Query Optimization
Exercise Session 3

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select *
from lineitem l, orders o, customers c
where l.l_orderkey=o.o_orderkey
    and o.o_custkey=c.c_custkey
    and c.c_name='Customer#000014993'.
Homework: Task 2

We know $|R_1|$, $|R_2|$, domains of $R_1.x$, $R_2.y$, ...
We know $|R1|$, $|R2|$, domains of $R1.x$, $R2.y$, (that is, $|R1.x|$, $|R2.y|$), and whether $x$ and $y$ are keys or not. The selectivity of $\sigma_{R1.x=c}$ can be estimated as...

- if $x$ is the key:
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Selectivity estimation

We know $|R_1|$, $\max(R_1.x)$, $\min(R_1.x)$, $R_1.x$ is arithmetic.

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The selectivity of \(\sigma_{R_1.x > c}\) is \(\frac{\max(R_1.x) - c}{\max(R_1.x) - \min(R_1.x)}\)

The selectivity of \(\sigma_{c_1 < R_1.x < c_2}\) is
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The selectivity of $\sigma_{R1.x > c}$ is $\frac{\max(R1.x) - c}{\max(R1.x) - \min(R1.x)}$

The selectivity of $\sigma_{c1 < R1.x < c2}$ is $\frac{c2 - c1}{\max - \min}$
Homework: Task 3

- \(|R| = 1,000\) pages, \(|S| = 100,000\) pages
- 1 page - 50 tuples, 1 block - 100 pages
- avg. access = 10 ms, transfer speed = 10,000 pages/sec
- Time for block-nested loops join = ?
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| avg. access = 10 ms, transfer speed = 10,000 pages/sec
| Time for block-nested loops join = ?
| choose left argument: $R$ vs. $S$, $\frac{1,000}{100}$ vs. $\frac{100,000}{100} \Rightarrow R$
Homework: Task 3

- Time to read one block:
  \[ T_b = \text{avg. seek} + \left( 100 \frac{1}{\text{transfer speed}} \right) = 0.02s \]
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- Read 1 block from \( R \), join it with \( S \):
  \[ T_b + \text{time to read } S \approx 10s \]
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Read 1 block from \( R \), join it with \( S \):
\[ T_b + \text{time to read } S \approx 10s \]

Repeat it for every block in \( R \):
\[ T_{BNLJ} = \frac{\#\text{pages in } R}{\text{block size}} (10s) \approx 100s \]
select v.titel
    from Vorlesungen v, Professoren p
    where v.gelesenvon = p.persnr
        and p.name = 'Kant'
    and v.sws = 2;
select r.a, s.c
  from R r, S s, T t, U u
  where r.a = s.a
    and r.b = t.b
    and r.b = u.b;
select r.a, s.c
    from R r, S s
    where r.a + s.a = 7;
select r.a, s.c
    from R r, S s, T t, U u
where (r.a + s.b) = (t.b + u.a);
Search space

Search space is defined by:

- Query graph type
Search space

Search space is defined by:
- Query graph type (chain, star, tree, clique, cycle, grid)
- Join tree class
Search space

Search space is defined by:

- Query graph type (chain, star, tree, clique, cycle, grid)
- Join tree class (left-deep, zig-zag, bushy)
- Cost function class
select *
from R1, R2, R3, R4
where R1.a = R2.b
    and R2.c = R3.d
    and R3.e = R4.f

▶ What kind of query graph is it?
Search space

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```

- What kind of query graph is it?
- Let's allow cross-products ⇒ the shape of the query graph does not matter
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What kind of query graph is it?
Let’s allow cross-products ⇒ the shape of the query graph does not matter
Count left-deep trees
Count zig-zag trees
Count bushy trees
Homework: Task 1 (15 points)

Selectivity estimation continues...

- Our estimations (prev.homework) are far from perfect
- Construct two specific SQL examples, where our estimations are very "bad"
- Use IMDB schema (SQL script on the website)
- "Bad" – means that the logical plan will be suboptimal (w.r.t $C_{out}$), if we use these estimations
- In other words, bad estimations mislead the optimizer and it outputs a clearly suboptimal plan
- Construct one query where PostgreSQL estimates are wrong and lead to a suboptimal plan
- Force the optimal plan, compare the difference
- Hint: use join_collapse_limit
- Hint: correlations on joins, LIKE predicate etc.
Homework: Task 2 (5 points)

- Give an example query instance where the optimal join tree (using $C_{out}$) is bushy and includes a cross product.
- Note: the query graph should be connected!
Info

- Exercises due: 9 AM, November 10, 2014