

# Midterm 1 Version 1 Review

March 29, 2020

## Question 1

a. Because we know

$S_1 = \{aa, bb, cc, aab, aac, aaa, bba, bbb, bbc, cca, ccb, ccc, aaaa, \dots\}$  and  $S_2$  is a set of all strings over U with length 3, we can conclude

$$S_1 \cap S_2 = \{aaa, aab, aac, bba, bbb, bbc, cca, ccb, ccc\}$$

b. See table below

$p$	$q$	$r$	$\neg r$	$p \vee q$	$p \vee q \Rightarrow \neg r$
T	T	T	F	T	F
T	T	F	T	T	T
T	F	T	F	T	F
F	T	T	F	T	F
T	F	F	T	T	T
F	T	F	T	T	T
F	F	T	F	F	T
F	F	F	T	F	T

c. Let  $x \in \mathbb{N}$ , and  $y = \underline{\hspace{2cm}}$ .

We will prove that predicate  $P(x, y)$  is true, or predicate  $Q(x, y)$  is true.

**Correct Solution:**

Let  $x = \underline{\hspace{2cm}}$ , and  $y \in \mathbb{N}$ .

We will prove that **both predicates  $P(x, y)$  and  $Q(x, y)$  are false.**

**Notes:**

- How can I proceed a proof when there is  $\forall$  on R.H.S of the statement?  
What's the general structure of proof given this symbol?

## Question 2

- a.  $\exists x \in P, Student(x) \wedge Attends(x)$   
b.  $\forall x \in P, \exists y \in P, Student(y) \wedge Attends(y) \Rightarrow Loves(x, y)$

**Correct Solution:**

$\forall x \in P, \exists y \in P, Student(y) \wedge Attends(y) \wedge Loves(x, y)$

**Notes:**

- When should  $\Rightarrow$  be used, and when should  $\wedge$  be used?
- c.  $\forall x \in P, Student(x) \wedge Attends(x) \Rightarrow Loves(x, x)$

## Question 3

## Question 4