Mathematisch-Naturwissenschaftliche Fakultät
Wilhelm-Schickard-Institut für Informatik
Datenbanksysteme · Prof. Dr. Grust

EBERHARD KARLS
UNIVERSITÄT
TÜBINGEN

Datenbanksysteme I

WS 2021/22
Torsten Grust, Christian Duta

Assignment #13

Submission Deadline: February 09, 2022 - 10:00

The topics discussed in this assignment are still relevant for the upcoming exam. Any points aquired for handing in your solutions for this assignment count as bonus points towards your total.

Exercise 1: Review Questions (4 Bonus Points)

Please answer the following questions **briefly**.

1. Which are the **core** operators of the relational algebra? Explain the term "relationally complete" *briefly*.
2. Briefly explain the difference between *monotonic* and *non-monotonic operators* of the relational algebra.
3. Consider relations $R(A, B, C)$, $S(B, D)$. Rewrite the following relational algebra expressions into equivalent expressions that use only core operators:
   (a) $R \bowtie S$
   (b) $\pi_B(R) \cap \pi_B(S)$
4. Consider the following relation instance:

R

A	B	C
1	2	1
1	3	2
3	1	1
6	2	1
1	4	2

   What is the result relation of the expression $T = \pi[A, C](R)$?

Exercise 2: Relational Tavern **(11 Bonus Points)**

Consider the following taverns database schema:

```
patrons(p, t)
likes(p, w)
offers(t, w)
```

A row (p, t) in relation `patrons` indicates that person p is a patron at tavern t. A row (p, w) in relation `likes` indicates that person p likes wine w. A row (t, w) in relation `offers` indicates that tavern t offers wine w. Formulate the following queries using relational algebra operators (like in the lecture):

1. Which wines are mentioned in the database?

   Schema of the result: `w`

2. Which wines are not liked by any person?

   Schema of the result: `w`

3. Which patrons have been to all taverns?

   Schema of the result: `p`

4. List all patrons which like none of the wines on offer.

   Schema of the result: `p`

5. Which patrons have been to any taverns that offer any of their favorite wine?

   Schema of the result: `p`

6. Which patrons have been visiting *only* taverns that offer any of their favorite wine?

   Schema of the result: `p`

7. Which patrons have been visiting any taverns that offer *only* their favorite wine? (⚠Beware: *tricky!*⚠)

   Schema of the result: `p`

8. Which patrons have been visiting *only* taverns that offer *only* their favorite wine?

   Schema of the result: `p`