

1DV013 – Database Theory

Theoretical Assignment 3 (35 p)

Deadline: October 19, 2014

1 Relations comparison

Consider the following relations:

R1: (A, B, C, D)

R2: (C, D, E, F)

Are the following two relational algebra expressions equivalent? Explain your answer!

$$\pi_{B,C}(R1) \bowtie R2$$
$$\pi_{B,C,D}(R1) \bowtie R2$$

2 Bags and sets

- Why are *bags* used instead of *sets* for relational algebra purposes?
- Provide an example of a relational algebra expression that would produce the same results for Bag laws and Set laws, and an example of an expression that would produce different results for Bag laws and Set laws.

3 Gallery

Consider the following relational schema for administrating exhibitions of pictures:

Artist (artistId, name, dateOfBirth, dateOfDeath, homeCountry)

Picture (picId, name, artistId, value)

Museum (museumName, city, country)

Exhibited(picId, museumName, from, to)

The key attributes are underlined. *Exhibited* may contain exhibitions of pictures in the past, present, or future.

Provide relational algebra expressions as well as SQL statements for the following queries:

1. Name and date of birth of **all living** artists who have painted at least one picture of value 50,000 (assume SEK) or more.

2. All museums (with name and city) in which at least one picture of 'Leonardo Da Vinci' is or was exhibited.
3. The museums (with name and city) which **exhibit or exhibited** pictures of **all** the artists born between 1920 and 1950.
4. In **natural** language, describe the result of the following query:

$$\pi_{\text{museumName,city,name}}(((\pi_{\text{homeCountry,artistId}}(\text{Artist}) \bowtie \text{Picture}) \bowtie \text{Museum}_{\text{homeCountry} \leftarrow \text{country}}) \bowtie \text{Exhibited})$$
Your answer for this question should look like "This query describes all the pictures exhibited in Antarctica after 1899".

4 Relational Algebra

Consider the following relations:

R(a, b, c)
 S(a, e, f)
 T(a, h)

And consider the following relational algebra expression:

$$\pi_{e,h}(\sigma_{b=10}((R \bowtie T) \bowtie S))$$

Which of the following expressions are equivalent to the one above? Give a short explanation to each answer.

1. $\pi_{e,h}((\sigma_{b=10}(R)) \bowtie (\pi_{a,e}(S)) \bowtie T)$
2. $\pi_{e,h}(\sigma_{b=10}(((\pi_b(R)) \bowtie (\pi_{a,e}(S))) \bowtie (\pi_{a,h}(T))))$
3. $\pi_{e,h}((\pi_{a,b}(\sigma_{b=10}(R))) \bowtie (\pi_a(S)) \bowtie T)$

Hand in a single PDF document with the answers. Assignment must be submitted via the Moodle submission system. Email submission attempts will be ignored.