

Introduction to Databases: Tutorial 2

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Problem 1

Consider the following Schema– Customer : ID, Name, City Account : Number, Branch, ID, Balance

Write the following questions in relational calculus

- (1) ID and name of customers who own an account in a branch in their City

$$\{i, na \mid \exists c \text{ Customer}(i, na, c) \wedge \exists nu, c, i, ba \text{ Account}(nu, c, i, ba)\}$$

- (2) ID and name of customers who do not own any account

$$\{i, na \mid \exists c \text{ Customer}(i, n, c) \wedge \neg \exists nu, br, i, ba \text{ Account}(nu, br, i, ba)\}$$

$$\{i, na \mid \exists c \text{ Customer}(i, n, c) \wedge \forall nu, br, i', ba \text{ Account}(nu, br, i', ba) \wedge i \neq i'\}$$

- (3) ID and name of customers who own an account with a balance which is no less than the balance of any other account.

$$\{i, na \mid \exists c \text{ Customer}(i, n, c) \wedge \forall nu, br, i', ba \text{ Account}(nu, br, i', ba) \rightarrow \exists nu', br', i, ba' \text{ Account}(nu', br', i, ba') \wedge ba' \geq ba\}$$

Problem 2

Given a schema consisting of a binary relation R and a ternary relation S , write a relation calculus query that computes the active domain

Problem 3

Consider the schema of Problem 1. Express the following relational algebra query in relational calculus.

$$\text{Customer} \bowtie (\pi_{ID, City}(\text{Customer}) \cap \rho_{CustID \rightarrow ID, Branch \rightarrow City}(\pi_{Branch, CustID}(\text{Account})))$$

$$\begin{aligned} & C(x_{ID}, x_{Name}, x_{City}) \wedge \\ & (\exists x_{Name} C(x_{ID}, x_{Name}, x_{City}) \wedge \\ & (\neg \exists x_{name} C(x_{ID}, x_{Name}, x_{City}) \wedge \exists x_{Number}, x_{Balance} A(x_{Number}, x_{City}, x_{ID}, x_{Balance}))) \end{aligned}$$