83

CMPT 333 620 21S

Andrew Giardina

Homework 2 Answers

Problem 1

a) CMPT 333 - Variable

b) cmpt 333 - Constant

c) 333 - Constant ✓

d) "cmpt 333" - Constant

e) p(X, x) - Non-Ground Atomic Formula

f) p(3,4,5) - Ground Atomic Formula

g) "p(3,4,5)" - Constant

Problem 2

(csg("CMPT220", S, G) AND snap(S, "L. Van Pelt", A, P))
→ answer(G)

My Substitutions:

S = 40015
G = "B+"
A = "35 Millway Lane"
P = "531-5117"

Making these substitutions will demonstrate an overall TRUE evaluation.

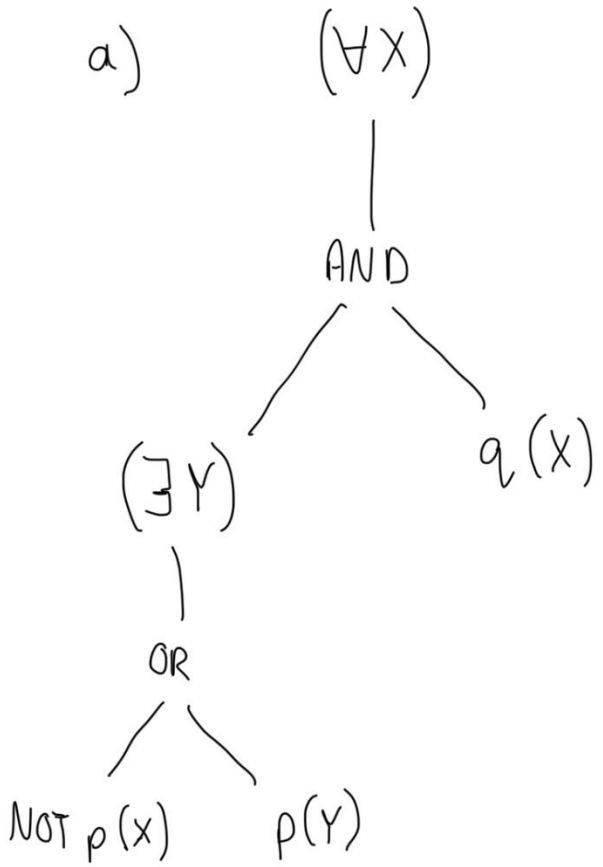
Problem 3

a) (∀X)(∃Y) NOT (p(X) OR p(Y) AND q(X)) -2

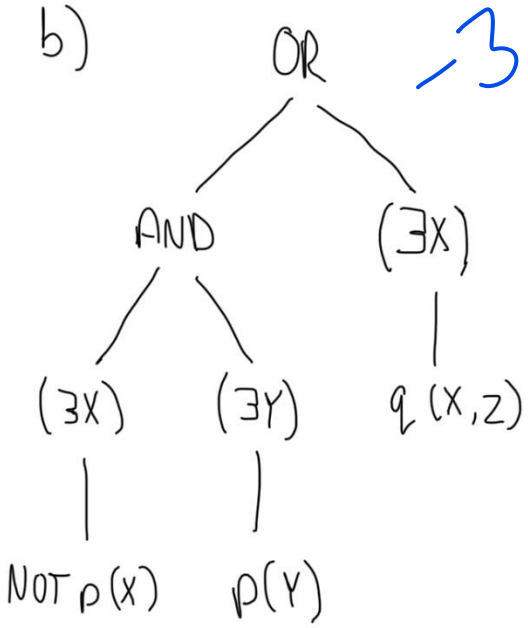
b) (∃X) NOT p(X) AND ((∃Y) p(Y) OR (∃X) q(X, Z)) -2

Problem 4

a)



b)



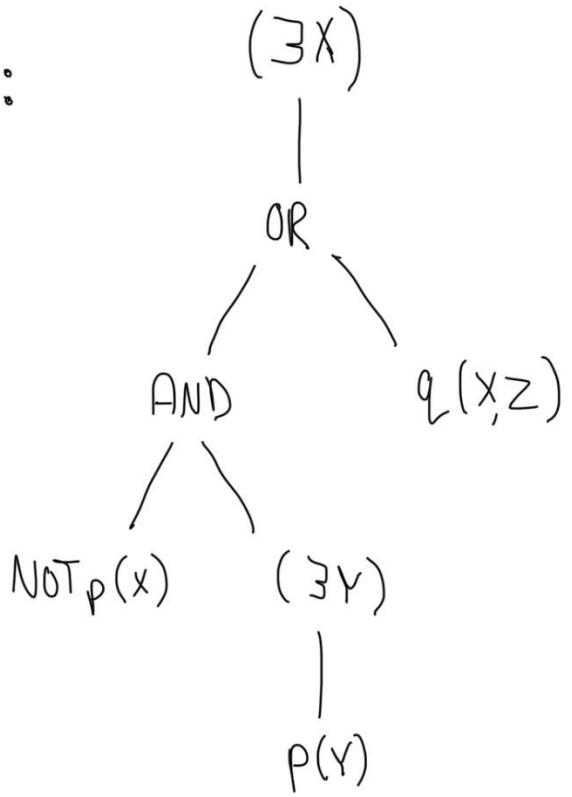
-3

Problem 5

Rewritten Expression:

$$(\exists X)\left(\text{NOT}\, p(x)\ \text{AND}\left((\exists Y)\, p(Y)\ \text{OR}\ q(X,Z)\right)\right)$$

Tree for Reference:



-3

Problem 6

* S for Chris Brown is 12345

-3

1)

$(\forall C)((\exists S)\, csg(C, "12345", "A") \rightarrow csg(C, "12345", "A"))$

2)

$(\forall C)((\exists S)\, csg(C, "12345", "A") \rightarrow NOT\ csg(C, "12345", "A"))$

Problem 7

a) $(\forall X)(\exists Y)(loves(X,Y))$

- I_{True}
  - D is the set of all living Humans
  - loves(X,Y) is true if X loves Y

This is true because all People (X) have Someone that they love (Y).

- I_{False}
  - D is the set of all Fruits in the world
  - loves(X,Y) is true if X loves Y

False because fruits have no emotions

b) $p(X) \rightarrow$ NOT $p(X)$

- I_{True}
  - D is the set of all Negative Integers
  - $p(X)$ is true if $(X + X) > 0$

True because $p(X)$ will always be false, and false implications are always true ✓

- I_{False}
  - D is the set of all integers
  - $p(X)$ is true if $X = X$

False because $p(X)$ will always be true, and a true implying NOT (True) ≡ False will always be false ✓

c) $(\exists X)\, p(X) \rightarrow (\forall X)\, p(X)$

- I_{True}
  - D is the set of all Students at Marist
  - $p(X)$ is true if X wears a mask

True because there exists a masked student, and all students wear masks. True → True ≡ True

- I_{False}
  - D is the set of all students in your Language Study Course.
  - $p(X)$ is true if X is a Senior

False because there does exist a student that is a Senior (me), however not all students are Seniors. True → False ≡ False

d) $(p(X,Y)$ AND $p(Y,Z)) \rightarrow p(X,Z)$

- I_{True}
  - D is the set of all Real Numbers
  - $p(X,Y)$ is true if $X < Y$

True, this claims if $X < Y < Z$, then $X < Z$. Always evaluates to true.

- I_{False}
  - D is the set of enforced alternating Binary digits. Ex: if $x=0$, Y must $= 1$; if $x=1$, Y must $= 0$
  - $p(X,Y)$ is true if $X != Y$

False, $(p(X,Y)$ AND $p(Y,Z))$ will always be true. But implication will always be false

Problem 8

a) $p(X)$ subbed for p

$q(Y)$ subbed for q

$(p + q) \equiv (q + p)$ by Communitive Law for OR

b) $p(X, Y)$ subbed for p

$(pp) \equiv p$ by Idempotence Law of AND

c) $p(X)$ subbed for p

$p \rightarrow \text{False} \equiv \text{NOT } p$

Not sure which law...

Cases

$1 \rightarrow 0 \equiv \text{Not } 1$ ✓

$0 \equiv 0$

$0 \rightarrow 0 \equiv \text{NOT } 0$ ✓

$1 \equiv 1$

$$(p \rightarrow q) \equiv (\bar{p} + q)$$

Problem 9

a) $(\exists X)\left(q(X,2) \text{ OR } \left(\text{NOT}_p(X) \text{ AND } (\exists Y)_{p(Y)}\right)\right)$ -3

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

I assume that (X) is supposed to be $(\exists X)$
Typo? For Question b)

Problem 10

a) $(\forall X)(\exists Y)\left(p(X,Y) \text{ AND } q(\not Y)\right)$ -2

b) $(\forall Y)$ NOT $(\exists X)\left(\text{NOT}_p(X,Y) \text{ OR } \text{NOT}_{p(Y,X)}\right)$ -2

?