Exercise sheet for Session 3

Uncertain data management

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1 Exercise 1: Codd tables

Consider the following instance I:

Events

class	**session**	**teacher**	**room**
UDM	1	`NULL`	`NULL`
FOO	`NULL`	`NULL`	C42
UDM	9	`NULL`	`NULL`
FOO	`NULL`	`NULL`	C43

Class

class	**session**
UDM	1
FOO	`NULL`

Exam

class	**session**
UDM	9
FOO	`NULL`

Question 1. Rephrase in plain English what we know about the UDM class, and what we know about the FOO class.

Question 2. Write a Boolean conjunctive query that asks whether some class has a scheduled session in the same room as the exam for that class. Write it in the relational algebra and in the relational calculus.

Question 3. Is this query *possible* on the instance? If yes, what is a witnessing possible world?

Question 4. Is this query *certain* on the instance? If no, what is a counterexample possible world?

Question 5. Write a tuple-generating dependency that says that whenever a class has a scheduled session then it has a scheduled exam with the same teacher (but possibly in a different room).

Question 6. Is there a possible world that satisfies this constraint? Do all possible worlds satisfy this constraint?

Question 7. Replace three pairs of `NULL`s by named `NULL`s to obtain a v-table where the constraint is always respected.

2 Exercise 2: v-tables and c-tables

Consider the following instance of a v-table:

Events

class	session	teacher	room
UDM	1	$\texttt{NULL}_1$	$\texttt{NULL}_2$
$\texttt{NULL}_3$	2	$\texttt{NULL}_1$	$\texttt{NULL}_4$
FOO	1	John	$\texttt{NULL}_2$

Question 1. What is this relation saying in plain English?

Question 2. Write a query Q_1 in the relational algebra that returns the triples of a class *class* and two sessions $s_1 < s_2$ such that s_1 and s_2 are sessions of *class* that have the same teacher.

Question 3. Evaluate Q_1 on the instance to obtain a c-table R_1.

Question 4. Write an analogous query Q_2 that returns the triples of a class and two sessions $s_1 < s_2$ of the class that take place in the same room (but may have different teachers).

Question 5. Evaluate Q_2 on the instance to obtain a c-table R_2.

Question 6. Compute a c-table representation of the union R of R_1 and R_2.

Question 7. How many rows may the possible worlds of R have?

3 Exercise 3: Boolean c-tables

Consider the following instance:

Classes

session	date	prof	room
2	Nov 28	Antoine	C017
3	Dec 5	Antoine	C47
4	Dec 12	Silviu	C47
5	Jan 9	Silviu	C47
6	Jan 16	Silviu	C47

Consider the following uncertain Boolean events:

- x_1: Room C47 collapses. All UDM classes in room C47 must be canceled.
- x_2: D&K students accept to return from vacation. If this does *not* happen, all UDM classes in January are cancelled.
- x_3: Silviu wins the lottery and escapes to the Bahamas. All of Silviu's classes must be canceled.

Question 1. Annotate the rows of the instance to make a Boolean c-table that describes the correct outcome depending on the value of the events.

Question 2. How many possible worlds does the table have?

Question 3. Using only two Boolean variables x and y, create a different Boolean c-table on the same rows that describes the same set of possible outcomes.