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Data Models and Query Languages Summerterm 2013

1. Exercise Sheet: Conjunctive Queries

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Exercise 1 (SQL, Relational Algebra and Conjunctive Queries)

Consider the following database scheme.

- $\text{Sales}(PName, SName, CName)$
- $\text{Part}(PName, Type)$
- $\text{Cust}(CName, CAddr)$
- $\text{Supp}(SName, SAddr)$

Further assume that $CAddr$ and $SAddr$ store the point of origin of the customers and suppliers, respectively. Specify the following queries in SQL, relational algebra and as a conjunctive query (if possible).

- a) Part-, supplier-, and customer name of all parts of type "typ1" that have been bought from a customer living in Freiburg.
- b) All parts of type "typ2" that have been bought from both customer "Lausen" and customer "Schätzle".
- c) All parts that have never been sold.

Exercise 2 (Containment Mapping)

Consider the following conjunctive queries Q_1, Q_2 and decide whether $Q_1 \sqsubseteq Q_2$, $Q_2 \sqsubseteq Q_1$, and $Q_1 \equiv Q_2$ hold. Provide the corresponding containment mappings or show that no such mapping exists.

- $Q_1 : \text{ans}(X, Y) \leftarrow R(X, Z), R(Z, T), S(T, Y)$
- $Q_2 : \text{ans}(X, Z) \leftarrow R(X, X), S(X, Z)$

Exercise 3 (Canonical Instance)

Consider the following conjunctive queries Q_1, Q_2 and decide whether $Q_1 \sqsubseteq Q_2$, $Q_2 \sqsubseteq Q_1$, and $Q_1 \equiv Q_2$ hold using the method of canonical instances.

- $Q_1 : \text{ans}(X) \leftarrow R(X, Y, X), R(X, Z, Y), S(Y, X)$
- $Q_2 : \text{ans}(X) \leftarrow R(X, Y, Z), S(Y, Z)$

Exercise 4 (Containment Relationships and Minimization)

Consider the following four conjunctive queries, where c denotes a constant.

- $Q_1 : ans(X, Y) \leftarrow R(X, A), R(A, B), R(B, Y)$
- $Q_2 : ans(X, Y) \leftarrow R(X, A), R(A, B), R(B, C), R(C, Y)$
- $Q_3 : ans(X, Y) \leftarrow R(X, A), R(B, C), R(D, Y), R(X, B), R(A, C), R(C, Y)$
- $Q_4 : ans(X, Y) \leftarrow R(X, A), R(A, c), R(c, B), R(B, Y)$

- a) Find all equivalences and containment relationships between the above queries.
- b) Minimize all queries.