

# Chapter 12 Homework

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22 February, 2024

## 1 12.1

- $\exists$  somebody who loves everybody
- $\exists$  somebody who loves no one
- $\neg \exists$  one person who loves everyone

## 2 12.3

- A I dont think so because there is no
- B Yes becausethere are no negative natural numbers
- C Yes x is before y in the alphabet
- D
- E

## 3 12.5

- A  $\forall$  two sets union = to a set containing both sets
- B  $\forall$  sets  $A = \dots, \exists$  a set  $\in -A$
- C  $\forall s_n \in S, S \subseteq A, s_n \in A$
- D
- E

## 4 12.7

In the formula

$$\begin{aligned} & \forall x \forall y P(x, y) \Leftrightarrow \neg(P(y, x)) \\ & \quad \wedge \forall x \exists y P(x, y) \\ & \wedge \forall x \forall y \forall z (P(x, y) \wedge P(y, z) \Rightarrow P(x, z)) \end{aligned}$$

In english this formula just ststes for any x, for any y in the function P (x,y) then not P is (y,x) and for any x there exists a y in the function P and for all x,y,z, in a function P (x,y,z)

## 5 12.9