Query Optimization'14

Exercise Session 1

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April 14

Organizational Matters

- Exercise sessions are here to illustrate the material of the course with examples, special cases, etc.
- Homework every week: programming assignment and 2-3 problems
- Do 75% or better and get the bonus for the final grade
- Written exam at the end
- Slides on the website
- Email subject should start with [qo14]

Execution plan

- Students(Id, Name), Lecture(Id, Name), Attends (SId, LId)
- Find all students that attend lectures together with *Schopenhauer*, excluding *Schopenhauer* himself.

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```
select s2.name
 from Students s1, Students s2,
        Attends a1, Attends a2
 where s1.name='Schopenhauer'
    and s1.id <> s2.id
    and a1.sid=s1.id
    and a2.sid=s2.id
    and a1.lid=a2.lid
```

Canonical Translation

```
select distinct v.title
  from Lectures v, Professors p
  where v.prof_id = p.persnr
    and p.name = 'Kant'
    and v.sws = 2;
```

Reminder:

- cross product (**from**)
- add a selection (**where**)
- add a projection (**select**)
- the result is a tree

Logical optimization: preliminary

Cardinality and Selectivity

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Selectivity of a predicate, selectivity of a join

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- (now: with joins)
- example of a predicate with (very) low selectivity
- (now: with joins)
- independent and correlated conditions

Logical optimization

- $|\text{Students}| = 1000$
- $|\text{Lectures}| = 100$
- $|\text{Attends}| = 5000$
- $f_{s,l} = 0.001$
- $f_{a,l} = 0.01$

Find the students that attend the course 'Ethik'

- SQL query
- canonical transformation, compute cardinalities
- push down selections, compute cardinalities

Logical optimization

```
select distinct s.name
  from Vorlesungen v, Hoeren h, Studenten s
  where v.titel='Ethik'
    and v.vorlnr=h.vorlnr
    and v.matrnr=s.matrnr
```

Cost Estimation

The goal of optimization is to minimize the cost function

Reminder: C_{out}

$$C_{\text{out}}(T) = \begin{cases} 0 & \text{if } T \text{ is a leaf } R_i \\ |T| + C_{\text{out}}(T_1) + C_{\text{out}}(T_2) & \text{if } T = T_1 \bowtie T_2 \end{cases}$$

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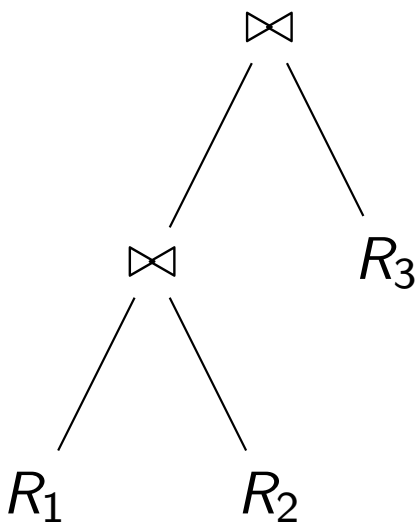

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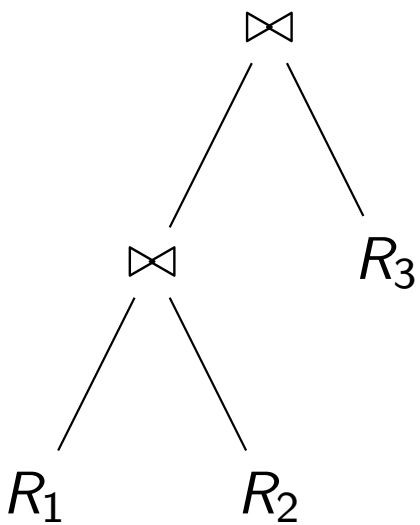

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- $|R_2| = 200$
- $|R_3| = 100$
- $f_{1,2} = 0.1$
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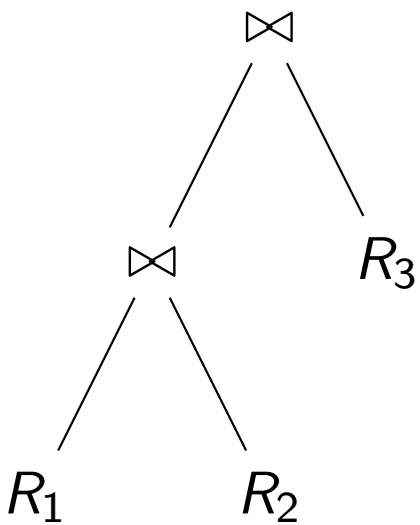

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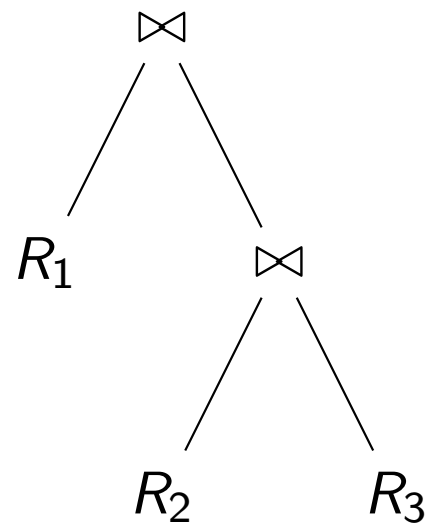

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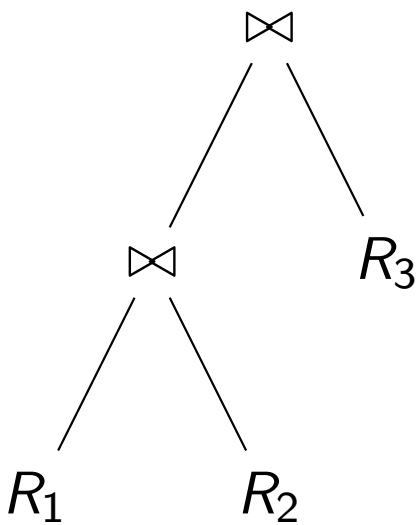

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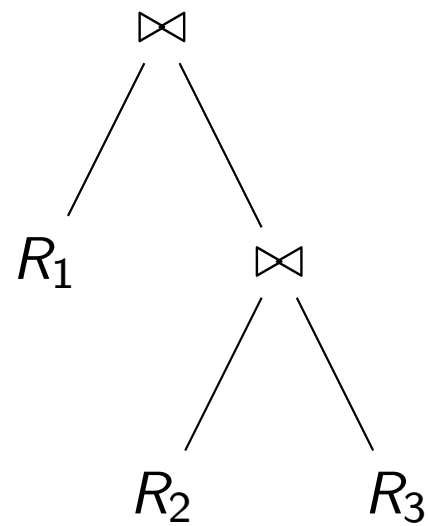

That's why we need join ordering!

Info for Homework

- You can work in groups with up to two students
- Handwritten (and/or scanned) solutions will not be accepted. Use LaTeX (preferable) or Word.
- Programming assignment:
  - Implement your own query optimizer step by step
  - Initial code base (very simple database system) is available on the website
  - Language: C++11 (great opportunity to learn it btw)
  - Solutions should come with a Makefile and instructions on how to build/run it
  - Future assignments will build upon the current

Homework – Guidelines

- Submit the whole project directory, not just separate source files (no binaries!)
- You can work within the TinyDB directory, changing its structure if needed
- (Briefly) comment the source code: every class, field, method, design choice
- Give examples of the input queries for which you tested. How about unit tests?

Info

- Slides and exercises:
  http://www-db.in.tum.de/teaching/ss14/qo/
- Send any questions, comments, solutions to exercises etc. to andrey.gubichev@in.tum.de
- Exercises due: 9 AM, April 28