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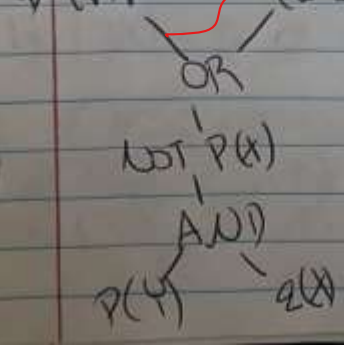
Briana Parchment CMPT333
Homework 2

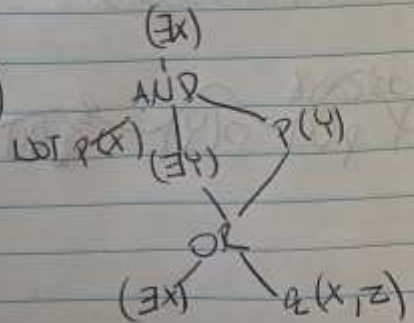
Problem 1
a) ~~Constant~~ Variable
b) Constant
c) Constant -2
d) Constant
e) ~~Ground~~ No Ground Atomic Formula
f) Ground Atomic Formula
g) ~~Non-a Ground Atomic Formula~~ constant

Problem 2
(Csg("CMPT222", S, G) AND) ~~Snap~~ (S, "L. Van Pelt", A, P) -> answer(G)

I substituted the course name and student name to demonstrate the truth of the statement.

Problem 3
a) $\forall x \exists y (NOT\ p(x)\ OR\ p(y)\ AND\ q(x))$
b) $\exists x (NOT\ p(x)\ AND\ (\exists y\ p(y)\ OR\ \exists x (q(x,z))$

Problem 4
a)


b)


-3

Problem 5

b) $(\exists X)(NOT\ p(X)\ AND\ (\exists Y)(p(Y)\ OR(q(X,z))))$

Problem 6

1. csg(C, S, "A") AND snap(S, "C.Brown", A, P)

2. NOT(csg(C, S, "A") AND snap(S, "C.Brown", A, P)

Problem 7

a) False: All Y loves X
True: There exists a Y that loves a X.

b) False
~~False~~: If p(x) is false, then NOT p(x) is true
~~False~~:
True: NOT p(x) can be true if p(x) is ~~true~~.

c) True: If X exists, then there is a p(x)
False: For all X there is a p(x).

d) True: p(X,Z) will not occur if (p(X,Y) AND p(Y,Z) does not occur
False: If (p(Y,Z) occurs, ~~for~~ then (p(X,Y) AND p(Y,Z)) occurs.

Problem 8

a) p(X) p(Y) q(X) q(Y)

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Problem 8

a) $(p(x) \text{ OR } q(y)) \equiv (q(y) \text{ OR } p(x))$

a b

p(x)	p(y)	q(x)	q(y)	a	b	E a≡b
1	1	1	1	1	1	1
1	0	1	0	1	1	1
0	0	0	0	0	0	1
0	1	0	1	1	1	1

Tautology

b) $(p(x,y) \text{ AND } p(x,y)) \equiv p(x,y)$

a b

p(x,y)	p(x,y) AND p(x,y)	E a≡b
1	1	1
0	0	1

Tautology

c) $(p(x) \rightarrow \text{FALSE}) \equiv \text{NOT } p(x)$

b b

p(x)	NOT p(x)	p(x) → FALSE	E a≡b
1	0	0	1
0	1	1	1

Tautology

Problem 9

a) $((\exists x)(q(x,z) \text{ NOT } p(x))) \text{ AND } ((\exists y)\, p(y))$

b) $(\exists x)(p \text{ OR } q \text{ OR } x)$

Problem 10

a) $(\exists y b(x(q(y))$

b) $(\exists x)(p(x,y)(y,x))$

Problem 11
The implication is true, because AND is commutative.

Problem 12
a) $(\exists X)(\neg\forall T\, p(X)) \text{ AND } ((\exists Y) p(Y)) \text{ OR } ((\exists X) q(X,Z))$

$(\exists X)(\neg\forall T\, p(X) \text{ OR } (q(X,Z)) \text{ AND } (\exists Y)\, p(Y))$

b) $(\exists X)(\exists X) p(X) \text{ OR } (X) q(X) \text{ OR } r(X))$

$((\exists X)\, X\, q(X) \text{ OR } p(X) \text{ OR } r(X))$

Problem 13
$([Q, X] E) \text{ AND OR } ((Q, Y) F)$

Problem 14
1. $(\neg\forall T(\exists X)(\exists Y)) \text{ OR } (\neg\forall T\, p(X,Y))$

2. $(\neg\forall T((\exists X) p(X)) \text{ AND } (\neg\forall T(\exists Y) q(X,Y))$

Problem 15
Yes it is true that E is a tautology whenever $(\exists X) E$ is a tautology.