CS3563: DBMS II
Assignment 2

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Please work individually on this assignment, forgetting about previous groupings.

1. Relational Algebra and SQL Queries

Consider the following relational schema:

$$Suppliers(\underline{sid : integer},\ sname : string,\ address : string)$$
$$Parts(\underline{pid : integer},\ pname : string,\ color : string)$$
$$Catalog(\underline{sid : integer,\ pid : integer},\ price : real)$$

The Suppliers relation describes suppliers of parts. The Parts relation contains information about each part. The Catalog relation lists the prices in dollars charged for parts by suppliers.(The keys are underlined)

a) Find the sid of suppliers who supply all blue parts. Write this query in relational algebra **without** using the division operator. ***(5 marks)***

b) For each supplier that supplies atleast two different parts, output its name and cost of the least expensive part that the supplier carries. Write this query in SQL. ***(5 marks)***

c) Find the names of suppliers and colors of the parts that they supply. Write this query in domain relational calculus. ***(5 marks)***

d) Can you pose a query such that the information in the database is sufficient to answer the query (e.g., you can use the contents of the Suppliers, Parts, and Catalog relation to somehow compute the answer to the query), but you cannot express the query in SQL? State such a query in English (obviously not in SQL) ***(8 marks)***

2. Functional Dependencies

Consider a relation R with six attributes ABCDEF. The following functional dependency $F1 = A \rightarrow BCDEF$, holds over R. Write down two other functional dependencies, F2 and F3, which satisfy the following three properties.

1) Neither F2 nor F3 can be inferred from F1 using Armstrong's axioms
2) Relation R with functional dependencies F1 and F2 is in BCNF
3) Relation R with functional dependencies F1, F2, and F3is in 3NF but not in BCNF

(12 marks)

3. ER Diagram

Assume that MedRX pharmacy has offered to give you a free lifetime supply of medicine if you design its database. Given the rising cost of health care, you agree. Here's the information that you gather:

- Patients are identified by an SSN, and their names, addresses, and ages are recorded.
- Doctors are identified by an SSN. For each doctor, the name, specialty, and years of experience must be recorded.
- Every patient has a primary physician (doctor). Every doctor has at least one patient.
- Each pharmacy has a name, address, and phone number.
- Each pharmacy sells several drugs and has a price for each. For each drug, the trade name and formula must be recorded. A drug could be sold at several pharmacies, and the price could vary from one pharmacy to another.
- Each drug is manufactured by a given pharmaceutical company, and the trade name identifies a drug uniquely from among the products of that company. Each pharmaceutical (drug-manufacturing) company is identified by name and has a phone number. If a pharmaceutical company is deleted, you need not keep track of its products any longer.
- Doctors prescribe drugs for patients. A doctor could prescribe one or more drugs for several patients, and a patient could obtain prescriptions from several doctors.
- Each prescription has a date and a quantity associated with it. You can assume that, if a doctor prescribes the same drug for the same patient more than once, only the last such prescription needs to be stored.

- Pharmaceutical companies have long-term contracts with pharmacies. A pharmaceutical company can contract with several pharmacies, and a pharmacy can contract with several pharmaceutical companies. For each contract, you have to store a start date, an end date, and the text of the contract.

a) Draw an ER diagram that captures the preceding information. ***(10 marks)***

b) How would your design change if the design requirements change as follows: If a doctor prescribes the same drug for the same patient more than once, several such prescriptions may have to be stored (State in English, you do not need to modify the E-R diagram) ***(5 marks)***