Submission 1.2

ok yes this is me Hob II hi how are you! by the way don't
take off late points for the submission or anything, i got an extension
until thursday night from mr bailey k thx

October 6, 2023

1 Problem 1

1.1 a)

$\forall x \forall y (x \geq y \rightarrow f(x) \geq f(y))$
$\neg \forall x \forall y (x \geq y \rightarrow f(x) \geq f(y))$
$\exists x \forall y (\neg (x \geq y \rightarrow f(x) \geq f(y)))$
$\exists x \forall y (x \geq y \wedge \neg (f(x) \geq f(y)))$
$\exists x \forall y (x \geq y \wedge (f(x) < f(y)))$
(ANSWER IN QL)
x is greater than or equal to y, and f(x) is less than f(y).
(ANSWER IN ENGLISH)

1.2 b)

$\forall x \forall y (x > y \rightarrow f(x) < f(y))$
$\neg \forall x \forall y (x > y \rightarrow f(x) < f(y))$
$\exists x \forall y (\neg (x > y \rightarrow f(x) < f(y)))$
$\exists x \forall y (x > y \wedge \neg (f(x) < f(y)))$
$\exists x \forall y (x > y \wedge f(x) \geq f(y))$
(ANSWER IN QL)
x is greater than y and f(x) is greater than or equal to f(y).
(ANSWER IN ENGLISH)

1.3 c)

x = y and f(x) is less than f(y) would cause (a) to be true but (b) to be false.
Function: —x-1—

1.4 d)

If x is less than y, then the difference between f(x) and x is greater than the difference between f(y) and y.

(PROGRESSIVE ANSWER IN ENGLISH)
$\forall x \forall y (x < y \rightarrow f(x) - x > f(y) - y)$
$\neg \forall x \forall y (x < y \rightarrow f(x) - x > f(y) - y)$
$\exists x \forall y (\neg (x < y \rightarrow f(x) - x > f(y) - y))$
$\exists x \forall y (x < y \wedge \neg (f(x) - x > f(y) - y))$
$\exists x \forall y (x < y \wedge f(x) - x \leq f(y) - y)$
(ANSWER IN QL)
If x is less than y then the difference f(x) and x is less than or equal to the difference between f(y) and y.
(NOT PROGRESSIVE IN ENGLISH)

1.5 e)

The curve is fair, because the comparison in absolute value between two scores (difference between the two) remains the same because it is simply adding 5, which is supported by the definition of a fair curve.

2 Problem 2

You have to prove that there is no value you can plug in for δ (where x is less than delta) such that f(x) - 1 is less than ϵ.

3 Problem 3

You would need to provide an instance where the sequence of numbers that converges at 0. However you also need to have the function f(x) of those values not converge at 1.

4 Problem 4

4.1 a)

x = something
y = something
Cxy = y is the cause of x
$\forall x \exists y (Cxy)$
$\exists y \forall x (Cxy)$

4.2 b)

Valid: No, Sound: No

4.3 c)

Counterexample: If two things, x and y, are the causes of themselves then their causes are unconditionally unrelated and therefore do not have the same cause.

4.4 d)

∃y∀x(Cxy)
There is no way to get to the conclusion from the single premise using the natural deduction proofs.

5 Problem 5

5.1 a)

o = Al
b = Fred
Hxy = x hates y
∀x(Hxo→ Hbx))
∀x(Hox)

Hob∧Hbo

5.2 b)

Valid: Yes, Sound: Yes

5.3 d)

∀x(Hxo→Hbx)
∀x(Hox)
∀x(Hob) (UI)
Hoo (UI)
Hoo→Hbo (UI)
Hbo (MP)
Hob∧Hbo (Conj)

6 Problem 6

6.1 a)

L(x) = x is large
H(x) = x is hostile
P(x) = x is impervious to pesticides
∀x(Lx∧Hx)
∃x(Px)

$\exists$x(Lx$\wedge$Hx$\wedge$Px)

6.2 b)

Valid: Yes, Sound: No

6.3 d)

$\forall$x(Lx$\wedge$Hx)
$\exists$x(Px)
$\exists$a(La$\wedge$Ha) (UI)
$\exists$a(Pa) (EI)
$\exists$a(La$\wedge$Ha$\wedge$Pa) (Conj)
$\exists$x(Lx$\wedge$Hx$\wedge$Px) (EG)

7 Problem 7

7.1 a)

Sx = x is succeeding
Bx = x is bright
Mx = x is mature
$\exists$x($\neg$Sx)
$\forall$x((Bx$\wedge$Mx$\wedge$)$\rightarrow$Sx)

$\exists$x($\neg$Bx$\vee\neg$Mx)

7.2 b)

Valid: Yes, Sound: No

7.3 d)

$\exists$x($\neg$Sx)
$\forall$x((Bx$\wedge$Mx)$\rightarrow$Sx)
$\exists$a($\neg$Sa) (EI)
(Ba$\wedge$Ma)$\rightarrow$Sa (UI)
$\neg$Sa$\rightarrow$ $\neg$(Ba$\wedge$Ma) (Contrapos)
$\neg$Sa$\rightarrow$ $\neg$Ba$\vee\neg$Ma (DeM 1)
$\neg$Ba$\vee\neg$Ma (MP)
$\exists$x($\neg$Bx$\vee\neg$Mx) (EG)

8 Problem 8

8.1 a)

Px = x is a pig
x = something
y = something
z = something
Cxy = y is the cause of x
$\exists x \exists y \exists z(Px \land Py \land Pz \land x \neq y \land y \neq z \land x \neq z)$

$\exists x \exists y(Px \land Py \land x \neq y)$

8.2 b)

Valid: Yes, Sound: Yes

8.3 d)

$\exists x \exists y \exists z(Px \land Py \land Pz \land x \neq y \land y \neq z \land x \neq z)$
$\exists a \exists b \exists c(Pa \land Pb \land Pc \land a \neq b \land b \neq c \land a \neq c)$ (EI)
$\exists a \exists b \exists c(Pa \land Pb \land (Pc \land a \neq b \land b \neq c \land a \neq c))$
$\exists a \exists b \exists c(Pa \land Pb \land a \neq b)$ (Simp)
$\exists a \exists b(Pa \land Pb \land a \neq b)$

$\exists x \exists y \exists c(Px \land Py \land x \neq y)$ (EG)

9 Problem 9

9.1 a)

x = something
y = something
p = Popeye's
o = olive oyl
Ixy = x likes y
$\forall x(Ixo \implies Ipx)$
$\forall x(Iox)$

$Iop \land Ipo$

9.2 b)

Valid: Yes, Sound: HTD (Hard to determine)

9.3 d)

$\forall$x(Ixo $\implies$ Ipx)
$\forall$x(Iox)
Ioo (UI)
Ipo (MP)
Iop (UI)

Iop$\wedge$Ipo (Conj)

10 Problem 10

10.1 a)

x = something
y = something
a = this argument Cx = x has a false conclusion
Sx = x is sound $\neg\exists$x(Sx$\wedge$Cx)
Ca

$\neg$Sa

10.2 b)

Valid: Yes, Sound: Yes

10.3 d)

$\neg\exists$x(Sx$\wedge$Cx)$\therefore$ $\forall$x(Cx $\implies$ $\neg$Sx). If x has a false conclusion, then there is no case where it is also sound.

10.4 d)

$\neg\exists$x(Sx$\wedge$Cx)
Ca
$\forall$x($\neg$(Sx$\wedge$Cx)) (QEx)
$\forall$x($\neg$Sx$\vee\neg$Cx) (DeM 1)
$\neg$Sa$\vee\neg$Ca (UI)

$\neg$Sa (DS)

11 Problem 11

11.1 a)

x = something
y = something
m = Mandy
a = Andy
Lxy = x likes y
∀x(Lxm)
¬∃x(Lmx∧x≠a)

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a=m

11.2 b)

Valid: Yes, Sound: No

11.3 d)

∀x(Lxm)
¬∃x(Lmx∧x≠a)
∀x(¬(Lmx∧x≠a)) (QEx)
∀x(¬Lmx∨¬x≠a)
∀x(¬Lmx∨x=a)
∀x(Lmx→x=a)
Lmm (UI)
Lmm→m=a (UI)
a=m (MP)

12 Problem 12

12.1 a)

x = something
y = something
j = Dr. Jekyll
h = Mr. Hyde Fxy = x is afraid y
∀x(Fxh)
¬∃x(Fhx∧x=j)

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h=j

12.2 b)

Valid: Yes, Sound: No

12.3 d)

$\forall$x(Fxh)
$\neg\exists$x(Fhx$\wedge$x$\neq$j)
$\forall$x($\neg$(Fhx$\wedge$x$\neq$j)) (QEx)
$\forall$x($\neg$Fhx$\vee\neg$x$\neq$j) (DeM 1)
$\forall$x($\neg$Fhx$\vee$x=j)
$\forall$x(Fhx$\rightarrow$x=j)
Fhh (UI)
Fhh$\rightarrow$h=j (UI) h=j (MP)

13 Problem 13

13.1 a)

Valid: no

13.2 b)

Counterexample: there could be a case where is Gx is true but Hx is false, meaning that Gx being true does not necessarily mean that Hx is true also.

14 Problem 14

14.1 a)

Valid: yes

14.2 b)

Proof by contradiction:
Suppose there is an x where Gx is false and Fx is true
Fx being true implies that Gx is also true
In this case of x, Gx is true by one premise and false by the other, which is a contradiction
There will therfore never be a case for x where Gx is false while Fx is true

15 Problem 15

15.1 a)

Valid: no

15.2 b)

Counterexample: There exists a case such that Fx and Hx for an x is true, which means that Fx does not necessarily imply ¬Hx in ALL cases