2012 박사과정 자격시험 (CS560 Database Systems)

2012년 6월

학과 : _____   학번 : _____   이름 : _____

총 배점: 100 points

1. [15 points] Explain the distinctions among the terms primary key, candidate key, and superkey.

2. [15 points] Consider the relational database of Figure 1, where the primary keys are underlined.
   Give an expression in the relational algebra, tuple relational calculus and domain relational calculus for each request:

   1) Find the names and cities of residence of all employees who work for First Bank Corporation.

   2) Find the names of all employees who live in the same city as the company for which they work.

   3) Find the names of all employees who earn more than every employee of Small Bank Corporation.

   Figure 1.

   employee(person-name, street, city)
   works(person-name, company-name, salary)
   company(company-name, city)

3. [20 points] Use the definition of functional dependency to argue that each of Armstrong's axioms (reflexivity, augmentation, and transitivity) is sound.

4. [15 points] Explain the purpose of the checkpoint mechanism. How often should checkpoints be performed? How does the frequency of checkpoints affect

- System Performance when no failure occurs

- The time it takes to recover from a system crash

- The time it takes to recover from a disk crash

5. [15 points] Show that the two-phase locking protocol ensures conflict serializability.

6. [20 Points] Construct an E-R diagram that satisfies following requirements.

Requirements:

- Bank is organized into branches. Each branch is located in a particular city and is identified by a unique name. The bank monitors the assets of each branch.

- Bank customers are identified by their social-security numbers. The bank stores each customer's name, and the street and city where the customer lives. Customers may have accounts.

- The bank offers two types of accounts—savings and checking accounts. Accounts can be held by more than one customer, and a customer can have more than one account. Each account is assigned a unique account number. The bank maintains a record of each account's balance, and the most recent date on which the account was accessed by each customer holding the account. In addition, each savings account has an interest rate, and each checking account has an overdraft rate.

- A loan originates at a particular branch and can be held by one or more customers. A loan is identified by a unique loan number. For each loan, the bank keeps track of the loan amount and the loan payments. Although a loan payment number does not uniquely identify a particular payment among those for all the bank's loans, a payment number does identify a particular payment for a specific loan. The date and amount are recorded for each payment.