



Exercise Sheet 2: Data Modelling I (until Thursday, 06.11.2014)

Please note: you need **50%** of all exercise points to receive the *Studienleistung* for this lecture. In order to pass the RDB I Module, you need both the *Studienleistung* **and** you need to pass the exam. Exercises have to be turned in until **Thursday before the lecture** either in the lecture hall or into our mailbox (Informatikzentrum 2nd floor). Please do not forget your **Matrikelnummer** and your **tutorial group number** on your solutions. Your solutions may be in German or English. Unless otherwise specified: **Always use your own words!**

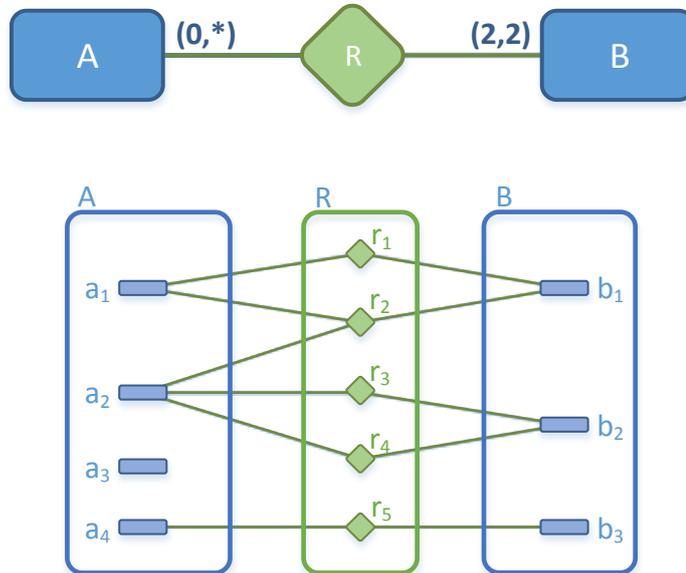
Exercise 2.1 – Database Design (9 Points)

- a) What steps are necessary to receive a **conceptual design** based on a **Universe of Discourse**? (2 points)
- b) What is the difference between conceptual/logical/physical **data models** and conceptual/logical/physical **schemas**? (2 points)
- c) Describe the **ANSI-SPARC Architecture**:
 - i. Where are the conceptual/logical/physical schemas located in the ANSI-SPARC Architecture? What is their purpose and how are they connected? (3 Points)
 - ii. What is the purpose of the presentation layer? (1 Point)
 - iii. What is meant physical and logical data independence? (2 Points)

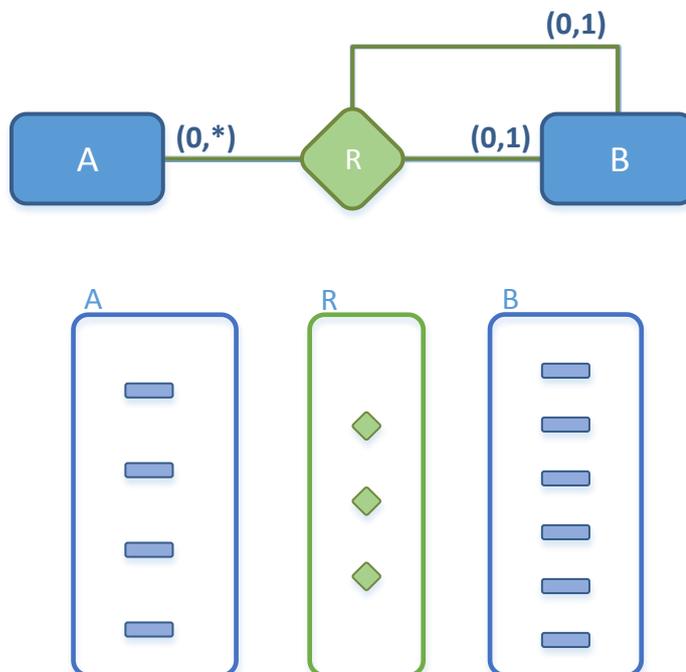
Exercise 2.2 – ER Modelling (18 Points)

- a) What is the difference between an **entity** and an **entity type**? Please give an example. (1 Point)
- b) Why do entity types usually need **key attributes**? How are entity types without key attributes called? (2 Points)

- c) The following ER diagram introduces a relationship type **R** between two entity types **A** and **B** with given cardinalities. The figure below the ER diagram shows two **entity sets** containing instances of A and B and a **relation set** containing instances of R. However, this figure contains two errors, which contradicts with the given ER diagram. Identify and explain these errors (4 points)



- d) Similar to exercise 2.2.c the following ER diagram shows a relationship type R and two entity types A and B. The figure below again shows entity sets with instances of A and B and a relation set with instances of R. However, the relation instances of R have no links to the instances of A and B. Complete the figure below in a way that it is consistent with the ER diagram. (3 Points)



e) In the following, we will informally describe **requirements** for the lending of books in a library. Based on these requirements, construct an ER diagram, which fulfills the given requirements. **Notice:** not every piece of information in the requirements has to have an equivalent in the ER diagram. Think carefully about which entity types and relationship types are necessary in order to fulfill the given requirements. **Document** your design decisions in an appropriate level (8 Points)

- Only registered customers are allowed to borrow books.
- Customers must be able to find and locate books in the library. Therefore:
 - Customers must be able to search books by title, author name or ISBN
 - As a result the book search engine returns the location of the book in the library
- The library can have multiple copies of a book. Whenever a book is lent to a customer, is important to know which copy was lent to which customer.
- The lending period for each copy is limited to three weeks. One week before the customer has to return the book, the customer gets an automatically sent mail containing a text like:

Dear <Mr. or Mrs.> <surname>,

the lending period of the book <booktitle> is about to expire. Please return the book before <date>.

kind regards,
the library

- If a book was returned to late, a fixed processing fee of 1€ will be charged.