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CSCI4511W
Homework 4
4/1/18

Problem 1
1.

2.
0,0=x and 1,0=x and 2,0=x and the three don't equal o or blank //row 1
Or
0,1=x and 1,1=x and 2,1=x and the three don't equal o or blank //row 2
or
0,2=x and 1,2 =x and 2,2=x and the three don't equal o or blank //row 3
Or
0,0=x and 0,1=x and 0,2=x and the three don't equal o or blank //col1
Or
1,0=x and 1,1=x and 1,2=x and the three don't equal o or blank //col2
Or
2,0=x and 2,1=x and 2,2=x and the three don't equal o or blank //col3
Or
0,0=x and 1,1=x and 2,2=x and the three don't equal o or blank//diag1
Or
2,0=x and 1,1=x and 0,2=x and the three don't equal o or blank//diag2
<=> x wins

the three don't equal o or blank
===
a,b!=o and a,b!=blank and c,d!=o and c,d!=blank and e,f!=o and e,f!=blank

3.
0,0=x and 0,0 != o and 0,0 != blank
Or
0,0 =o and 0,0 != x and 0,0 != blank
Or
0,0=blank and 0,0 != x and 0,0 != blank

4.
[x___]V[xo__]V[[x_o_]V[x__o]V[xox_]V[xo_x]V[xxo_]V[x_ox]V
[xx_o]V[x_xo]V[xoxo]V[xxoo]V[xoox]V
[_x__]V[ox__]V[_xo_]V[_x_o]V[oxx_]V[ox_x]V[_xox]V[_xxo]V[oxxo]V[oxox]V
[__x_]V[o_x_]V[__xo]V[_ox_]V[o_xx]V[x_xo]V[xox_]V[_oxx]V[ooxx]V
[___x]V[o__x]V[_o_x]V[__ox]V[____] <=> valid board

There cannot be more o than x
There cannot be more than one x than o

[0,0 0,1 1,0 1,1]
Example: [x_ox] === 0,0=x and 0,1=blank and 1,0=o and 1,1=x and 0,0!=o and 0,0!=blank and 0,1!=x and 0,1!=o and 1,0!=blank and 1,0!=x and 1,1!=o and 1,1!=blank

Problem 2
Original:
((A=>B) V (CV (!D^!E)))^ ((FVG) => (!H^I))

Implication Elimination:
((!A V B) V (CV(!D^!E))) ^ (! (FVG) V (!H ^ I))

Convert to text for my own ease of understanding:
((not A or B) or (C or (not D and not E))) and (not (F or G) or (not H and I))

DeMorgan's:
((not A or B) or (C or (not D and not E))) and ((not F and not G) or (not H and I))

Distribution:
((not A or B) or ((C or not D) and (C or not E))) and ((not F and not G) or (not H and I))

Distribute First Half:
(not A or B or C or not D) and (not A or B or C or not E) and ((not F and not G) or (not H and I))

Distribute Second Half:
(not A or B or C or not D) and (not A or B or C or not E) and (not F or not H) and (not F or I) and (not G or not H) and (not G or I)

Convert to Equation in LaTex:

$$(\neg A \vee B \vee C \vee \neg D) \wedge (\neg \mathrm{A} \vee \mathrm{B} \vee \mathrm{C} \vee \neg \mathrm{E}) \wedge (\neg \mathrm{F} \vee \neg \mathrm{H}) \wedge (\neg \mathrm{F} \vee \mathrm{I}) \wedge (\neg \mathrm{G} \vee \neg \mathrm{H}) \wedge (\neg \mathrm{G} \vee \mathrm{I})$$

Problem 3
1. !A or B === A => B
!B or C === B => C
!C or D === C => D
A=>B=>C=>D
A=> D
It is entailed

2. It is not entailed.

3. Since we do not have 2), it is not entailed

4. !D or B === D => B
B => C => D
B=> D
B=> D ^ D=> B
D ⇔ B
It is entailed

5. It is not entailed
We do not have Values for any Variables

Problem 4

$\forall x\ Planet(x) \rightarrow Orbit(x, Sun)$
$\forall x\ Planet(x) \rightarrow \big(Rocky(x) \vee Gassy(x)\big)$
$Rocky(Earth)$
$\mathrm{Orbit(Moon, Earth)}$
$\exists x\ x == Moon \wedge !\,Planet(x) \wedge !\,Asteroid(x)$
$\forall x\ Asteroid(x) \rightarrow Orbit(x, Sun) \wedge \big(kuiperBelt(x) \vee asteroidBelt(x)\big)$
$\forall x\ Planet(x) \leftrightarrow !\,Asteroid(x)$
$\forall x, y\ x == Jupiter \rightarrow Larger(x, y)$
$\forall x, y\ \big(Planet(x) \wedge Asteroid(y)\big) \rightarrow Larger(x, y)$
$Planet\big(former(Ceres)\big) \wedge Asteroid(former(Ceres))$
$Asteroid\big(current(Ceres)\big) \wedge Planet(current(Ceres))$

Problem 5

1. Zebra is owned by 5 (Japanese person). 1 (Norwegian dude) drinks water
2. Virgilijus has Flowers in their yard. Gallchobhar watches Starcraft 2.