CS2102 Database Systems AY2018/19 Semester 2

Final Test (Duration: 2 hours, Total Marks: 80)

Question 13

(5 Marks) Questions 1-14 use the schema R(A,B,C,D,E) and set of functional dependencies F = { AB -> C, C -> DE, B -> AC, A -> B, E -> CD }.

Give one possible minimal cover of F.

Question 14

(5 Marks) Questions 1-14 use the schema R(A,B,C,D,E) and set of functional dependencies F = { AB -> C, C -> DE, B -> AC, A -> B, E -> CD }.

Using the minimal cover computed from Q13, give one possible lossless-join, dependency-preserving, 3NF decomposition of R with respect to F.

Question 16

(6 marks) Consider the ER model shown in Figure 2 (refer to attachment file). Assume that all the attributes have integer domain.

Translate the ER model into a relational schema using SQL such that the relational schema captures as many of the constraints in the ER model as possible.

Question 18

(6 marks) Consider the following relational database, where the primary key of each table is shown underlined.

- Pizzas (pizza)
- Customers (cname, area)
- Restaurants (rname, area)
- Sells (rname, pizza, price)
- Likes (cname, pizza)

Pizzas indicates the pizzas of interest. **Customers** indicates the name and location of each customer. **Restaurants** indicates the name and location of each restaurant. **Sells** indicates the pizzas sold by restaurants and their prices.

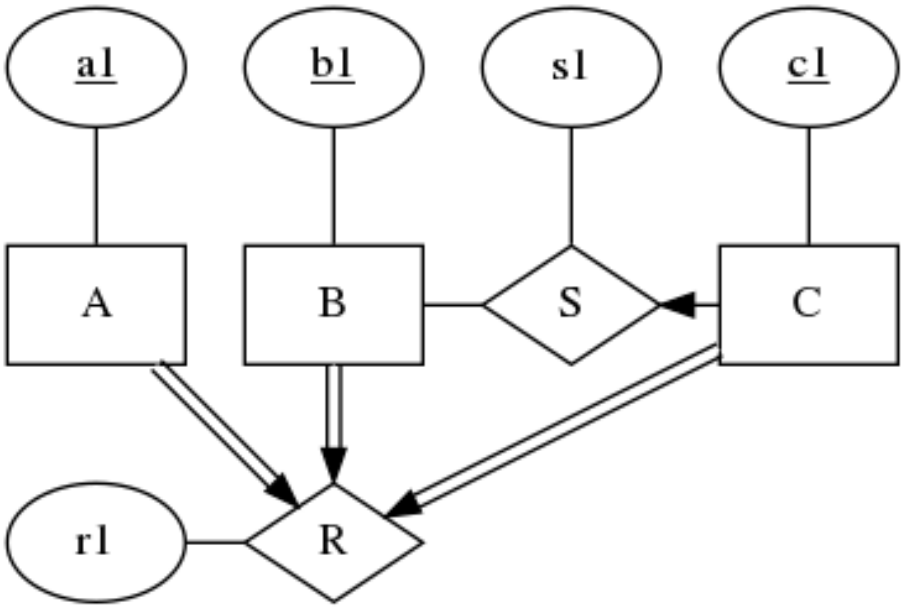

Figure 2

Figure 1:

Likes indicates the pizzas that customers like. Assume that the domain of the **price** attribute is NUMERIC and the domain of the remaining attributes is TEXT. Assume the following foreign key constraints:

- Sells.rname references Restaurants.rname
- Sells.pizza references Pizzas.pizza
- Likes.cname references Customers.cname
- Likes.pizza references Pizzas.pizza

We say that a restaurant R is **interesting** if R satisfies at least one of the following conditions:

- R is located in the 'Central' area, or
- R sells at least ten pizzas, or
- the price of every pizza sold by R is at most $20.

Write a single-statement SQL query to find all interesting restaurants. Your query must output a table with the schema (rname) without any duplicate records.

Question 19

(8 marks) Consider the same relational database as that for Question 18. For convenience, the information about the relational database is repeated from Question 18. Consider the following relational database, where the primary key of each table is shown underlined.

- Pizzas (pizza)
- Customers (cname, area)
- Restaurants (rname, area)
- Sells (rname, pizza, price)
- Likes (cname, pizza)

Pizzas indicates the pizzas of interest. **Customers** indicates the name and location of each customer. **Restaurants** indicates the name and location of each restaurant. **Sells** indicates the pizzas sold by restaurants and their prices. **Likes** indicates the pizzas that customers like. Assume that the domain of the **price** attribute is NUMERIC and the domain of the remaining attributes is TEXT. Assume the following foreign key constraints:

- Sells.rname references Restaurants.rname
- Sells.pizza references Pizzas.pizza
- Likes.cname references Customers.cname
- Likes.pizza references Pizzas.pizza

We say that a customer C is **happy** if for each pizza P that C likes, there are at least two restaurants, which are located in the same area as C, that sells P.

For example, if Alice likes only pizzas P1 and P2, then Alice will be happy if (a) restaurants RA and RB both sell P1; (b) restaurants RC and RD both sell P2; and (c) restaurants RA, RB, RC and RD are all located in the same area as Alice. Note that it does not matter whether {RA,RB} and {RC,RD} are the same or different set of restaurants.

Write a single-statement SQL query to find all happy customers. Exclude customers who do not like any pizza. Your query must output a table with the schema (cname) without any duplicate records.

Question 20

(8 marks) Consider the same relational database as that for Question 18. For convenience, the information about the relational database is repeated from Question 18. Consider the following relational database, where the primary key of each table is shown underlined.

- Pizzas (pizza)
- Customers (cname, area)
- Restaurants (rname, area)
- Sells (rname, pizza, price)
- Likes (cname, pizza)

Pizzas indicates the pizzas of interest. **Customers** indicates the name and location of each customer. **Restaurants** indicates the name and location of each restaurant. **Sells** indicates the pizzas sold by restaurants and their prices. **Likes** indicates the pizzas that customers like. Assume that the domain of the **price** attribute is NUMERIC and the domain of the remaining attributes is TEXT. Assume the following foreign key constraints:

- Sells.rname references Restaurants.rname
- Sells.pizza references Pizzas.pizza
- Likes.cname references Customers.cname
- Likes.pizza references Pizzas.pizza

We say that a **pizza P is a popular pizza in Area A** if (1) P is sold by some restaurant in area A, and (2) for every pizza P', the number of restaurants located in A that sell P' is no more than the number of restaurants located in A that sell P.

max query to find pizza in most num of areas

We say that a **pizza P is a popular pizza** if for every pizza P', the number of areas in which P' is popular is no more than the number of areas in which P is popular.

Write a single-statement SQL query to find all popular pizzas. Exclude pizzas that are not sold by any restaurant. Your query must output a table with the schema (pizza) without any duplicate records.
