Query Optimization: Exercise

Session 9

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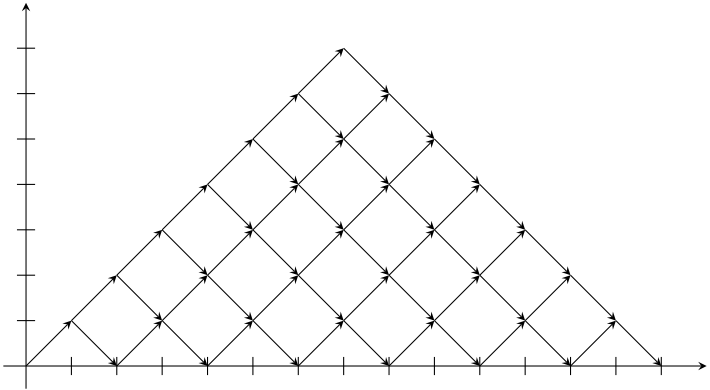
Homework

Give the permutation with rank 64 of 8 relations.

Give the shape of the random join tree with rank 125 of 8 relations.



Metaheuristics [2]

- Iterative Improvement
- Simulated Annealing
- Tabu Search

Genetic Algorithms

Big picture

- Create a "population", i.e. create p random join trees
- Encode them using ordered list or ordinal number encoding
- Create the next generation
  - Randomly mutate some members (e.g. exchange two relations)
  - Pairs members of the population and create "crossovers"
- Select the best, kill the rest

Details

- Encodings
- Crossovers

Encoding

Ordered lists

- Simple
- Left-deep trees: Straight-forward
- Bushy trees: Label edges in join-graph, encode the processing tree just like the execution engine will evaluate it

Ordinal numbers

- Are slightly more complex
- Manipulate a list of relations (careful: indexes are 1-based)
- Left-deep trees: $(((R_1 \bowtie R_4) \bowtie R_3) \bowtie R_2) \bowtie R_5 \mapsto 13211$
- Bushy trees: $(R_3 \bowtie (R_1 \bowtie R_2)) \bowtie (R_4 \bowtie R_5) \mapsto 12\,21\,23\,12$

Subsequence exchange for ordered list encoding

- Select subsequence in parent 1, e.g. *abcdefgh*
- Reorder subsequence according to the order in parent 2

Subsequence exchange for ordinal number encoding

- Swap two sequences of same length and same offset
- What if we get duplicates?

Subset exchange for ordered list encoding

- Find random subsequeces in both parents that have the same length and contain the same relations
- Exchange them to create two children

Combinations

- 2PO (II and then SA)
- AB Algorithm (IKKBZ and then II)
- Toured SA (SA for each join sequence produced by GreedyJoinOrdering-3)
- GOO-II (run II on the result of GOO)

Iterative Dynamic Programming [1]

- IDP-1
  - build solutions up to size k using DP
  - replace the cheapest with a compound relation
  - repeat until all relations are covered
- IDP-2
  - greedily build a solution for the complete query (e.g. using GOO)
  - find the most expensive subtree that covers at most k relations
  - optimize that subtree using DP
  - replace the original subtree a compound relation representing the DP solution
  - repeat until a single compound relation remains (or out of budget)

Next Homework

- Give an example where II does not find the optimal solution
- Implement Quick-Pick
  - choose your own queries on the TPC-H dataset
  - run them (either using the tester or a dedicated executable)

- Slides: db.in.tum.de/teaching/ws1819/queryopt
- Exercise task: gitlab
- Questions, Comments, etc:
  mattermost @ mattermost.db.in.tum.de/qo18
- Exercise due: January 7th, 2019, 9 AM

[1] D. Kossmann and K. Stocker.
Iterative dynamic programming: a new class of query optimization algorithms.
ACM Trans. Database Syst., 25(1):43–82, 2000.

[2] M. Steinbrunn, G. Moerkotte, and A. Kemper.
Heuristic and randomized optimization for the join ordering problem.
VLDB J., 6(3):191–208, 1997.