Query Optimization
Exercise Session 9

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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: \(((R_1 \Join R_4) \Join R_3) \Join R_2) \Join R_5\)
- Bushy trees: \((R_3 \Join (R_1 \Join R_2)) \Join (R_4 \Join R_5)\)
Encoding

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- 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: \((R_3 \bowtie (R_1 \bowtie R_2)) \bowtie (R_4 \bowtie R_5)\)
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Encoding
Crossover

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 subsequences in both parents that have the same length and contain the same relations
  ▶ Exchange them to create two children
Submit exercises to radke@in.tum.de