

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, a complement is.
- 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 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)

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|----|-----------------|----|--------------------|
| 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.

- | | |
|--------------------------|----------------------|
| <input type="checkbox"/> | $A \in A$ |
| <input type="checkbox"/> | $\{\} \subseteq A$ |
| <input type="checkbox"/> | $A \cap A = \{\}$ |
| <input type="checkbox"/> | $A \cup \{\} = \{\}$ |

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

- | | |
|--------------------------|----------------|
| <input type="checkbox"/> | $A \cap B = A$ |
| <input type="checkbox"/> | $A \cup B = B$ |
| <input type="checkbox"/> | $B \in A$ |
| <input type="checkbox"/> | $B \subset A$ |

- c) A and B are any sets.

- | | |
|--------------------------|---|
| <input type="checkbox"/> | $(A \cup B) \subset (A \cap B)$ |
| <input type="checkbox"/> | $(A \cap B) = (A \setminus B)$ |
| <input type="checkbox"/> | $(A \cup B) = (A \setminus B) \cup (B \setminus A) \cup (A \cap B)$ |
| <input type="checkbox"/> | $(A \cap B) = (A \setminus B) \cup (B \setminus A) \cup (A \cap B)$ |

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) 2nd statement
 b) 4th statement
 c) 3rd statement