

# Homework 4

## CMPSC 360

Kinner Parikh  
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### Question 1:

NEWS.KIT = I was reading the newspaper in the kitchen

GLASS.KIT = My glasses are on the kitchen table

GLASS.BREAK = I saw my glasses at breakfast

NEWS.LIV = I was reading the newspaper in the living room

GLASS.COFF = My glasses are on the coffee table

H1: NEWS.KIT  $\rightarrow$  GLASS.KIT

H2: GLASS.KIT  $\rightarrow$  GLASS.BREAK

H3:  $\neg$  GLASS.BREAK

H4: NEWS.LIV  $\vee$  NEWS.KIT

H5: NEWS.LIV  $\rightarrow$  GLASS.COFF

1. GLASS.KIT  $\rightarrow$  GLASS.BREAK

H2

2.  $\neg$ GLASS.BREAK

H3

3.  $\neg$ GLASS.KIT

Modus Tollens on 1 and 2

4. NEWS.KIT  $\rightarrow$  GLASS.KIT

H1

5.  $\neg$ NEWS.KIT

Modus Tollens on 4 and 3

6. NEWS.LIV  $\vee$  NEWS.KIT

H4

7. NEWS.LIV

Disjunctive Syllogism on 6 and 5

8. NEWS.LIV  $\rightarrow$  GLASS.COFF

H5

9. GLASS.COFF

Modus Ponens on 8 and 7

Therefore, the glasses are at on the coffee table.

### Question 2:

H1:  $(\neg v \vee \neg p) \rightarrow (s \wedge z)$

H2:  $s \rightarrow o$

H3:  $\neg o$

C:  $v$

1.  $s \rightarrow o$

H2

2.  $\neg o$

H3

3.  $\neg s$

Modus Tollens on 1 and 2

4.  $(\neg v \vee \neg p) \rightarrow (s \wedge z)$

H1

5.  $\neg v \rightarrow (s \wedge z)$

Additive rule on 4

6.  $\neg v \rightarrow s$

Simplification of 5

7.  $\neg \neg v$

Modus Tollens of 6 and 3

8.  $v$

Double negation on 7

### Question 3:

1. This is not a valid argument ( $a^2$  is positive, but  $a$  could be  $\pm a$ )

2. This is a valid argument (the only solution for  $\sqrt{0^2}$  is 0)

**Question 4:**

$P(x)$  = if  $x$  has taken CMPSC-360, then they can take CMPSC-465 next semester

$$\frac{\forall x P(x)}{\therefore P(c) \text{ if } c \in U}$$

The argument is valid because of universal instantiation.

**Question 5:**

For all natural numbers  $n$ ,  $\frac{n}{3} + \frac{n^2}{2} + \frac{n^3}{6}$  is a natural number

Proof:

Suppose  $n$ , and we know that  $n \in \mathbb{N}$

By definition of multiplies,

**Question 8:**