

# Logical Structures in Natural Language: Exercises

## Sets and Functions

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### 1 Sets

#### 1.1 Exercise: membership vs. sub-set relation

Give the following sets:

$$\begin{array}{ll} A = \{a, b, c, 2, 3, 4\} & E = \{a, b, \{c\}\} \\ B = \{a, b\} & F = \emptyset \\ C = \{c, 2\} & G = \{\{a, b\}, \{c, 2\}\} \\ D = \{b, c\} & \end{array}$$

check whether the following statements are true or false.

- |                     |                     |                             |
|---------------------|---------------------|-----------------------------|
| (a) $c \in A$       | (g) $D \subset A$   | (m) $B \subseteq G$         |
| (b) $c \in F$       | (h) $A \subseteq C$ | (n) $\{B\} \subseteq G$     |
| (c) $c \in E$       | (i) $D \subseteq E$ | (o) $D \subseteq G$         |
| (d) $\{c\} \in E$   | (j) $F \subseteq A$ | (p) $\{D\} \subseteq G$     |
| (e) $\{c\} \in C$   | (k) $E \subseteq F$ | (q) $G \subseteq A$         |
| (f) $B \subseteq A$ | (l) $B \in G$       | (r) $\{\{c\}\} \subseteq E$ |

#### 1.2 Exercise: set descriptions

Give a descriptive definitions of the following sets:

1.  $\{5, 10, 15, 20 \dots\}$
2.  $\{300, 301, 302, \dots, 399, 400\}$

#### 1.3 Exercise: Set operations

Given the sets  $A = \{a, b, c\}$ ,  $B = \{c, d\}$  e  $C = \{d, e, f\}$ .

(a) Which is the result of the following operations?

1.  $A \cup B$
2.  $A \cap B$
3.  $A \cup (B \cap C)$

4.  $C \cup A$
5.  $B \cup \emptyset$
6.  $A \cap (B \cap C)$
7.  $A \setminus B$

(b) Is it right to say that:

1.  $a \in \{A, B\}$
2.  $a \in A \cup B$

## 1.4 Cartesian Product

Given the set  $A = \{2, 3, 4\}$  and  $B = \{4, 5\}$ , build the cartesian products

- a)  $A \times B$ .
- b)  $B \times A$ .
- c)  $B \times B$

## 2 Solutions

### Sets: membership vs. sub-set relation 1.1

(a): Y   (g): Y   (m): N  
(b): N   (h): N   (n): Y  
(c): N   (i): N   (o): N  
(d): Y   (j): Y   (p): N  
(e): N   (k): N   (q): N  
(f): Y   (l): Y   (r): Y

### Set description 1.2

1.  $\{x | x \text{ is a multiple of } 5\}$
2.  $\{x | 300 \leq x \text{ and } x \leq 400\}$

### Set operations

(a)

1.  $\{a, b, c, d\}$
2.  $\{c\}$
3.  $\{a, b, c, d\}$
4.  $\{a, b, c, d, e, f\}$
5.  $\{c, d\}$
6.  $\emptyset$
7.  $\{a, b\}$

(b)

1. N
2. Y

### Cartesian Product

- a)  $A \times B = \{(2, 4), (2, 5), (3, 4), (3, 5), (4, 4), (4, 5)\}$
- b)  $B \times A = \{(4, 2), (4, 3), (4, 4), (5, 2), (5, 3), (5, 4)\}$
- c)  $B \times B = \{(4, 4), (4, 5), (5, 4), (5, 5)\}$