

CS392 Database System Concept

Assignment 2

Due to Mar. 24th, 2014 (150' in total)

1. (20') Explain *ACID*, and describe an example for each of them.
2. (20') Complete the SQL DDL definition of the bank database of Figure 4.2 in textbook to include the relations *loan* and *borrower*.
3. (20') Referential-integrity constraints as defined in this chapter involve exactly two relations. Consider a database that includes the following relations:

salaried_workder(name, office, phone, salary)

hourly_worker(name, hourly_wage)

address(name, street, city)

Suppose that we wish to require that every name that appears in *address* appear in either *salaried_workder* or *hourly_worker*, but not necessarily in both.

- a. Propose a syntax for expressing such constraints.
 - b. Discuss the actions that the system must take to enforce a constraint of this form.
4. (20') Consider an employee database with two relations:

employee(employee_name, street, city)

works(employee_name, company, salary)

Where primary keys are underlined. Write a query to find companies whose employees earn a higher salary, on average, than the average salary at First Bank Corporation.

- a. Without using SQL functions
 - b. (Optional) Using SQL functions as appropriate.
5. (20') Let the following relation schemas be given:

$R = (A, B, C)$

$S = (D, E, F)$

Let relation $r(R)$ and $s(S)$ be given. Give an expression in the tuple relational calculus that is equivalent to each of the following:

- a. $\Pi_A(r)$
 - b. $\sigma_{B=17}(r)$
 - c. $r \times s$
 - d. $\Pi_{A,F}(\sigma_{C=D}(r \times s))$
6. (20') Let $R = (A, B)$ and $S = (A, C)$, and let $r(R)$ and $s(S)$ be relations. Write relational algebra expressions equivalent to the following domain-relational-calculus expression:
 - a. $\{ \langle a \rangle \mid \exists b (\langle a, b \rangle \in r \wedge b = 17) \}$
 - b. $\{ \langle a, b, c \rangle \mid \langle a, b \rangle \in r \wedge \langle a, c \rangle \in s \}$

- c. $\{ \langle a \rangle \mid \exists b (\langle a, b \rangle \in r) \vee \forall c (\exists d (\langle d, c \rangle \in s) \Rightarrow \langle a, c \rangle \in s) \}$
- d. $\{ \langle a \rangle \mid \exists c (\langle a, c \rangle \in s \wedge \exists b_1, b_2 (\langle a, b_1 \rangle \in r \wedge \langle c, b_2 \rangle \in r \wedge b_1 > b_2)) \}$
7. (30') Let $R = (A, B)$ and $S = (A, C)$, and let $r(R)$ and $s(S)$ be relations. Using the special constant *null*, write tuple relational calculus expressions equivalent to each of the following:
- $r \bowtie \neg s$
 - $r \neg \bowtie \neg s$
 - $r \neg \bowtie s$