_x$	DM(3)
5.	$\neg S_x$	EI(1)
6.	$\neg B_x \vee \neg M_x$	MP(4,5)
7.	$\exists_x(\neg B_x \vee \neg M_x)$	EG(6)

5. b Valid
Sound

d P_x: x is a pig

1.	$\exists_x \exists_y \exists_z((x \neq y) \wedge (x \neq z) \wedge (z \neq y) \wedge P_x \wedge P_y \wedge P_z)$	P_1
2.	$\exists_x \exists_y((x \neq y) \wedge (x \neq a) \wedge (a \neq y) \wedge P_x \wedge P_y \wedge P_a)$	$EI(1)$
3.	$\exists_x \exists_y((x \neq y) \wedge P_x \wedge P_y)$	Simp(2)

6. b Valid Sound

d L_{xy}: x likes y
p: Popeye
o: Olive Oyl

1.	$\forall x(L_{xo} \implies L_{px})$	P_1
2.	$\forall x(L_{ox})$	P_2
3.	L_{oo}	UI(2)
4.	$L_{oo} \implies L_{po}$	UI(1)
5.	L_{po}	MP(3,4)
6.	L_{op}	UI(2)
6.	$L_{po} \wedge L_{op}$	Conj(5,6)

7. a S_x: x is sound
C_x: x has a true conclusion
a: this argument

$$\begin{array}{l} \neg C_a \\ \neg \exists_x(S_x \wedge \neg C_x) \\ \hline \neg S_a \end{array}$$

b Valid
Sound

c Assume there is an interpretation in which $\neg C_x$ and $\neg\exists_x(S_x \wedge \neg C_x)$ are both true, but $\neg S_x$ is false. So there must be some element of UD, call it 1, such that $(1 \ni S)$ and $\neg(1 \ni C)$. However, the second premise would be false in this interpretation. $\rightarrow\leftarrow$ No such interpretation.

d S_x: x is sound
C_x: x has a true conclusion
a: this argument

1. $\neg C_a$	P_1
2. $\neg\exists_x(S_x \wedge \neg C_x)$	P_2
3. $\forall_x\neg(S_x \wedge \neg C_x)$	QEx(2)
4. $\forall_x(\neg S_x \vee \neg\neg C_x)$	DM(3)
5. $\forall_x(\neg S_x \vee C_x)$	DN(4)
6. $\neg S_a \vee C_a$	UI(5)
7. $S_a \implies C_a$	CSis(6)
8. $\neg C_a \implies \neg S_a$	CP(7)
4. $\neg S_a$	MP(1,8)

8. a O_x: x weighs over 200 pounds
j: Jones' killer
s: Smith

$$\begin{array}{l} O_j \\ \neg O_s \\ \hline O_s \neq O_j \end{array}$$

c Assume there is an interpretation in which O_x and $\neg O_y$, but not $O_y \neq O_x$. So there must be two elements of UD, call them 1 and 2, such that $1 \ni O$ and $\neg(2 \ni O)$, and $2 = 1$.

d O_x: x weighs over 200 pounds
j: Jones' killer
s: Smith

O_j	P_1
$\neg O_s$	P_2
$\neg(O_s \iff O_j)$	
$\forall_x\forall_y(x = y \implies (P_x \iff P_y))$	Leibniz
$\forall_x\forall_y(\neg(P_x \iff P_y) \implies x \neq y)$	CP
$O_s \neq O_j$	MP

9. b Valid
Not sound

d L_{xy}: x likes y
m: mandy
a: andy

1. $\forall_x(L_{xm})$	P_1
2. $\forall_x(L_{mx} \iff (m = a))$	P_2
3. L_{mm}	UI(1)
4. $L_{mm} \iff (m = a)$	UI(2)
5. $(L_{mm} \implies (m = a)) \wedge ((m = a) \implies L_{mm})$	Equiv(4)
6. $L_{mm} \implies (m = a)$	Simp(5)
7. $m = a$	MP(3,6)

10. b Valid
Sound

d A_{xy}: x if afraid of y
h: Mr. Hyde
j: Dr. Jekyll

1. $\forall_x(A_{xh})$
2. $\forall_x(A_{hx} \iff (x = j))$
3. A_{hh} UI(1)
4. $A_{hh} \iff (h = j)$ UI(2)
5. $(L_{hh} \implies (h = j)) \wedge ((h = j) \implies L_{hh})$ Equiv(4)
6. $L_{hh} \implies (h = j)$ Simp(5)
7. $j = h$

3 Arguments in quantificational logic 2.8.5

2. b Assume the premise is true. In order for it to be true in all cases that an element of F must be within G, all elements of F must be contained within G. Therefore, if an element is not in G, it cannot be within F.

   c
   1. $\forall_x(F_x \implies G_x)$ P_1
   2. $F_x \implies G_x$ UI(1)
   3. $\forall_x(\neg G_x \implies \neg F_x)$ UG(2)