Databases - Lab Sheet 6

Gordon Royle

School of Mathematics & Statistics
University of Western Australia

Question 1

Suppose $R(A, B, C, D, E)$ has the following functional dependencies

$$AB \rightarrow C, C \rightarrow D, BD \rightarrow E$$

Which of the following does *not determine* E?

- BE
- BCD
- C
- AB

BE determines E, BCD determines E and AB determines E, and so C is the only one that does not.

Question 2

Suppose $R(A, B, C)$ contains just one tuple $(0, 0, 0)$, and that R must always satisfy the FDs

$$A \rightarrow B, B \rightarrow C$$

Which of the following tuples can be legally inserted into R

- $(0, 1, 0)$
- $(0, 0, 2)$
- $(2, 0, 1)$
- $(1, 2, 0)$

The only one that can be added is $(1, 2, 0)$ because all of the others will cause a violation of an FD. For example, if we added $(0, 1, 0)$ then there would be two rows with the same A but different B, which violates $A \rightarrow B$.

Question 3

Consider the relation $R(A, B, C, D, E, F)$ with FDs

$$CDE \rightarrow B, ACD \rightarrow F, BEF \rightarrow C, B \rightarrow D$$

Which of the following is a key for R?

- $ABDF$
- ABE
- BDF
- $ABCE$

The only key for R is ABCE because if two rows have the same ABCE then they have the same D (from $B \rightarrow D$) and then the same F (from $ACD \rightarrow F$).

Question 4

Suppose $R(A, B, C, D, E)$ satisfies

$$D \to C, CE \to A, D \to A, AE \to D$$

Which of the following is a key for R?

- AD
- A
- BD
- BDE

The only key is BDE because none of the other sets determine E.

Question 5

Consider a relation $R(A, B, C, D)$. For which of the following sets of FDs is R in Boyce-Codd normal form?

1. $A \rightarrow C, B \rightarrow A, A \rightarrow D, AD \rightarrow C$
2. $BC \rightarrow A, AD \rightarrow C, CD \rightarrow B, BD \rightarrow C$
3. $A \rightarrow D, C \rightarrow A, D \rightarrow B, AC \rightarrow B$
4. $BD \rightarrow C, AB \rightarrow D, AC \rightarrow B, BD \rightarrow A$

Relation (1) is not in BCNF because $A \rightarrow C$ is an FD, but A is not a (super)key. Relation (2) is not in BCNF because $BC \rightarrow A$ is an FD, but BC is not a (super)key, as it does not determine D. Relation (3) is not in BCNF because $A \rightarrow D$ is an FD, but A is not a superkey as it does not determine C. Relation (4) is in BCNF because all the left-hand sides of the FDs are superkeys.

Question 6

Using the `ClassicModels` database, what SQL statement will list the number of employees in each office (by office code).

```
+------------+----------+
| 1          |        6 |
| 2          |        2 |
...
```

```
SELECT officecode, count(*)
FROM employees
GROUP BY officecode;
```

Question 7

Using the `ClassicModels` database, what SQL statement will list the number of employees in each office (by city).

```
+---------------+----------+
| San Francisco |        6 |
| Boston        |        2 |
...
```

```
SELECT Offices.City,
       COUNT(*)
FROM   Employees
       JOIN Offices USING (Officecode)
GROUP  BY Officecode;
```

Question 8

Using the `ClassicModels` database, what SQL statement will list the names and credit limits of all customers with a *higher than average* credit limit sorted in decreasing order of credit limit.

```
+----------------------------------+-------------+
| customername                     | creditLimit |
+----------------------------------+-------------+
| Euro+ Shopping Channel           |      227600 |
| Mini Gifts Distributors Ltd.     |      210500 |
...
```

```
SELECT Customers.Customername,
       Customers.Creditlimit
FROM   Customers
WHERE  Customers.Creditlimit > (SELECT AVG(Creditlimit)
                                FROM   Customers)
ORDER  BY Creditlimit DESC;
```

Question 9

Using the `ClassicModels` database, what SQL statement will produce a list of the (names of the) companies that do not have a dedicated sales rep?

```
+------------------------------+
| customername                 |
+------------------------------+
| Havel & Zbyszek Co           |
| Porto Imports Co.            |
..
```

```
SELECT Customername
FROM   Customers
WHERE  Salesrepemployeenumber IS NULL;
```

Question 10

Using the `ClassicModels` database, what SQL statement will produce a list of the last names of the salespeople together with the number of accounts they have (i.e. the number of customers for whom they are the sales rep).

```
+-----------+----------+
| Jennings  |        6 |
| Thompson  |        6 |
| Firrelli  |        6 |
...
```

```
SELECT   E.lastname,
         COUNT(*)
FROM     Employees e
JOIN     Customers c
where    E.employeenumber = C.salesrepemployeenumber
GROUP BY E.employeenumber
```

Question 11

Using the `ClassicModels` database, what SQL statement will produce a list of the last names of *everyone* in the company, together with the number of accounts they have, sorted alphabetically.

```
+-----------+---------------------------------------+
| Bondur    |                                     0 |
| Bondur    |                                     6 |
| Bott      |                                     8 |
...
```

```
SELECT Employees.Lastname,
       COUNT(Customers.Salesrepemployeenumber)
FROM   Employees
       LEFT OUTER JOIN Customers
                    ON Employees.Employeenumber =
                       Customers.Salesrepemployeenumber
GROUP  BY Employees.Employeenumber
ORDER  BY Employees.Lastname;
```