

## 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 ( $\bowtie$ ) based on the previous example! How can it be expressed using
  - the natural join  $\bowtie$ , selection  $\sigma$ , and projection  $\pi$ ?
  - the Cartesian product  $\times$ , selection  $\sigma$ , and projection  $\pi$ ?
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!

id	from	to	name	size	team	pos	division
1	1984	1993	Michael Jordan	199	Chicago Bulls	G	Central
1	1995	1998	Michael Jordan	199	Chicago Bulls	G	Central
1	2001	2002	Michael Jordan	199	Washington Wizards	G	Atlantic
2	1987	1998	Scottie Pippen	205	Chicago Bulls	SF	Central
2	1998	1999	Scottie Pippen	205	Houston Rockets	SF	Southwest
2	1999	2003	Scottie Pippen	205	Portland T.B.	SF	Pacific
2	2003	2004	Scottie Pippen	205	Chicago Bulls	SF	Central
...							