

### Questions on Sets and Functions

#### (1) Questions on the Basic Properties of Sets

For each of the following, please state whether it's true or false. If the statement is false, please explain why it's false.

- a.  $3 \notin \{x : \{y : y^2 < x\} \neq \emptyset\}$
- b.  $\{a, b, c, \{d, e, f\}\} \cap \{d, e, f\} = \{d, e, f\}$
- c.  $\{a, b, c\} \cup \{a, b, c, d\} = \{a, b, c, a, b, c, d\}$
- d.  $\{x : x + 1 = 2x\} \supset \{y : 3/y = 3\}$
- e.  $\{y : y \text{ is French}\} \cap \{z : z \text{ is 3 years old}\} = \{x : x \text{ is French and } x \text{ is 3 years old}\}$
- f.  $\{y : y \text{ is a dog}\} \subseteq \{z : z \text{ is an animal}\}$

#### (2) Questions on the Basic Properties of Functions

- a. Is the following set a function? Why or why not?

$$\{ \langle 1, 1 \rangle, \langle 2, 1 \rangle, \langle 3, 1 \rangle, \langle 4, 1 \rangle, \langle 5, 1 \rangle \}$$

- b. What is the domain of the following function? What is its range? Does the function map the natural numbers onto the natural numbers? Finally, what is  $f(3)$ ?

$$f = \{ \langle 1, 2 \rangle, \langle 2, 3 \rangle, \langle 3, 104 \rangle \}$$

- c. Please define the following function using the notation introduced in (34) on the handout *Formal Foundations*.

$$\{ \langle \text{Seth}, \text{True} \rangle, \langle \text{Vincent}, \text{True} \rangle, \langle \text{Angelika}, \text{True} \rangle, \langle \text{Kyle}, \text{False} \rangle \}$$

- d. Please define the following function as a set of ordered pairs.

$$f: \{x : 0 < x < 6\} \rightarrow \{\text{True}, \text{False}\}$$

for every  $x \in \{x : 0 < x < 6\}$ ,  $f(x)$  is True iff  $x$  is evenly divisible by 2

- e. Please define the function in (2d) using the 'table notation' (see (37) on the handout *Formal Foundations*).