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Assignment 1

Query Optimization

Ilaria Battiston - 03723403
Mareva Zenelaj - 03736071

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1 First exercise

1.1 SQL and relational calculus

1.1.1 SQL

```
SELECT DISTINCT Studenten.MatrNr, Name
FROM Studenten, Hoeren, (
       SELECT VorlNr
       FROM Studenten, Hoeren
       WHERE Name = 'Schopenhauer'
       AND Studenten.MatrNr = Hoeren.MatrNr) Tmp
WHERE Studenten.MatrNr = Hoeren.MatrNr
AND Hoeren.VorlNr = Tmp.VorlNr
AND Name <> 'Schopenhauer'

SELECT DISTINCT PersNr, Name
FROM Professors, Vorlesungen, (
       SELECT VorlNr, COUNT(MatrNr)
       FROM Hoeren
       GROUP BY VorlNr
       HAVING COUNT(MatrNr) > 1) Tmp
WHERE Professors.PersNr = Vorlesungen.gelesenVon
AND Vorlesungen.VorlNr = Tmp.VorlNr
```

1.1.2 Tuple calculus

Here we assume that the data structures are sets, therefore contain no duplicates.

$\{s : \{MatrNr,\ Name\} \mid s \in \text{Studenten} \wedge s.name \neq \text{'Schopenhauer'}$
$\wedge \exists h \in \text{Hoeren}(s.MatrNr = h.MatrNr)$
$\wedge \exists v \in (\{v \mid \text{Hoeren} \wedge \exists s \in (\text{Studenten} \wedge s.name = \text{'Schopenhauer'} \wedge s.MatrNr = v.MatrNr)\}$
$\wedge v.VorlNr = h.VorlNr)\}$

$\{p : \{PersNr,\ Name\} \mid p \in \text{Professoren}$
$\wedge \exists v \in \text{Vorlesungen}(p.PersNr = v.gelesenVon)$
$\wedge \exists c1,\ c2 \in (\{c1,\ c2 \mid \text{Hoeren}$
$\wedge c1.MatrNr \neq c2.MatrNr \wedge c1.VorlNr = c2.VorlNr\})$
$\wedge c1.VorlNr = v.VorlNr\}$

1.2 Relational algebra

Here we assume that the data structures are sets, therefore contain no duplicates.

$\sigma_{S.Name \neq \text{'Schopenauer'}}$
$(S \times \sigma_{S.MatrNr=H.MatrNr}$
$(H \times \sigma_{H1.VorlNr=H.VorlNr}$
$(H1 \times \sigma_{H1.MatrNr=S1.MatrNr \wedge S1.Name=\text{'Schopenhauer'}}(S1))))$

$\sigma(P \times \sigma_{P.PersNr=V.gelesenVon}$
$(V \times (\sigma_{V.VorlNr=H1.VorlNr}$
$(H1 \times \sigma_{H1.MatrNr \neq H2.MatrNr \wedge H1.VorlNr=H2.VorlNr}(H2)))))$