

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

Question 3

Question 4