Exercise 1 - Recapitulation

1. SQL and Relational Algebra

1. Name some important primitive and non-primitive operations of the relational algebra!

2. Describe the functionality of a natural join by using a simple example?

3. Describe the semi-join (⋈) based on the previous example! How can it be expressed using
   - the natural join ⊞◁, selection σ, and projection π?
   - the Cartesian product ×, selection σ, and projection π?

4. Translate the following queries to relational algebra:
   (a) select r1.a, r1.b, r2.c, r3.d
       from r1, r2, r3
       where r1.a = r2.a and r2.c = 50 and r3.d < r3.e
   (b) select a, c
       from r1
       where c in (select b from r2 where r2.a = r1.a)

2. Transactions

1. What is a Transaction?

2. What are the ACID properties?

3. Database Design – Functional Dependencies and Normal Forms

1. What are functional dependencies and normal forms and what are they used for?

2. Describe the normal forms 1 to 3 and the necessary steps to transform a schema which is not corresponding to these normal forms!

3. For the following relation: which functional dependencies do exist (based on the given data)?
   Transform the schema to the third normal form and describe all necessary steps!

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