Weekly exercises IN3020 and IN4020
Week 3

February 3, 2022

1 Review

1. List the operations of relational algebra we have seen this week and briefly state the purpose of each.
2. When are the $\cup$ and $\setminus$ operations defined on two relations R and S?
3. Can you imagine some cases when we need to use the ρ operator to specify the query unambiguously?
4. What do we mean with a commutative operation? Give an example of a commutative operation from relational algebra.
5. What do we mean with an associative operation? Give an example of an associate operation from relational algebra.
6. What do we mean with an idempotent operation? What if the operation is unary? And binary? Give one example of an idempotent operation from relational algebra.

2 Relation algebra computations

Here are two relations:
`R[A,B]`: $\{(1,2),(3,4),(4,5)\}$
`S[C,D]`: $\{(1,2),(3,5),(3,6),(4,5),(5,6)\}$

Using our basic Relational Algebra for sets using named perspective, compute the following:

1. $\pi_A(R)$
2. $\pi_B(S)$
3. $\sigma_{A=1}(R)$

4. $R \bowtie S$
5. $(\rho_{B \to C}(R)) \bowtie S$
6. $\sigma_{D=5}(\rho_{A \to C}(R)) \bowtie S$

3 Relation algebra expression

In this exercise, consider four relations with the following schemas (the domains and the meaning of the attributes are as expected):

```
Product[manufacturer,model,type]
PC[model,speed,ram,hd,price]
Laptop[model,speed,ram,hd,screen,price]
Printer[model,color,type,price]
```

Express the following queries as relational algebra expressions using the following relational algebra operators: $(\sigma, \pi, \times, \cup, \setminus, \rho, \bowtie,)$.

1. The PC models that have speed at least 2.50
2. The manufacturers that sell printers, but not PC's
3. The manufacturers that sell PCs but not laptops
4. The manufacturers that make laptops with a hard disk of at least 500 GB
5. The model numbers and prices of all products made by manufacturer hp.