

## Exercises 1                      Sets

### Set, element, empty set, subset, intersection, union, complement

#### Objectives

- understand what a set, an element of a set, an empty set, a subset, an intersection, a union, a complement is.
- be able to perform basic set operations.

#### Problems

1.1      Look at the sets A, B, and C:

A = Set of all cities of the world

B = Set of all European cities

C = Set of all coastal cities of the world

Find at least four elements of the following sets:

- a)       $B \cap C$                                       b)       $B \setminus C$   
c)       $C \setminus B$                                       d)       $A \setminus (B \cup C)$

1.2      Harshbarger/Reynolds\*: Chapter 0 (Algebraic Concepts), Section 0.1 (p. 2-9)  
(Scanned pages 2-55 and A1-A5 in file “Algebraic Concepts.pdf” on Moodle)

- a)      Theory (p. 2-6)                              b)      Exercises (p. 6-9)

\*Harshbarger, R.J. and Reynolds, J.J.: Mathematical Applications for the Management, Life, and Social Sciences; Houghton Mifflin Company, Boston / New York 2007, 8th edition, ISBN 978-0-618-73162-6

1.3      Decide which statements are true or false. Put a mark into the corresponding box.  
In each problem a) to c), exactly one statement is true.

a)      A is any set.

- $A \in A$   
       $\{\} \subseteq A$   
       $A \cap A = \{\}$   
       $A \cup \{\} = \{\}$

b)      A = Set of all cities of the world  
B = Set of all European cities

- $A \cap B = A$   
       $A \cup B = A$   
       $B \in A$   
       $B \subset A$

c)      A and B are any sets.

- $(A \cup B) \subset (A \cap B)$   
       $(A \cap B) = (A \setminus B)$   
       $(A \cup B) = (A \setminus B) \cup (B \setminus A) \cup (A \cap B)$   
       $(A \cap B) = (A \setminus B) \cup (B \setminus A) \cup (A \cap B)$

**Answers**

- 1.1    a)     $B \cap C = \{\text{Lisbon, Copenhagen, Barcelona, Naples, Stockholm, ...}\}$   
      b)     $B \setminus C = \{\text{London, Paris, Madrid, Berlin, Rome, ...}\}$   
      c)     $C \setminus B = \{\text{Tokyo, San Francisco, Sydney, Rio de Janeiro, ...}\}$   
      d)     $A \setminus (B \cup C) = \{\text{Chicago, Mexico City, Nairobi, Beijing, ...}\}$
- 1.2    see Harshbarger/Reynolds: Chapter 0, Algebraic Concepts  
      (Scanned pages 2-55 and A1-A5 in file “Algebraic Concepts.pdf” on Moodle)
- 1.3    a)    2<sup>nd</sup> statement  
      b)    4<sup>th</sup> statement  
      c)    3<sup>rd</sup> statement