Exercises 1   Sets
Set, element, empty set, subset, universal set, intersection, union, complement

Objectives

- know and understand what a set, an element of a set, an empty set, a subset, an intersection, a union, and a complement are.
- know and understand the illustration of a set in a Venn diagram.
- 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 five 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   You will find a pdf-file with scanned pages of the textbook Harshbarger/Reynolds* on Moodle:
> Additional Course Material > Algebraic Concepts (Harshbarger/Reynolds)
(pages 2 to 55 of chapter "0 Algebraic Concepts" and pages A1 to A5)

Go to section "0.1 Sets" (pages 2 to 9).

a)   Study the theory (pages 2 to 6).

b)   Do the exercises (pages 6 to 9).

*Harshbarger, R.J., 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 = Set of all cities of the world
B = Set of all European cities

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

b)   A is any set.

☐ $A \cup \{\} = \{\}$
☐ $A \cap A = \{\}$
☐ $A \setminus A = \{\}$
☐ $A \setminus A = A$

c)   A and B are any sets.

☐ $(A \cup B) \subset (A \cap B)$

☐ $(A \cap B) = (A \setminus B)$

☐ $(A \cup B) = (A \setminus B) \cup (B \setminus A) \cup (A \cap B)$

☐ $(A \cap B) = (A \setminus B) \cup (B \setminus A) \cup (A \cap B)$

Hint:
- Draw a Venn diagram for each statement.

Answers

1.1   a)   B ∩ C = {Lisbon, Copenhagen, Barcelona, Naples, Stockholm, ...}

          b)   B \ C = {London, Paris, Madrid, Berlin, Rome, ...}

          c)   C \ B = {Tokyo, San Francisco, Sydney, Rio de Janeiro, Cape Town, ...}

          d)   A \ (B ∪ C) = {Chicago, Mexico City, Nairobi, Beijing, Bogotá, ...}

1.2   see Harshbarger/Reynolds (page A1)

       Note:
       - Only answers of the odd-numbered exercises (1, 3, 5, ...) are available.

1.3   a) 4th statement

          b) 3rd statement

          c) 3rd statement