CIS 521 Logic

a = student FailEcon(a)

1 a) $\exists a$ FailEcon(a)

b) $\exists a$ FailEcon(a) $\wedge$ FailPsych(a)

c) let s = score

BMath(s) = best math score

BPhys(s) = best physics score

BMath(s) > BPhys(s)

d) let p = people DisVeg(p) = dislike vegetarians, Smart(p)

$\forall p$ DisVeg(p) $\rightarrow$ Smart(p)

e) let w = woman let m = man Likesman(w, m) Vegetarian(m)

$\exists w \forall m \neg$Vegetarian(m) $\rightarrow$ Likesman(w, m)

f) let b = barber let m = man shave(shaver, shavee)

$\exists b \forall m \neg$ shave(m, m) $\rightarrow$ shave(b, m)

g) let m = musician let p = people TimeLoved(m, p)

$\forall m \exists p \forall$ TimeLoved(m, p) $\wedge$ $\forall m \forall p \exists$ TimeLoved(m, p)
$\wedge \neg (\forall m \forall p \forall$ TimeLoved(m, p))

2) Let m = man Let i = me (I)

$\neg Siblings(i, m) \wedge Father(m) = Son(Father(i))$

Son of Father of i = i since ¬(siblings(i)
Father(m) = i
then man is my son.

3)a) $\forall x (\forall y Eats(x,y) \rightarrow FastFood(y)) \rightarrow (\exists y HasHealthProblem(x,y)$

$\forall x(\neg\forall y \neg Eats(x,y) \vee FastFood(y)) \vee (\exists y HasHealthProblem(x,y))$

$\forall x (\exists y \neg(\neg Eats(x,y) \vee FastFood(y)) \vee (\exists y HasHealthProblem(x,y))$

$\forall x (\exists y Eats(x,y) \wedge \neg FastFood(y)) \vee (\exists y HasHealthProb(x,y))$

$\forall x [\exists y Eats(x,y) \wedge \neg FF(y)] \vee (\exists z HHP(x,z))$

$\forall x [Eats(x, F(x)) \wedge \neg FF(F(x))] \vee [HHP(x, G(x))]$

$[Eats(y, F(x)) \wedge \neg FF(F(x)] \vee [HHP(x, G(x))]$

$[Eats(x, F(x)) \vee HHP(x, G(x))] \wedge [\neg FF(F(x)) \vee HHP(x, G(x))]$

b) HHP = Has Health Problem
HC = High Cholesterol
HBS = High Blood Sugar

$\forall x (\exists y HHP(x,y)) \rightarrow HC(x) \vee HBS(x)$

$\forall x \neg(\exists y HHP(x,y)) \vee [HC(x) \vee HBS(x)]$

$\forall x (\forall y \neg HHP(x,y)) \vee HC(x) \vee HBS(x)$

$\forall x \neg HHP(x,y) \vee HC(x) \vee HBS(x)$

c) DC = Drinks coke
HBS = High Blood Sugar

$\forall x \neg DC(x) \rightarrow \neg HBS(x)$

$\forall x \; DC(x) \vee \neg HBS(x)$

$DC(x) \vee \neg HBS(x)$

d) WO = workout
SL = short life

$\forall x (HC(x) \wedge \neg WO(x)) \rightarrow SL(x)$

$\forall x \neg (HC(x) \wedge \neg WO(x)) \vee SL(x)$

$\forall x [\neg HC(x) \vee WO(x)] \vee SL(x)$

$\neg HC(x) \vee WO(x) \vee SL(x)$

e) $\neg \exists x \, Lazy(x) \wedge WorksOut(x)$

$\forall x \, \neg Lazy(x) \wedge WorksOut(x)$
$\neg Lazy(x) \wedge WorksOut(x)$

f) $\forall x \, Eats(Donald, x) \rightarrow FF(x)$

$\forall x \, \neg Eats(Donald, x) \vee FF(x)$
$\neg Eats(Donald, x) \vee FF(x)$

g) $\neg DrinkCoke(Donald)$

h) $Lazy(Donald)$

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b) $Lazy(Donald)$
$\forall x \, Eats(Donald, x) \rightarrow FastFood(x)$

So we know Donald is lazy and for all food if Donald eats it, it is fast food.

We know by a) $x = Donald$ so since
$\forall y \, Eats(Donald, y) \rightarrow FastFood(y)$ then
$\exists z \, HasHealthProblem(Donald, z)$

by b) Donald has either HighCholesterol or HighBloodSugar

by g) Donald does not drink coke so by c) he does not have high blood sugar so by b) he has highCholesterol.

Since by h) Donald is lazy so

Lazy(Donald) $\equiv \neg\neg$ Lazy(Donald)

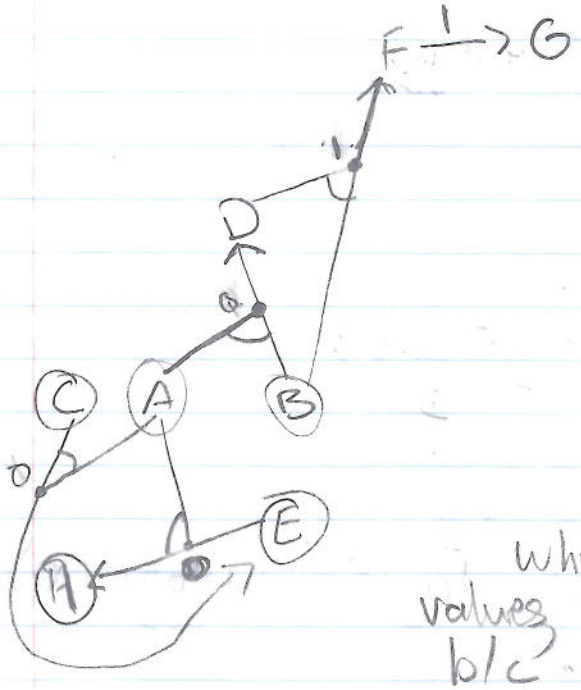
by e) $\neg$Lazy(x) $\wedge$ Workout(x)

Donald does not Workout.

by d) since Donald has high cholesterol and does not work out this implies Donald will live a short Life so

shortlife(Donald) $\equiv$ true

4)



Given A = true

C = true

$A \wedge C \rightarrow E$ $T \wedge T \rightarrow T$

$A \wedge E \rightarrow H$ $T \wedge T \rightarrow T$

If A and C true

E = true

$T \wedge T \rightarrow T$

$A \wedge E \rightarrow H$

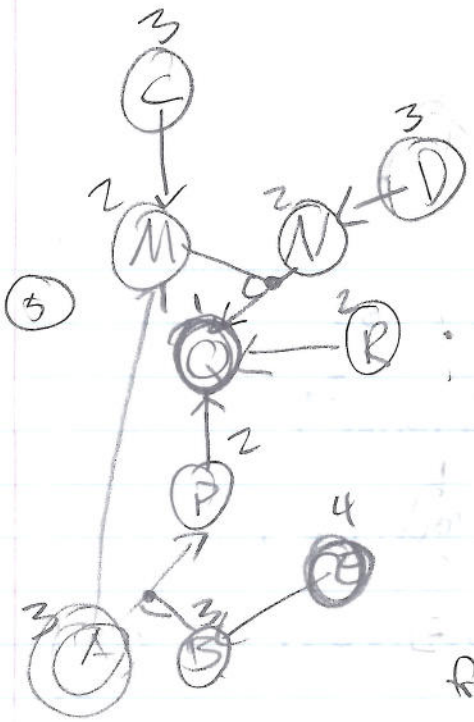
So H is true

While there may be other true values these are the relevant statements b/c

$A \wedge B \rightarrow D$

$B \wedge D \rightarrow F$

$F \rightarrow G$ do not evaluate the truth of H



bode

Q

d) $M \wedge N \rightarrow Q$

f) $A \rightarrow M$ h) $D \rightarrow N$

A and D are given as true from (i), (j) so Q is true

⑥ $\log(63200) = 4.8$

$2.8 + 2 = 4.8$ d)

c) $632 \times 100 = 63200$

e) $\forall x, y \quad x = y \rightarrow \log x = \log y$

e) $\log(632 \times 100) = \log(63200)$

f) $\forall x, y \quad \log(xy) = \log x + \log y$

f) $\log(632 \times 100) = \log(632) + \log(100)$

h) $\forall x, y, z, w \quad \log x = y \wedge \log z = w \rightarrow \log x + \log z = y + w$

$\log(632) = 2.8$ $\log(100) = 2$ $\log(632) + \log(100) = 2.8 + 2$

$\log(63200) = 4.8$