

# Midterm 1 Version 1 Solution

March 19, 2020

## Question 1

- a.  $S_1 = \{aa, bb, cc, aaa, aab, aac, bba, bbb, bbc, cca, ccb, ccc, \dots\}$

So,

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

- b. See below

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

- c. **Negation:**  $\exists x \in \mathbb{N}, \forall y \in \mathbb{N}, \neg P(x, y) \wedge \neg Q(x, y)$ .

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

We will prove that predicate  $P$  and  $Q$  are not true.

## Question 2

- a.  $\exists x \in P, Student(x) \wedge Attends(x)$
- b.  $\forall x \in P, \exists y \in P, Student(y) \wedge Attends(y) \wedge Loves(x, y)$
- c.  $\forall x \in P, Student(x) \wedge Attends(x) \Rightarrow Loves(x, x)$
- d.  $\forall x_1, x_2 \in P, x_1 \neq x_2 \wedge Loves(x_1, x_2) \Rightarrow (Attends(x_1) \wedge \neg Attends(x_2)) \vee (\neg Attends(x_2) \wedge Attends(x_1))$

**Correct Solution:**

$$\forall x_1, x_2 \in P, x_1 \neq x_2 \wedge Loves(x_1, x_2) \wedge Loves(x_1, x_2) \Rightarrow \neg Attends(x_1) \vee \neg Attends(x_2)$$

## Question 3

## Question 4